THE

CYCLOPAEDIA;

OR,

Universal Dictionary

OF

ARTS, SCIENCES, AND LITERATURE.

VOL. XXXIV.
THE

CYCLOPAEDIA;

OR,

UNIVERSAL DICTIONARY

OF

Arts, Sciences, and Literature.

BY

ABRAHAM REES, D.D F.R.S. F.L.S. S.Amer. Soc.

WITH THE ASSISTANCE OF

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BY THE MOST DISTINGUISHED ARTISTS.

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Starch.

Starch, a substance which is extracted from wheaten flour, by washing it in water. All farinaceous seeds, and the roots of most vegetables, afford this substance in a greater or less 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 pâte: 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 subside 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 fee.

The starch so obtained, when dried in the sun, or by a flove, is usually concreted 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 pâte with boiling-hot water, and when this pâte is allowed to cool, it becomes semitransparent and gelatinous, and being dried, becomes brittle, and somewhat resembles gum.

Starch, although found in all nutritive 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 entellial sile, that it cannot be extracted in sufficient purity to concret 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 Sicil starch is required, good grain must be used. This, being well cleansed, and sometimes coarsely bruised, is put into woodenaffs full of water to ferment: to affit the fermentation, the vessels 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 finger, 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 fack, and the halves are separated and rubbed off, by beating and rubbing the fack upon a plank: the fack 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 it take 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-veil, 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 veils are exposed to the sun, which soon produces the acoust fermenta- tion, and takes up fuch matter as renders the starch more pure and white. During this process, the starch for fale in the shops receives its colour, which confits of smallt 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 linen cloths 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 warm air, in and about the building, and partly by the change of the seasons, which renders the air too cold to admit of its being taken up again.
warm air; and by the floor immibing the moisture. In winter the heat of a stove must be employed to effect this quickly. Lastly, the pieces of dried flour are scraped, to the outside crust, which makes inferior flour, and the pieces are broken into smaller pieces for sale.

The grain we remain in the stack after the flour is extracted, consists chiefly of the husks and the glutinous part of the wheat, which are very nutritious food for cattle.

The French manufacturers, according to Les Arts et Metiers, pursue more economical methods, as they are enabled, by employing an acid water for the fermentation in the first instance, to make the malt inferior, and the bran or husks of the grain are saved for food. This water they prepare, by putting a sufficient quantity of water into a tub, and adding two pounds of leaven, as some bakers use to make their dough rise or ferment. The water stands two days, and is then stirred up, and a pain of warm water added to it; then being left to settle till it is clear, it is poured off for use. To use this water in the fermentation of the materials, a quantity of it is poured into a tub, and about one third of the materials, a quantity of it is poured into a tub, and about as much 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 of refuse wheat, and the other half bran. In this tub continues to steep and ferment 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 sufficient steeped, or fermented, an amass matter, which is: oil of the grain, will be, swimming on the surface, having been thrown up by the fermentation. This must be skimmed off, and the fermented grain, being taken out of the tub, is put into a fine sieve, placed over a filter-tub, when fair water is poured upon it, and washed through the sieve into the tub; by which means the flour is cleared through the sieve with the waste of which about five times the quantity of the grain are used.

The water stands in the filter-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 flour. The water which is taken off is ar, and is called pure water: this is the proper leaven for flour steeping & the materials. The flour now obtained must be rendered marketable; for which purpose, as much water is poured upon it as will enable it to be pounded and broken up with a shovel, and then the tub is filled up with fair water. Two days after this, the water is laded out from the tub, and the flour appears in the bottom, but covered over with a dark-coloured and inferior kind of starch, which is taken off, and employed for fattening hogs. The remainder of the sediment, which is good flour, is washed several times, to remove all the inferior flour; and in this manner, a quantity of four inches of thick flour household 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 flour, ought to afford more, the whole bag used, than the bran or husks; but the flour so extracted is always of an inferior quality to that which is extracted on the bran of good wheat, particularly in the whiteness its colour. The flour in the different tubs is brought together into one, and there worked up with as much water as will dissolve it into a thin paste, which is put into a filter-tub, drained through with fresh water. This water is settled in the tub, and afterwards poured off, but before it is so completely settled as to lose all its white colour: this renders the flour which is deposited in the filter-tine and whiter, and the flour which deposited by the water so poured off is of a more common quality.

Flour thus purified is taken out of the bottom of these tubs, and put into wicker baskets, about 18 inches long and deep, rounded at the corners, and lined with linen cloth, which are not fastened to the baskets. The water from the flour through the cloths for a day, and the baskets are then carried up to apartments at the top of the house where the flour is male of very clean white plasters; when the windows are open, to admit a current of air, here the baskets are turned downwards upon the floor, and the linen cloths, not being fastened to the basket, follow the flour, and, when taken off, leave or cakes of flour, which are left to dry a little, and then broken into smaller pieces, and left on the flour-tub; till very dry. If the weather is at all umit the flour is removed from the platter-floor, and preserved upon shelves, in an apartment which is warmed by a fire, and there it remains till perfectly dry. The piece of afterwards removed, to remove the outside crust which skims common flour and the scraped pieces being thrown into the basket, the flour is carried to the above, and spread to a depth of three inches, on hurdles covered with cloths. The flour must be turned over every morning and evening, to prevent it from turning to a greenish colour, which would otherwise do.

These manufacturers, who are not provided with a stove, make use of the top of a beer's oven to spread the flour upon; as after being thoroughly dried here, it is ready for sale.

Starch may be made free potatoes, by soaking them about an hour in water, and taking off their roots and fibres, then rubbing them quite dry by a strong brush; after this they are reduced to a powder, by grating them in water. This pulp to be collected in a tub, and mixed up with a large quantity of clear water: at the same time, another clean tub will be provided, and a sieve, not too fine, must be inserted over it by two wooden rails extended across the tub. The pulp-water are thrown into the sieve, and the flour or starch is carried through with the water; the flour is then thrown out, till it runs through quite clear. The subsolp which remains in the sieve, being wicked in water, makes an excellent food for animals; in the quantity this pulp is near seven-eighths of all the potatoes employ

The liquor which has passed through the sieve is turbid, and of a dark colour, is an extractive matter which is distilled in it. When it is subjected to ret for five or six hours, all the matter depts or settles to the bottom, and the liquor which remains to be poured off as sublees; and a large quantity of fresh water is thrown upon the flour, and stirred up: it is then left for a day, and the water being poured off, the flour will found to have again settled in a white slaty. But to improve it, another quantity of water is poured on, and mixed with it; in which state it is pulled through a fine sieve, to arrest any small quantity of the pulp which may have escaped the first tine. The whole must afterwa be suffered to stand quiet, till the flour is entirely set, and the water above become perfectly clear; but if water has any sensible colour or tans, the flour must be washed again with fresh water, for it is absolutely necessary none of the extractive matter be suffered to remain in it. The flour, when thus obtained pure, and drained from the water, may be taken out of the tub with a wooden shovel, and placed upon wicker-frames covered with paper, to be dried in some situation properly defended from the weather.

When the mass of flour from potatoes is attempted in a large waster kind of mill must be used to reduce
reduce them to a pulp, as the grating of them by hand is too tedious an operation. Anmill invented by M. Damien is very complete for this purpose. In its general structure it resembles a large coffeemill; 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 axle, within a hollow cylinder of plate-iron, toothed with parallel 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 it works, 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. Whatley 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 rolling 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 prefixed 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, grates 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 flarch 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 coagulant addition of clear cold water, till all the flarch was washed clean from the pulp which remained in the sieve; and the water being settled, deposited the flarch, which was afterwards repeatedly washed, purified, and dried, in the same manner as the potatoe-flarch before described. We are not informed if this manufacture has been carried into effect.

The four, nauseous, milky liquor obtained in the process of flarch-making, appears, upon analysis, to contain acetic acid, ammonia, alcohol, gluten, and phospate of lime. The office of the acid is to dissolve the gluten and phospate of lime, and thus to separate them from the flarch.

Flarch is used along with salt, or flour-blue, to stiffen and clear linen. The powder of it is also used to whiten and preserve the hair.

It is also used by the dyers, to dispose their fluffs to take colours the better.

Flarch is sometimes used instead of sugar-candy for mixing with the colours that are used instrong gum-water, to make them work more freely, and to prevent their cracking. It is also used medicinally for the same intentions with the vioceous insubance which the flour of wheat forms with milk, in fluxes and catarrhs, under various forms of powders, mixtures, &c. A draught of flarch, with three or four spoonfuls of any agreeable simple water, and a little sugar, compose an elegant jelly, of which a spoonful may be taken every hour or 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 action 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 flarch imported a duty is imposed; and by 49 Geo. III. c. 58. sched. (A), a further duty upon every hundred weight is imposed.

No person shall be a maker of flarch 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 flarch without entry. (19 Geo. III. c. 40. f. 5. 26 Geo. III. c. 51. f. 20.)

By 43 Geo. III. c. 69. sched. (A), every flarch-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 pay of 20l. 24 Geo. III. c. 41. f. 2.

Places of making flarch are to be entered, under penalty of 200l. (24 Geo. III. c. 48. f. 2.) All rooms and places, vessels and utensils, shall be marked and numbered, on 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 vessels for making or keeping flarch, unentered, shall be forfeited, or their value. (10 Ann. c. 26. f. 22.)

Every flarch-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 flarch-maker, on penalty of 100l. (24 Geo. III. c. 48. f. 2.)

Officers may at all times enter and search, 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 flarch, 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 flarch after it is dried, before it be weighed, &c. by the officers, on pain of 200l. (14 Geo. III. c. 14. 19 Geo. III. c. 40.) All flarch, before it be put into any flore or place to dry (except for cruffing), shall be put in papers, tied up with string, pasted over with a piece of paper of a different colour, and stamped by the officer, under penalty of 100l. (26 Geo. III. c. 51.) Foraging or using forged stamps incurs a forfeiture of 500l. (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 flarch before due notice is prohibited by 10 Ann. c. 26. f. 19. And if it be removed before it is weighed by the officers, he shall be liable to an additional fine forfeit 200l. (19 Geo. III. c. 45.) And if any dealer in flarch 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 flarch, exposes the party concerned, unless he can make it appear that the duty
duty has been paid, to a forfeit of 50l.: and obstructing the officer in entering, seizing, &c. the same, incurs a forfeit 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 tartrach, 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 tartrach shall be imported, except in packages containing at least 224 lbs., on pain of forfeiture, and of 5ol. from the master of the vessel. (42 Geo. III. c. 93.) Tartrach 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 flour or hair-powder, with the horn and package, fullpanted on good reason to have been privily made, or imported without payment of duty, or relashed 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 5l. for every hundred weight. (42 Geo. III. c. 93.) If any person shall knowingly harbour or conceal any flour unlawfully imported, or relashed after shipping for exportation upon debarment, 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, tale, platter of Paris, whiting, lime, &c. (sweet scent only excepted), on pain of forfeiting the same, and 50l. (12 Ann. Mat. 2. c. 9.) And if any maker of hair-powder shall mix any powder of alabaster, &c. (rice first made into tartrach, and sweet scent only excepted), he shall forfeit the same, and 50l. (12 Ann. Mat. 2. c. 9.) Or if any one make or fell any trade with such materials, he shall forfeit the same, and 50l. (4 Geo. II. c. 14.) Or if he shall have in his possession, for making, mixing, or counterfeiting hair-powder, any materials besides flour, or powder of flour, or rice made into tartrach, he shall forfeit the same, and 10l. Places for making hair-powder are to be entered, and officers may enter and feruey them, under a penalty of 20l. 4 Geo. II. c. 14.

Every maker of blue for sale shall make entry of his name, place of abode, place of manufacture and keeping, and materials, in pain of 50l. (4 Geo. II. 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 tartrach for which the duties have been paid, on pain of forfeiting the same and 100l.

Nor shall any maker of blue for sale receive into his possession any tartrach in papers not stamped, under pain of forfeiting 10s. a pound, together with the same: and if any maker shall keep above 28 lbs. of tartrach or hair-powder in any unentered place, the same shall be forfeited 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 prosecutor.

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 nutrient 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.
for his: five hundred and one par of firth, 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 marrow beans, (Vicia faba,) the latter writer is flatted to have obtained one thousand three hundred and twelve of flarch, thirty-one of albumen, and onethousand two hundred and four of other matters which may be conceived to be nutritious; such as gummy, flarchy, fibrous matter, analogous to animal matter.

The fame quantity of kidney-beans (Phaseolus vulgaris) is said to have afforded him, one thousand eight hundred and five parts of matter analogous to flarch, 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 fame number of parts of lentils he is also stated to have obtained one thousand two hundred and sixty-five parts of flarch, and one thousand four hundred and thirty-three of a matter analogous to animal matter, which is described as a glutinous substance 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 flarchy matters; 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 flarch. And that from one hundred parts of the common kidney potato Dr. Pearson obtained from twenty to twenty-three of flarch and mucilage: the same number of parts of the apple potatoe afforded by Humphrey Davy in various trials, from eighteen to twenty parts of pure flarch. From five pounds of several other different varieties, in the trials of another experimenter, from twelve to eighteen ounces and a quarter of flarch have been obtained. It is added, that from the analysis of Einhoff, it appears that seven thousand fix hundred and eighty parts of potatoe afford one thousand one hundred and fifty-three of flarch, five hundred and forty of fibrous matter analogous to flarch, one hundred and seven of albumen, three hundred and twelve of mucilage in the state of a saturated solution: in the whole, two thousand one hundred and twelve parts. So that a fourth part of the weight of the potato at least may, it is said, be considered nutritive matter. Hence its very 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 flarch from useless 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-power, pale, and other articles generally made from wheat.

STARCENBERG, 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 Wurmei; 14 miles N.E. of Weillam.

STARGARD, or Stargaard, a town of Puffian Pomperia, situated on the Pers; now belonging to Prussia; 20 miles S. of Dantzig. N. lat. 53° 57'. E. long. 16° 20'.

STARGARD, or Old Stargaard, a town of Germany, which gives name to a circle in the duchy of Mecklenburg; 55 miles S.E. of Gultro. N. lat. 53° 32'. E. long. 13° 17'.

STARGARD, or New Stargaard, 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 town of Eichstädt, a large and well-built towne, 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 1621, by burger-maister Peter Groning, and improved with regard to its constitution in 1704. Here are likewise a free-school, with divers good manufactures and a considerable trade; 74 miles N.E. of Berlin. N. lat. 53° 28'. E. long. 15° 20'.
very different it was from the *A. Lyechnis*. In this case the habit, supported by the character of the hairy, not chaffy or fealy, receptacle, surely authorizes a separation. The *lens* 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-tack, ovate, acute, fleshy 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 wolly, beneath; somewhat triple-ribbed, with many branching veins. Flower-flats several, at the top of each branch, fimple, 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 common in this class. He supposes it must be a fine vulnary. Its cottony texture, no doubt, would contribute to flame the blood of a fresh wound.

**STARKENBACH**, in Geography, a town of Bohemia, in the circle of Koniginrath; 11 miles N.E. of Gotttch. **STARKENBERG**, a town of Prussia, in the province of Natangen; 17 miles E.S.E. of Konigberg.—**Alto,** 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 Somerfet, on the W. side of Kennebeck river, containing 828 inhabitants; 35 miles N.W. of Augusta.

**STARKSBOROUGH**, a town of the flat of Vermont, in Addison county, containing 726 inhabitants; 12 miles E. of Ferrisburg.

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

**STARKLEACKEN**, a town of Prussia, in the province of Bartenland; 9 miles S. of Bartenlein.

**STARLING**, or **Stare**, in Ornithology. See **STERNUS**. 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 repulent, with changeable blue, purple, and copper; each feather being marked with a pale yellow spot; the inner coverings are edged with yellow, and slightly glossed with green; the quill-feather and tail are dusky; 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 houses, 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, anduck the eggs; in winter they assemble in large flocks: their flight is fo boisterous r as to be scarcely eterable: they are very docile, and may be taught to speak. Pennant.

Mr. Ray mentions a beautiful species, described by Bonnus under the name of the Indian starling, or *farrus 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 crest. It learns to imitate the human voice, and talks much better than the parrot, but is troublesome in being over noisy.

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

**STARO, in Commemr**, a corn measure in Italy. At Mantua, a faro of corn weighs 80 lbs.; and 86 such measures are = 25 English bushels nearly, or 80.94 faro = 10 Eng.-quarters, and each faro = 2125 cubic inches. At Ferr_, 93.22 faro = 10 English quarters, and each faro = 5 cubic inches. At Florence, 118.70 faro = 10 Eng.-quarters, and each faro = 1440 cubic inches. See in Dry Measure.

**STARDUB**, in Geography, a town of Russia, in the province of Novgorod; 11 miles N. of Nov. Siererelio. N. lat. 52° 35'. E. long. 33° 44'.

**STARSOLO**, a town of Russia, in the government of Pskov; 20 miles N.W. of Rogatchev.

**AROSIT, in Geography**, a name given in Potosi to the governors of mines and cajenas. They are appointed by the king to supervise their revenues, and to administer justice in his name. The district subject to the jurisdiction of each is called *stare*. However, there are fortresses who have no jurisdiction.

**AROSCH, in Geography**, a town of Moravia, in the circle of Znaym; 15 miles N. of Budweis.

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

**SALT POINT, a cape on England, on the S.E. coast of the city of Devon; 9 miles S. of Dartmouth.** N. lat. 50° W. long. 3° 3'.

**SARTING, amon Drinkers, the putting of new beer; ale, to that which is decayed, to revive it again.**

**STING, in the Marge.** A horse is said to be stabling, thriving, or timorous, that takes every object he sees to be surplus to what it is: upon which he flrops, flies out, and is suddenly to be seen, insomuch, that the rider cannot make him com near the place where the object is. It is more common to geldings than foamer-horses. Such horses as have bad ears are most subject to it, as well as those that have been kept a long time in a stable without airing out their ears are easily cured of it. When they have a Hittis horse, never beat him in his confomnatic but make him advance gently, and with soft means, till the scarecrow that alarms him, till he recovers it, and gains assurance.

**STAZITZ, in Geography**, a town of Moravia, in the circle of Znaym; 15 miles N. of Znaym.

**STAZHOVA, bay or gulf of the Frozen ocean, on the coast of Russia; 16° 38'. E. long.: 16° 38'.**

**STAREGUT, a bay on the S.W. coast of Jamaica, of Star gut Point.**

**STARVY Point, cape on the S.W. coast of Jamaica.** N. lat. 17° 58'. W. long. 7° 45'.

**STARTING to cat**, a kind of punishment used by the people of Arag one ages ago; and it is reported by Tavore, that chief ladies in the kingdom of Tonquin are at this day served to death for adultery.

**STAVITZ, in Geography**, a town of Silefia, in the principality of Groth; 3 miles N. of Pafchikau.

**STARZEL, a part of Wurtemberg, which runs into the Neckar; milesove Rotenburg.**

**STASITZ, a town of European Turkey, in Bosnia; 22 miles Sf Banjulika.**

**STASFELITZ, own of Webuahia, in the duchy of Magdeburg; 40 miles S. of Magdeburg.** N. lat. 51° 55'. E. long. 11° 45'.

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

**STASIS, in Ant Geography, a town of Alia, in the Pericle; built upon large rock.**

**STASIS, a word used by physicians to express a flagitation of the humours.**

**STASNAS, Geography, a town of Sweden, in Warmland; 12 25 W. of Carlsbad,**
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 together 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 he, or they, who are invested with it, are the sovereign.

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 mull, 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 in 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 confines the government to a single person, it is a "monarchy;" and this monarch may be limited or absolute. See Society, Sovereign, and Sovereignty.

Every nation that governs itself, whatever may be the forms of that government, without any dependence on a foreign power, in a "sovereign state." Its rights are the same as that of any other state: and if it be sovereign and independent, it must govern itself by its own authority and laws. Indeed, these are synonymous expressions. Those states may be reckoned in this class, which have nevertheless bound themselves to another more powerful by an unequal 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 correspondence 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 enters into engagements to perform levant offices equivalent to that protection, 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 lieu, and sovereignties have voluntarily rendered themselves feudatories to others; yet if the homage leaves indepedency and sovereignty authority in the administration of the state, and only means certain duties to the lord of the fief, or even a mere honor aritnowledgment, it does not prevent the state, of the feudatory prince, from being strictly 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 it, in virtue of voluntary engagements. But a people that has pilled 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 confits 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, and a nation is 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 conform 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 observed in society. All these, in order 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 "political laws;" and in this class, those that concern 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 firm support of the public authority, and pledge of the liberty of the citizens. But this constitution is a vain phantom, and the laws are idle, if they are not sufficiently 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 pernicious 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 at the helm, 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?
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 resolution of the majority. But if the question be to quit a 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 tilled it, though obliged to infer 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 fill 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 serious 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 at 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, Zeeland, and Utrecht, in conjunction with William I. prince of Orange, and erected, in 1584, 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, Zeeland two, Utrecht one, Friesland two, Overyssel one, and Groningen two. These were all changed every three years, except the deputy from the nobility of Holland, and the two from Zeeland, 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 Dipylos, the same with acro. See acro.

STATED WIND. See Wind.

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

STATEN ISLAND, 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 1661. The centre of Staten Island is about 12 miles S.W. of New York; it is about 14 miles long, and its greatest breadth is about 12 miles; the area is about 77 square miles, or 49,280 acres. It is bounded on the N. and W. by Newark bay and Bruntwick river; E. and S. by Hudson river and the Atlantic ocean. Its southern extremity is in N. lat. 40° 29', and the western extremity 16°: W. long, from New York.

The towns are, Castletown, containing 1350 inhabitants; Northfield, including 1595; Southfield 1007, and Westfield 1444 inhabitants; the whole population being 5347, and the number of electors 599. The county of Richmond is hilly and broken, including some extensive tracts of good arable land. Its infarur situation, and the benefic 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 sends one member to the house of assembly.

STATER, 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 wilderfe and horror ascribed to it in the account of lord Anfon's voyage. On the N. side, Hawkeworth fays, in his detail of this voyage (vol. ii. p. 64.), are the appearances of bays or harbours; and the land was deftitute 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 fiews a surface of craggy hills which fpare up to a vail height, especially near the west end. Except the craggy summits of the hills, the greatest part was covered with trees and shrubs, or some fome of herbage, and there was little or no snow on it. The currents between Cape Defeada and Cape Horn fent from W. to E., that is, in the fame direction as the coast; but they are by no means confiderable. To the E. of the cape their direfection is towards Staten Land. They are rapid in Strait Le Maire, and along the S. coast of Staten Land, and fent like a torrent round Cape St. John, where they take a N.W. direktion, and continue to run very frong both within and without New Year's Ifles. S. lat. 54° 40'. W. long. 65°.

STATER, an ancient silver coin, weighing four Attic drachms, and worth about three shillings or three fhillings and a penny sterling. See Drachm.

There was also a gold coin under this name: that of Cyzicus was much valued, having on one fide 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 fater of Athens was equal in value to twenty drachms, and a drachm of gold was equal to about ten of fiver.

The χρυσος, gold piece, gold fater, or "Philipus," as it was called in compliment to Philip of Macedon, was a dirachm; and there is reafon to believe, that it paffed for twenty silver drachms on its firft aparence; but in later times for twenty-five Greek drachmas, or Roman denarii. That the gold coins of Philip, called "Philippi," were dirachms,
drachms, we know from ancient authors, and from the great number of them that still remain; and that the χρυσῶν or chief gold coin of Greece, which of the same weight, is also evident from ancient authors. Being of twenty silver drachms, it was annually worth 1 s. 2 d. but valuing gold now at a medial price of 4 l. per ounce, it is intrinsically worth 1 l. at present. But we have larger gold coins than the χρυσῆ or didrachm. The δρακάριον of Alexander and of Lycurgus weighs its double, or about two hundred and sixty-six grains, and passed for forty silver drachms, or l. 10s.; now worth 3 l. Of Lycurgus, Antiochus III., and of some of the Egyptian monarchs, we have even the τιμίακαριον or quadruple χρυσῆ, weighing about five hundred and thirty grains, and current for eighty drachmas of silver, 3 l., now worth 4 l. flersling. We have also smaller coins, such as the διδρακάριον, or half the χρυσῆ, of Hero I. of Syracuse, and of Pyrrhus, which weighed three drachms, and passed for ten silver drachms, or 7 l. 6d.; now worth 10 l.;—also, the τριεκτάριον, or quarter of the Philippus, of Philip, Alexander, and Lycurgus, weighing thirty-three grains, and passing for five drachmas of silver, 3 l. 6d., now worth intrinsically 5 s.; and also gold coins of Greece still smaller, and which could not have passed for more than two drachmas of silver.

STATEA ROMA, or fleecyland, a name given to the Roman balance.

STATES, a term applied to the several orders, or classes, of a people, assembled 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 elected 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 redressed properly in the general assembly of the states themselves of all the several provinces; but as that assembly ordinarily consisted 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 no 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. 1302, 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 passing of laws, and posseffed 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 addresed 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 separately, and prepared their "pétitions," 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 construed 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 addresed an ordinance to each of the estates in particular. Sometimes he mentioned the assembly of the three estates. Sometimes mention is made only of the assembly of that estate to which the ordinance is addressed. Sometimes no mention at all is made of the assembly of estates which suggested the propriety of enacting the law. Thus the states-general had only the privilege of advising and remonstrating; the legislative authority resided in the king alone.

Sta*s of Holland, an assembly consisting of the deputies of the council, or colleges of each city; in which the deputies, or members of that assembly first known, 441 but the sovereign, or the higher estates, had seats, in the sense, or the rights, which they had in the assembly of the states-general.

Originally, none but the nobility, and the six principal cities, had seats, or voices, in the states. Afterwards they were the deputies of eighteen cities. The nobility had the first voices, which were pronounced by the grand penonary, as penonary 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 port-town of South Carolina, and the capital of Clermont county, on the E. side of Breech creek, which unites with Sharks creek, and discharges itself into the Waterree, a few miles below the town. It contains 10 or 12 houses, four court-houses and a jail; 20 miles S. by E. from Camden.

STATEs-lAND, a township of Hancock county, in the district of Maine, containing 71 inhabitants.

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

STATHEL, in Agriculture, a term sometimes employed to signify any fork of a road 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.

STATHUSIS, formed of cotis, a word used by the old writers to express the torrefaction, or roasting of the medicines before a flow fire, as is done frequently at present with rhubarb, &c.

STATHOLDER. See Stadtholder.

STASYCAL Baroscope. See Baroscope and Barometer.

Statical 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. 472, or Abr. vol. ix. p. 475, made by Dr. John Lining of Charles Town, in South Carolina.

STASTICAL Hydroscope. See Hyscroscope.

STASLY, in Botany, a name adopted from the Greeks, whole stem is reported to have been so called from ὁσσός, to stop, or arrest, because of its allirgent 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-Gillflower, seems to have originated with Dalechamp, whom Tournefort followed. Hence it has become appropriated to a fine and extensive genus, whole hairy and entangled stems, to well formed to impede the progress of a foot passenger, may literally almost justify its present use.—Linn. Gen. 153. Schreb. 205. Wild. Sp. Pl. v. 1. 1522. Mart. Mill. Dict. v. 4. Sm. Fl. C. Brit.
S. Limonium. Common Sea-Lavender Thrift. Linn. Sp. Pl. 394. Willd. n. 6. Fl. Brit. n. 2. Engl. Bot. t. 102. Fl. Dan. t. 315. (Limonium, et L. parvum; Ger. Em. 411.)—Stalk panicked, round. Leaves obvate-lanceolate, smooth, without ribs, tipped with a deciduous awn.—Common about muddy sea-shores 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 five inches long and one broad, tapering downward, leathery, somewhat waved, very smooth, rather glaucous. Stalk near a span high, hard and rigid, panicked, bracteated, its branches ending in close imbricated scales of handsome blue flowers, whole calyx is pale pink in a recent flate, white when dry, delitute of awns; its tube closely enveloped in a flower, feathery, membranous-edged involucrem, of a tangle leaf.

S. caroliniana. Carolina Sea-Lavender Thrift. Walt. Carol. 118. Pursh n. 2.—"Stalk round. Panicle much branched, divaricated. Calyx acute. Leaves lanceolate-oblong, blunitif, 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 Limnuez appears to have confounded with the last. Mr. Walter observed the separation of the capule into five valves at the base; a character of Julieu's Plumbagines. See that article.

S. bellidifolia. Daily-leaved Thrift. Sm. Prodr. Fl. Græc. Sibth. n. 733; Fl. Græc. t. 295, unpublished.—Stalk panicked, round. Leaves obvato-apatulate, abrupt, smooth. Calyx blunitif, without awes.—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, panicked copiously near from to bottom, rather zigzag. Flowers purple, loosely spiked. Calyx with a hairy tube, and white limb, with five brown ribs. Petals emarginate.

S. globularifolia. Globularia-leaved Thrift. Desfont. Atlant. v. 1. 274, by the description. Sm. Prodr. Fl. Græc. Sibth. n. 734. Fl. Græc. t. 296, unpublished. (Limonium medium, globularia folio; Barrel. l.c. t. 793, 794.)—Stalk panicked, round; with level topped branches. Leaves obvato-apatulate, pointed, smooth. Calyx acute.—Native of Barbary and Sicily, by the sea-side. The leaves are more glaucescent 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 finely haired.

torn upwards. Calyx bluish. Leaves spatulate, obtuse, pointlets, 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 Iiat in having blunt leaves, without points, in which respect it also differs from the coast of England, which Ilat is perhaps Barrerier's t. 759, and very nearly accords with our present plant, in its crowded spikes of flowers twice the size of the lat, and a much Iefs branched fruit. We have not been able to ascertain how far this and Vahl's curvata folia, Willd. n. 12, are distinct. Specimens from Narbonne, supposed to be the latter, agree in every thing with the figure of stricta folia, except in having a point to the leaf.

S. latifolia. Broad-leaved Thrift. Sm. Tr. of Linn. Soc. v. i. 250. Willd. n. 9. Ait. n. 7. (Limonium folio Emuile, flabelnis thalisminis rosamollis, floribus parvis caralis; Gerber's MSS.)—Stalk panicked, very much branched. Leaves downy, with minutely Iurry hairs. Calyx somewhat pointed, without awns.—Native of Ruffian Tartary, on the banks of the Don, near Afohp. It flowered in Shon gardens, under the care of Mr. Hoy, in 1788, as mentioned in the Linnaean Transactions, 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, besprinkled with Iurry tufts of soft hairs, and the vast profusion of its small blue flowers, which compose a spreading, rather level-topped, panicle, often two feet wide. It is a hardy perennial, flowering from May to July. Willdenow gives as a synonym S. tauriensis, Pallas Ind. Fl. Tur. 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. Grec. n. 735, excluding probably the synonym of Willdenow. (Parvum Limonium marbanense oleifolium; Lob. Ic. 295. Limonium parvum; Ger. Em. 411.)—Stalk panicked, 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 hoary, or reflexed, but not awned, at the extremity. Stems a foot high, more or less, roughish; their branches copious, zigzag and somewhat divaricated, about half of them all naked and barren; the upper branches 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. dictamnus. Many-fooked Thrift. Cavan. Ic. v. i. 37. t. 50. Sm. Prodr. Fl. Grec. n. 736. (Limonium minus oleo folio, Παπαδάκης; Barcel. Ic. t. 790.)—Stalk erect, panicked; 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 Cavallines. Dr. Sibthorpe found it in Greece. The leaves are four times as large as the Iat, and perfectly obtuse. Stem eighteen inches high; its lower branches repeatedly and minutely forked, almost like S. reticulata, but not prostrate. Inflorescence like the Iat. Calyx with a hairy tube. Flowers pale blue. Willdenow quotes Barrerier's t. 790 for his oleifolia; a species whose branches are described as angular and winged, and which, therefore, does not answer to Scopoli's oleifolia, Del. Ins. v. r. t. 10, nor are we able to determine what Willdenow intended.

S. reticulata. Mattet Thrift or Sea-Lavender. Linn. Sp. Pl. 354. Willd. n. 16. Fl. Brit. n. 3. Engl. Bot. t. 328. Hill Fl. Brit. t. 25. f. 2.—Stalk prostrate, panicked, zigzag; its branches rough with points; the lower ones barren. Leaves wedge-shaped, rather acute, without points.—Native of salt-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 flowers quite prostrate, their branches 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. palmaris. Humble Frosted Thrift. Sm. Prodr. Fl. Grec. n. 737. Fl. Gr. t. 297, unpublished.—Rough with hoary dots. Stalk panicked, round, erect, and rather close. Leaves spatulate, obtuse.—Gathered by Dr. Sibthorpi on the sea-coast of Asia Minor. The root 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 barren forked branches. The calyx is smooth, brown, with short ovate segments.

S. echinoides. Buglofs-leaved Thrift. Linn. Sp. Pl. 394, excluding Magnol's synonym. Willd. n. 172. Ait. n. 13. Fl. Gr. t. 298, unpublished.—Rough with hoary dots. Stalk panicked, round, jointed, very much branched, zigzag, divaricated. Leaves spatulate.—Native of the flours of Cyprus and Crete. The root is strong and woody, crowned with many fow-leaves of frosted leaves, much like the last. The flowers, however, are very different, a foot or more in height, hoary, repeatedly branched, flout, 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 hollow. Linnaeus confounded this with the following, which he appears to have known from Magnol's work only.

S. arizolus. Awned Annual Thrift. Sm. Prodr. Fl. Grec. n. 739. Fl. Gr. t. 299, unpublished. (Linnum minus annuum, bullata folis, vel echinoides; Magn. Monsp. 157. t. 156. Tourn. Inst. 342.)—Stalk panicked, round, dotted; its branches loosely spiked. Leaves obovate, rough. Calyx of the fruit awned.—Native of the sea-flours of the south of France, and island of Cyprus. The root is fimple, small, and annual. Leaves fowler, radical, an inch, or two long, green, rough with tubercles. Stalks fowler, from fix to twelve inches high, erect, branch- ing from near the bottom into numerous long, fender, spreading, lax spikes of small pink flowers. Calyx with a fow smooth tube; its membranous limb so delicate, that it fow leaves the strong brown ribs, in the form of naked awns.

S. lapidosa. Plantain-leaved Thrift. Linn. Sp. Pl. 395.—Willd. n. 18. Ait. n. 14. Curt. Mag. t 656. (Sm. n. 15. Gmel. Sib. v. 2. 221. t. 91. f. 1.)—Stalk panicked; its branches angular and somewhat winged. Flowers crowded. Branches dilated, pointed, longer than the bluntness. Calyx. Leaves obovate or lanceolate, pointed.—Frequent throughout Siberia, in open, dry, billy places. Gmelin. Sometimes seen in our gardens, but seldom long preserved. The root is marked by biennial. The leaves are rough fow to the touch, usually about two inches long and one broad. Stalk from six to eighteen inches high, erect;
fimple, naked, and almost round, in the lower part; but
terminating in a large, angular-branched, dense panicule, of
handsome pink flowers. General and partial bracteas ovate
with a sharp point, the latter moss dilated and membranous
at the edges. Tube of the calyx hairy, concealed, like the
flattish involucrum by the bracteas; its limb white, mem-
branous, obtuse, crenate, not lobed, nor awned.
S. conficcus, Curt. Mag. t. 1629, appears to us, with-
out any doubt, a variety of this with narrow leaves; there
being in reality no material difference in the bracteas.
S. arboreus. Tree Thrift. — Stem arboreous, leafy.
Leaves obovate, thickly. Flower-flalks panicked; their
branches angular and winged. Flowers crowded. Bracteas
ovate, flothating, much shorter than the involucrem.—Gath-
ered on the maritime rocks at Barra and Rambula in
the life of Teneriffe, by Mr. Matthew, whose specimen, given
to the younger Linnaeus, is marked "Staftic arboreus of Sol-
lander," but we find nothing published under this name.
The Spaniards call the plant Stampsprewel del mar.
The stem is faid to be arboreceil, six feet high. The branches
are round, woody, one-third of an inch in diameter, scoured
with the crowded bafes of old footflalks, refembling thin
anlalar flpitkus. Leaves fix or eight at the end of each
branch, spreading every way, two or three inches long, and
about half as broad, obtufe, smooth; way at the edges;
tapering at the base into a rigid angular footflalk, dilated
and clipping the stem at the bottom. Flower-flalks terminal,
folitary, a foot or more in length, complifed and winged,
bearing a very large compound corymbs panicule, of in-
umerable crowded flowers, whose partial flalks are dilated
into a wedge-shaped, leafy, two-lobed form. Bracteas short,
ovate, membranous, the partial ones in pairs, fheathing
the base of the involucrem, which is thrice their length, involute,
coriceous and ribbed, refembling that of S. Liniunum
and its allies. Tube of the calyx smooth, concealed in the
involucrem; limb of a delicate light permanent blue, in the
dried fpecimen, 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 greenhouses.
Wild. n. 26. Fl. Grec. t. 300, unpublished. (Echinus, id eft
Tragacantha altera; Alpin. Exot. 57.
t. 56. Liniunum carpitiofum, folic aculeatfis; Buxb.
Cent. 2. 18. t. 10.) — Branches clothed with awl-shaped,
spiny leaves. Flowers somewhat fpikes. — Found by Buxbaun in
the deferts of Media, flowering in July. Dr. Sibthorpe gathered it on the Spaciote mountains of Crete,
as well as on the Bithynian Olympus. The long and woody
black root is crownet with dense tufted leafy flalks and
branches, two or three inches high. "Leaves about an inch
long, spreading every way, rigid, linear, channelled, smooth,
entire, with a fpiuous point. Flowers of a bright pink,
very beautiful, three or four together, in terminal, foliarly,
nearly fofife, spikes. Involution of two fpheating 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 Sibthorpe. The
flower-flalk in the figure of Buxbaun is elongated, naked,
and somewhat branched, 1 2 an inch long; but the Liniune
specimens, intermediate between the two, prove this to be
a mere variety, owing to flitution. It is pity this elegant
species is unknown in gardens.
Wild. n. 22. Thumb. Prodr. 54. (S. peregrina; Berg.
Cap. 82.) — Stem shrubby, leafy. Leaves ovate-whel-
ded, three-ribbed, flalked, pointed, smooth. Panicle
level-topped; its branches roughhith, somewhat angular,
without wings. — Native of the Cape of Good Hope.
The habit of this plant approaches that of our leaf species
but S. arboreus, but its flalk is left. The stem is shrubby,
with round, smooth, woody branches, leaty towards their
extremities. Leaves fheathed, rounded, obtufe or emar-
ginate, with a small point; smooth on both fides, with three
long equal ribs; tapering down gradually into a rigid footflalk,
whose dilated, membranous, fheathing base furrounds the stem.
Each leaf is about two inches long; the footflalks about half as much. Panicule corymbose and
level-topped; its branches quite defiitute of wings, rough
with minute points; the ultimate ones zigzag and molt an-
gular. Bracteas roundifh-ovate, acute, with a membranous
edge. Flowers not very numerous. Calyx with a hairy
tube, and broad, membranous, purple border, which is
very slightiy angular rather than lobed. Corolla purple.
Bergius's description hardly answers to the Linnean plant,
except perhaps what he fays concerning a variety. S.
chothiodes has no resemblance to purpurea.
S. aroja. Rofe-coloured African Thrift.— Stem shrubby,
leafy. Leaves obovate-oblong, single-ribbed, flalked,
pointed, rough on both fides. Branches of the panicle
rough, somewhat angular, without wings. Flowers
crowded.—We are obliged to fir Samuel Young, bart. of
Formoas, Berks, for fpecimens of this beautiful fpecies,
gathered at St. Helen's bay, on the coaft of Africa. Its
fize, shrubby habit, and leafy branches, agree with the left;
but the roundifhes of the whole plant, and particularly both
fides 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 rofe-coloured,
rather than purple, induce us to consider it as diftinct.
The tubular flalks involucrem, with two short fheathing
membranous-edged bracteas at its basis, is the fame in both
thefe fpecies.
Wild. n. 27. Ait. n. 20. (Liniunm lignolatum, &c.; Bocc. Sic. t. 16, 17.) — Stem shrubby, leafy. Leaves
lanceolate, fleshy, fcaly, with fheathing flalks. Flowers
diyantly fpikes. Corolla monopetalous; its tube longer
than the calyx. — Native of unculivated ground in Sicily,
as well as the fouth of France. It is not an unfrequen
green-house shrub, flowering in July and August.
Boccase fays the red woody root is fometimes thicker than a man's leg.
The stems are buoyfhy, but diffuse, unlefs artificially sup-
ported. Leaves numerous, obtufe, an inch or two long,
various in breadth, thick, fiblefes, glauccous and minutely
feci all over, tapering down into a footflalk, whose fcape is
cylindrical and fheathing. Flowers large, pink, in foliarly
or aggregate lax fpikes. Involution very hard and tight,
nealy concealing the calyx and its small border. Claws of
the petals combined.
Wild. n. 54. Ait. n. 22. Curt. Mag. t. 71. Fl.
Grec. t. 301, unpublished. (Liniunm folio simulato;
Ger. Em. 412.) — Stems herbaceous, winged. Radical
leaves finated; those of the flalk awl-shaped, decurrent,
three in a whorl. Calyx undivided, without awns.—Native
of Sicily, Barbary, and Palestine. Dr. Sibthorpe found it
very frequent on the inundated shores of the Greek iflands,
and fuppefted it might be the real /. 201/10; of Diffcorides.
The modern Greeks call it p6cox. In gardens it has been
known ever fince the days of Parthenis. The stem, which
endures long, even in a green-house. The numerous radical
leaves are pinnatifid, with numerous rounded lobes, green,
obtufe, and hairy, three or four inches long. Stems de-
cumbent,
Leaves are delicately cut-leaved, hardy, and form nice edgings. The involucre is of much finer 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 denuded, as in our S. ariflata, become recurved brilily awns.

S. loba. Lobed Spinosus Thrift. Linn. Suppl. 187. Willd. n. 35.—Stems herbaceous, without wings. Leaves radical; undivided, with awns.—Native of Barbary. This species is hardly known, except in the Linnaean herbarium. The specimens came from Morocco. The root is simple, long and taper, apparently annual. Leaves all radical, an inch and half long, hairy, much like thofe of S. finuata. Stalks round, three or four inches long, decumbent, panicled, with an awl-shaped leaf or two at their divisions. Bracteas wedge-shaped and decurrent, as in the leaf, but much smaller, and rough at the edge with hooked prickles. Leaves of the involucre rough, with long, spinous, spreading points. Limb of the calyx white or yellowish, like the leaf; but entire and without awns, like S. finuata.

S. stellata. Capped Thrift. Linn. Suppl. 187. Willd. n. 37. Ait. n. 23. L‘Her. Stirp. Nov. 25. t. 13.—Stem branched, winged with a triple crifped border. Leaves radical, ovate, pointed. Flowers spotted, crowded, all turned one way.—Native of the coast of Barbary, flowering in July. Sometimes kept in greenhouses. The partly decumbent stems are much branched, and remarkable for their crifped, 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. Bracteas, as well as involucre, reddish, obtuse, pointles, 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.

In the first fort there are several varieties: as with red flowers, with scarlet flowers, with white flowers; great thift with red flowers, with white flowers; and small Sea-pink, with fcfh-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 laft fort there are two varieties, which differ in their leaves, flems, and flowers.

Method of Culture.—All the farts of these plants are capable of being increafed by parting or fipping the roots. This, with the firft kind, fhould be performed in the autumn, or very early spring feafon, planting them immediately as edgings, or in the borders: they fhould not, however, be parted too small. And when planted out as edgings, a quantity of slips should be obtained in these feafons from old plants, by flipping or dividing the off-fets of their roots, each fip being furnished with roots and tops; then, having made up the edge of the bed or border even and firm, planting them either with a dibble in one range, two or three inches diftance in the row; or to form at once a close edging, to near as to touch one another, or in a small trench, close, as in planting box-edgings. These edgings fhould, every fummer, immediately after flowering, be trimmed with garden-hears, or a knife, to cut off all the decayed flower-flalks close to the bottom; likewise to trim in any projecting irregularity of the edging, at the fides or top; also, when it spreads confiderably out of the bounds, it fhould be cut in evenly, on each fide, in due proportion; performing those trimmings in moist weather, and not too late in autumn, otherwife the drought of summer, or the cold of winter, will be apt to injure them when newly cut, and cause them to have a flabby disagreeable appearance. But when these edgings grow confiderably out of bounds, or become very irregular, it is necefary to take them up, fit the plants small, and immediately replant them as before, in a neat regular edging. They fometimes require replanting every three or four years in this manner.

The fefcond forts may likewife be increafed by parting the roots in the autumn, or very early spring, preferring some mould to them, and planting them out again immediately, being placed in an eaf! border, where the foil is loamy.

They may also be raised from feeds obtained from abroad, fowing them on a fimalar border, keeping the plants clean; and when of fufficient growth, planting them out in pots. It is the common practice, in treating the fefcond fort, according to Martyn, to confider it as a greenhoufe plant; and it appears to the greateft advantage in a pot, as it is much dilpofed to throw up new flowering-flems. By hav-
ground, in a rather funny situation, where they generally
left the longe.

**STATICS, Statics,** formed of *statis,* 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; viz. that part which con-
siders the motion of bodies arising from gravity.

Others make them two distinct doctrines, reining me-
chanics 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 doc-
trine or theory of motion; and mechanics, the application
of it to machines.

For the laws of statics, see **Gravity, Descent, &c.**

**Statics, Static,** in **Medicine,** a kind of epileptic, or
persons seized with epileptics.

**Statics** differ from **catleptics,** in that these last have no
sense of external objects, nor remember any thing that
passes at the time of the paroxysm; whereas the statici
are all the while taken up with some very strong,
likely 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
staghi.

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

**STATION,** in **Geometry, &c.** a place pitched upon
to make an observation, take an angle, 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 business 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, N° 71, by means of a
telecope. But the practice of this method does not an-
swer to the theory.

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

**STATION, in Astronomy,** 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 inter-
mediate one, in which the planet neither appears to go
happier forwards nor backwards, but to stand still, and keep
the same place in her orbit; which is called her station.

**Station, in Britifh History.** The stations, or stations,
fortresses erected along the line of Severus's wall, were so
called from their liability, and the flated reedence of gar-
rifons. They were also called caftell, which hath been con-
verted into caflerz, a name which many of them still bear.
These were by far the largest, strongest, and most magni-
ificent of the fortreses, which were built upon the wall, and
were designed for the head-quarters of the cohorts of troops
which were placed there in garrison, and from whence de-
tachments were sent into the adjoining counties and turrets.
These stations, as appears from the writings of them, which
are still visible, were not all exactly of the same figure, nor
of the same dimensions; some of them being exactly
square, and others oblong, and some of them a little larger
than others. These variations were no doubt occasioned
by the difference of situation, and other circumstances.
The stations were fortified with deep ditches and strong
walls, the wall itself coinciding with, and forming the north
wall of each station. Within the stations were lodgings
for the officers and soldiers in garrison; the smallest of them
being sufficient to contain a cohort, or 600 men.
Without the walls of each station was a town, inhabited by labourers,
artificers, and others, both Roman and Britton, who chose
to dwell under the protection of these fortresses.

The number of the stations upon the wall was exactly eighteen;
and if they had been placed at equal distances, the interval
between every two of them would have been four miles and
a few paces: but the intervention of rivers, marshes, and
mountains; the convenience of situation for strength, pro-
fpect, and water; and many other circumstances to us un-
known, determined them to place these stations at unequal
distances. The situation which was always chosen by the
Romans, both here and everywhere else in Britain, where
they could obtain it, was the gentle declivity of a hill, near
a river, and facing the meridian sun. Such was the situa-
tion of the far greatest part of the stations on this wall.
In general we may observe, that the stations stood
thickest near the ends and in the middle, probably be-
cause the danger of invasion was greatest in those places.
But the reader will form a clearer idea of the number of
these stations, their Latin and English names, their situa-
tion and distance from one another, by inspecting the fol-
loving table, than we can give him, with equal brevity,
in any other way. The first column contains the number
of the station, reckoning from east to west; the second
contains its Latin, and the third its English name; and the
last its distance from the next station to the wall of the
well of St., in miles, furlongs, and chains.

<table>
<thead>
<tr>
<th>No.</th>
<th>Latin Name</th>
<th>English Name</th>
<th>M. F. C.</th>
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<tbody>
<tr>
<td>1</td>
<td>Segedunum</td>
<td>Cousins' house</td>
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<td>2</td>
<td>Pont's Elii</td>
<td>Newcastle</td>
<td>2   0 9</td>
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<td>Condercum</td>
<td>Benwell-hill</td>
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<td>Vindobala</td>
<td>Rutchemer</td>
<td>7   0 3/4</td>
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<td>Halton-cherter</td>
<td>5   1 7</td>
</tr>
<tr>
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<td>Cilurnum</td>
<td>Walwich-cherter</td>
<td>3   1 8</td>
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<tr>
<td>7</td>
<td>Procellita</td>
<td>Carrawburgh</td>
<td>4  5 3/4</td>
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<tr>
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<td>Borocivus</td>
<td>Hopefield</td>
<td>1   3 8</td>
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<tr>
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<td>Vinclana</td>
<td>Little-cherter</td>
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<td>Cambock</td>
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<td>Stanwix</td>
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<td>Broumbrugh</td>
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<td>18</td>
<td>Tunnicgulum</td>
<td>Boulhofs</td>
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</tr>
</tbody>
</table>

Length of the wall 68 3 3
STATION, Station, in Church History, is applied to the fall of the fourth and fifth 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 Canonical Epistle, can. 15, observes, that it was appointed, conformably to ancient tradition, to fall weekly on those days; on Wednesday, in memory of the counsel 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 Absinthe.

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 lstand 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. Station, exaeq, in the Ancient Muses, was sometimes used for any fixed pitch, or degree of sound, whether produced by intention or remission.

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

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

Stationarii, 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 constantly 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 distances of those lines being indefinite, 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 55° and Mars at a much greater distance; Venus at 45°, 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 fevers; connected with some particular constitution of the atmosphere, according to his hypothesis; and giving a particular epidemic character to the maladies of those fevers; and as contrived with those casual and short occurrences of particular diseases, which are now and then intermixed with the prevalent epidemics, and which he denominated intercurrent fevers.

(See Sydenham, Observat. Medice circa Morb. Aen. Historiam et Curat. fac. i. c. 2, and lect. 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, a conjecture, that they originated 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 Pappus, 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 facility, that during his father's life he obtained the crown in the poetical contests of his native place. He wrote a work in the poetical games celebrated at Alba. The poems which he addressed to several of the principal persons in Rome, are proofs of the friendships which he contracted 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 vanquished 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 latusril at the same time intimating, that notwithstanding this applause, the author might have faltered, had he not held his "Agraw," apparently a new composition, to a celebrated actor, a favourite of Domitian. He polluted a small estate and country house near the seat 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 "Thebaid," 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, and 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 "Thebaid" 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 farce and fantastic character of its incidents, which suited 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 Cæsar Barthelemy, 4to. 1664; of Veenhuyzen, Lug. Bat. 8vo. 1671; and
and the Delphin, 2 vols 4to. 1685. Markland's edition of the "Syria" is highly esteemed.

STATO della Chiesa, State of the Church, or Papedom, a name 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 secular power of the popes is traced back to the age of Pepin and Charlemagne; and the forged collection of papal ercels, published in the 9th century under the name of Hidorus, 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 papal spheres were conjoined to reside at Avignon. In 1513 Bologna was acquired by Julius II.; the marquisate 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.

Where the papal power predominates, no 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 a superior kind of alum, prepared from a whitish argilloaceous rock at Tolfa, near Civita Vecchia, from which place also is exported puzzolanum (what fee). The chief city of the papal territory is Rome (which fee); and its revenue has been computed at about 350,000l. per cent. But by exactions in foreign countries it is said to have been raised to 800,000l., subject, however, to a large debt, being per cent. Interett; and this strikingly evinces a defect of industry and prosperity. See Ecclesiastical State, Italy, and Pope.

STATO de Gis Prefidii, 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 consists of the towns of Orbistello, Porto Hercule, the principality of Piombino, 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.

STATORIES, among the Romans, made a part of the emperor's life guard.

STATUARY, 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 disposed to represent the figure of some animal. The common story is, that a maid, full of the idea of her lover, made the first eflay, by the assistance 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 fofter white marble usually wrought into statues, the fame 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 inlute, 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 strictures, the term statue is only applied to figures on foot; the word being formed from the Latin status, the size of the body; or from stare, 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 Foundery of Statues.

Dedalus, the son of Upalnasus, 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 statues 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, however, 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 Phorcians 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 manner which 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 surpafs 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 colossifer.

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

Statue, Allegorical, that which, under a human figure, or other symbol, represents something of another kind, as a part of the earth, a seafon, age, element, temperament, hour, &c.

Statue, Caryatic. See Caryatides.

Statue, Colossifer. See Colossus.

Statues, Curule, those which are represented in chariots drawn by biges, or quadriges, that is, by two or four horses; of which kind there were several in the circuses, hippodromes, &c. or in cars, as we see fome, 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-Crofs.

Statue, Greek, denotes a figure that is naked and antique,
tique, it being in this manner the Greeks represented their
deities, athletes of the Olympic games, and heroes. The
rest of this nudity, by which the Greek statues are distinc-
tuished, 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 Achillian
statues, by reason of the great number of figures of that
prince in most of the cities of Greece.

Statue, Hydraulie, any figure placed as an ornament of
a fountain, or grotto, or that does the office of a jet d'eau,
a creek, fount, or the like, by any of its parts, or by any
attribute it holds. The like is to be understood of any ani-
mal serving for the same use.

Statue. Pedestrian, 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.

Statue, Persian. See Persian.

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

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 cuir-
salas, loricae; those of senators and augurs, trabeata; those
of magistrates, with long robes, togae; those of the people,
with a plain tunic, tunicae; and lastly, those of women,
with long trains, flabellae.

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 Augustus, which were those of the
emperors; as those two of Caesar and Augustus, under the
portico of the Capitol.

Statues, Foundery of. See Foundery.

Statues, Pedestal of. See Pedestal.

Statues, Plinth of. See Plinth.

Statue, Repairing a. See Repair.

Statute, the size, or height of man; derived from the
Latin statuia, of stature, to stand.

The statue, 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 Ho-
er'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 surpassing; but then, it is true, they were,
even then, eftemmed giants.

The ordinary stature of men, Dr. Derham observes, is,
in all probability, the same 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, fearfully exceeds the measure of our ordinary coffins.
The cavity, he says, is only 6.488 feet long, 2.218 feet
wide, and 2.165 feet deep; from which dimensions, and those
of several embalmed 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 other and later inferences to add from
Hakewell: the tombs at Pisa, which are some thousands of
years old, are yet no longer than ours. The fame may be
said of Athelian's in Malmsbury church; and of Sheba's
in Paul's, of the year 693, &c.

The like evidence we have from the ancient armour,
fully contradictory to common reason, they are, with regard to such consequences, void. 8 Rep. 118.

The method of citing acts of parliament is various. Many of our ancient statutes are called after the name of the place where the parliament that made them was held; as the statutes of Morton and Marleberge, of Westminster, Gloucester, and Winchester. Others are denominated entirely from their subject; as the statutes of Wales and Ireland, the articuli clerici, and the prærogativa regui. Some are distinguished by their initial words, as the statute of quia emporium, and that of circumfeltæ againit. But the most usual method of citing them, especially since the time of Edward II., is by naming the year of the king's reign in which the statute was made, together with the chapter or particular act, according to its numeral order; as 9 Geo. II. c. 4. For all the acts of one session of parliament taken together, make properly but one statute; and, therefore, when two sessions have been held in one year, it is usual to mention both. Thus, the bill of rights is cited as 1 W. & M. R. c. 2. c. 2, signifying that it is the second chapter, or act, of the second statute, or the laws made in the second sessions of parliament, held in the first year of king William and queen Mary. Blackit. Com. book i.

Abridgments of the statutes have been made by several, from Magna Charta to the times of the respective abridgers. The first by Rafal, published in 1559; the second by Pulton, in 1606; the third by Wingate, in 1641; and others since by Hughes, Manby, Washington, Bott, Nelfon, Cay, &c.

Statute is also a term provincially employed to signify a hiring day for farm-servants.

Statutes of a Corporation, are those bye-laws, or private regulations, which it is empowered to make for its own better government, and which are binding upon the members, unless contrary to the laws of the land, and then they are void. This right of making bye-laws, under the preceding restriction, was allowed by the law of the Twelve Tables at Rome; but no trading company is, with us, allowed to make bye-laws which may affect the king's prerogative, or the common profit of the people, under the penalty of 46L. unless they be approved by the chancellor, treasurer, and chief justices, or the judges of assize in their circuits; and even though they be so approved, still, if contrary to law, they are void. Blackit. Com. book i.

Statute. Accessory by. See Accessory.

Statute. Alien upon the. See Alienation.

Statute. Guardian by. See Guardian.

Statute-Merchant is a bond of record, purgatory to the statute 13 Edw. 1. de mercatoribus, acknowledged before one of the clerks of the statutes-merchant, and mayor, or chief warden of the city of London; or two merchants of the said city for that purpose aligned; or before the mayor, chief warden, or master, of other cities or towns; or other sufficient men for that purpose appointed; sealed with the seal of the debtor, and of the king, which is of two pieces, the greater to be kept by the mayor, chief warden, &c. and the lesser by the said clerks. Its effect is, that if the obligor pay not the debt at the day, execution may be awarded against his body, lands, and goods; and that the obligee shall hold the same till the debt be levied. See Statute-Staple.

Statute-Seffions, called also Petit-seffions, in Law, are meetings in every hundred, to which constables repair, and others, both maidens and servants, for deciding differences between masters and servants, rating of wages, bellowing people in service, who, being fit to serve, either refuse to seek, or cannot get masters.

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

The statute-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 so holds the lands, he is tenant by statute-merchant, or statute-staple.

Improper is a bond of record, or recognition, 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 transaction, 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 is satisfied; and of these writs there is one against lay persons, and another against persons ecclesiastic.

Statuto Statula, 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 refuse to work according to the statute.

Stavanger, in Geography, a sea-port town of Norway, in the Christian era, situated on a bay of the North sea; anciently the see of a bishop, but removed, after the town was burnt in the year 1688, to Christiania; 86 miles S. of Bergen. N. lat. 58° 6’. E. long. 5° 44’.

Staveni, 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 ducy of Mecklenburg; 24 miles E. of Gütrow. N. lat. 53° 40’. E. long. 19°.

Staveren, a town of Holland, and the most ancient of Friesland, supposing 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 "Stavon." 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 less exposed. It was anciently a very rich, powerful, and populous city, with the best harbour in that country. The ancient kings of Friesland made it their ordinary residence, in a palace built by Richolde, the first king about the year 400. Richolde VI., after he had conquered all the country as far as Utrecht, called his conquests the Kingdom of Staveren, which flew 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 Obidale 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;
STA 

Town; and they still carry on some trade, especially in fishing, and in passage-boats over the pools and lakes of the neighbourhood. In 1799, the town was taken by the British fleet; 40 miles N. of Amsterdam. N. lat. 52° 50'. E. long. 6° 46'.

STAVERN. See FREDERICKSWORN.

STAVES. See STAGGERS.

STAVES. Flag. See FLAG-STAVES.

STAVES. Leveelling. See LEVELLING-STAVES.

STAVES. Tip. See Tip-STAVES.

STAVESACRE, STAPHISAGRIA, in Botany; for the characters, see DELPHINIUM.

Staveacre, Delphinium flavissagria, grows in Provence, Launedoc, 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 smell is disagreeable, and somewhat fetid; to the taste they are very bitter, acid, and nauseous. Their virtues are extracted partially by water, and completely by rectified spirit.

These seeds seem to have been known to the ancients, by whom they were employed as a medicinal for, on being chewed they 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 ten 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 simples 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.

STAUFO, in Geography, a castle of Germany, in the principality of Nassau Saarbrueck Utngen.—Allo, a castle of Germany, in the principality of Anspach, with a citadel; 30 miles S.E. of Anspach.

STAUFO, a town of the Britiag, on the Mehlbach; 24 miles N.N.E. of Bâle. N. lat. 49° 54'. E. long. 7° 48'.

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

STAVITESTI, a town of Walachia; 42 miles E.S.E. of Tergovia.

STAVANTON, a port-town of America, in the state of Virginia, and capital of Augusta county; situated on the S.E. side of Middle river, a water of Patowmac, N. of Maddington's cove. It contains about 160 houses, mostly constructed of stone, a court-house and gaol; 100 miles S.W. by S. of Winchester. Allo, 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 prefers it to its confluence with Dan, there refuming 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° 27'. E. long. 122° 17'.

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

STAUROS, in Ancient Geography, a people of Asia, in the environs of Hrycaort. Plane.

STAUROBIT, Granitse of Sauffur and Werner, and Staurus, of Haisty, in Modern Geography, a stone of the fideous genus according to Kirwan, of a reddish or blackish-brown colour, which forms always crystallized. Its crystals are of an hexagonal prismatic form, four faces of which are the largest; meeting in pairs, and forming two obtuse angles, measuring 129°. This 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 crofs; sometimes even three prisms are thus arranged, forming a triple crofs, whence its name of "Crofs-Hone." Its surface is smooth or uneven, and its lustre varies considerably. Internally it is more or less finking, with a lustre between vitreous and resinous. Its fracture, parallel to the axis, is imperfectly lamellar; in the opposite direction it is small-grained uneven, palling to conchoidal. It is brittle, and somewhat harder than quartz. Sp. gr. 3.28. 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 Vauquelin, are

33. Silex.
44. Alumin.
3.84. Lime.
13. Oxid of iron.
1. Oxid of manganese.

94.84
5.16 Lofs

100.

This mineral is found in St. Gothard, in Switzerland, in small crystals, imbedded in micaceous chittora, and accompanied with cyanite: in Brittany, near Quimper, in middling-sized crystals, imbedded in a micaceous clay, apparently produced by the decomposition of some primitive rock; also at St. Jago of Compoedella, in a primitive rock. Akin.

STAUROPHORI, Σταυροφοροι, compounds of Σταυρος, a crofs, and φοροι, I carry, in Church History, certain ecclesiastics, whose business it was to carry the crofs in processions.

STAUROPHYLAX, Σταυροφυλαξ, derived from Σταυρος, a crofs, and φυλαξ, I keep, a dignified officer in the church of Constantinople, to whose care the keeping of the crofs, found by St. Helena, was committed.

STAUROPOLE, in Geography, a town of Russia, in the government of Simbirsk, on the Volga; 44 miles S.S.E. of Simbirsk. N. lat. 53° 44'. E. long. 48° 52'.—Allo, a town of Russia, in the government of Caucaus, on the Volga; 88 miles W.N.W. of Ekaterinograd. N. lat. 44° 56'. E. long. 41° 50'.

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

STAVOTIDE, in Mineralogy, the name given by Haisty to granitse. See STAUROBIT.

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 Underwalden; 6 miles S.E. of Lucerne.

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

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

A flask, in the doctrine of critics, is justly esteemed 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 critics.

STAY, in Sea Language, a big strong rope employed to support the masts on the fore-part, by extending from their upper end at the main-head towards the fore-part of the ship, as the shrouds 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- stay or royal stays, &c.

Back-stays, brace, hinging, and flanging, are stays which support the topmasts and top-gallant masts from above; they reach from the heads of the topmast and top-gallant mast to the channel on each side of the ship, and affix the shrouds, when strained by a press of sail. The hinging back-stays change according to the action of the wind upon the sails, whether aft or upon the quarter. Bob-stays are stays used to confine the bowprit down upon the stem, and counteract the force of the stays which draw it upwards. Stay-fall stays are those on which the stay-falls are extended. The ship's-fall is similar to the fall-stays, and extends the jib. The martingale-fall supports the jib-boom, as the bob-stays support the bowprit.

Preventer-spring-stays are subordinate 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 catarpins and futtock-shrouds to the main, is now strictly forbidden in the navy, as the placing of the spring-fall before the foremost crosstrees was with a view to separate it from the flanging fall: it is for the future to be effected, by placing the collars live or fix feet apart on the bowprit. Skittles-stays are ropes used for hoisting or lowering buoys in or out of boats. Stay-rope have four strands, with a heart running through the middle, which keeps the rope true; and when hawser-laid as a rope, prevents it from stretching, and the strands have each their proper bearing. The stays are made of fine yarn, spun from the beet top hemp. Twenty threads a hook make a rope three inches in circumference, and so in proportion for any fize. The yarn is warped to the length and fize for the fall wanted. The strands are warped long enough for one strand to make two, when hauled about and hung upon the back-hook. By this an eye is left for the upper end of the fall to go through and form a collar, to go over the main-head. For falls of nine inches in circumference, each strand should be 3/4 inch, and so in proportion. The heart must be near the fize of the strand, or the rope will not lie round and true. Particular attention should be paid to making the falls, as on them the safety of the man, &c. greatly depends. Main, fore, and mizen-topmast, and some top-gallant-mast-stays, are cabbel-laid.

The fall of the fore-mast, called the fore-fall, reaches from the main-head towards the bowprit-end; the main-fall extends over the fore-cable to the ship’s head; and the mizen-fall is fletched down to that part of the main-mast which lies immediately above the quarter-deck; the fore-topmast-fall comes also to the end of the bowprit, a little beyond the fore-fall; the main-topmast-fall is attached to the head or bounds of the fore-mast; and the mizen-topmast-fall comes also to the bounds of the main-mast; the fore-top-gallant-fall comes to the outer end of the jib-boom; and the main-top-gallant-fall 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 falls, so as that she cannot make any way forwards, which is done in order to her tacking about.

STAY, in the Manoeuvres. To fall, or furlain your horse, is to hold the bridle firm and high. We likewise fall or furlain a horse with the inleg, or in-wheel, when he makes his crouse go before his shoulders upon volts; as also when we hinder him to traverse, and ride him equally, keeping him always subject, so that his crouse cannot flip out, and he cannot lose either his cadence, or his ground, but marks all his times equal.

STAY-Sail, in a Ship, a fore or triangular sail extended upon a fall. See SAIL.

STAY-Sail, TABBLE. See TACKLE.

STAY-Tackle Pendants. See PENDANTS.

STAYNER, Sir Richard, in Biography, was the gallant commander of a ship of war during the protectorate; and, in conjunction with captain Smith, took a Dutch East India ship of 800 tons burden, having on board four chests of silver. In 1656 he was appointed to the command of three frigates, and with this small squadron he fell in with the Spanish flotilla, consisting 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 fix hundred thousand pounds sterling, so that captain Stayner 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. Reconnorning the force and position of the enemy, the English admiral found it impossible to bring off the enemy's ships, though he thought they might be destroyed. Stayner 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 instantly 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 men, 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 so highly of the conduct of captain Stayner, that he immediately conferred on him the honour of knighthood. On the restoration, Sir R. Stayner had a command under Montague, 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
STEADMAN'S CREEK, a river of America, in New York, which runs into the Niagara, above Fort Schloffer.

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 ready in her course, without deviating to the right or left, or making angles (or yaw, as they call them) in and out. The helmman accordingly answers steady; thus denoting his attention and obedience to the pilot's orders.

STEAL, in Agriculture. See STEAL.

STEALING an Horse. See FORCIBLE ABDUCTION.

STEALING, in Law. See LARCENY.

STEAM, in a general sense, is a term used to signify the visible cloudinefs arising from the condenfation 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 see, that in the visible milky 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 globules.

Some have confined the word steam to the vapour of water 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 fame. Nothing, however, can be more absurd than this notion; steam can exist at the lowest known temperature. At 50° below the cypher of Fahrenheit, if the barometer could shew it, the pressure 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 temperatures; and before we proceed further on our subject, it may not be amifs 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 fize. 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 fides wet; and next introduced the mercury, inverting the tube so as to exclude the air. The water, being the lighteft 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; forming 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 gage 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 fteam alone affected the barometer; the thermometer, at the same time, marking the temperature.

From these facts Mr. Dalton conftructed his table. The altitudes of the mercury, answering to the degrees of temperature, 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 fame, but something approaching to a geometrical feries. The increafe, although not ftrictly geometrical, of the ratios themselves diminished regularly, which enabled him to calculate with fufficient exactnefs those degrees which he could not afcertain by experiment. We seldom find any of nature's laws attended with any thing fo indefinite; and Mr. Dalton very properly observes, that the defect is not in nature, but in the imperfect scale of our thermometers, which, M. de Luc and others have fhewn, do not mark equal increments of heat.
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**STEAM.**

**Table—continued.**

<table>
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<tr>
<th>Temperature in Inches of Mercury</th>
<th>Weight of Vapour in a Cubic Foot of Space</th>
<th>Temperature in Inches of Mercury</th>
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<th>Temperature in Inches of Mercury</th>
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STEAM.

In answer to some references which may be required, we have thought proper to add a third column to this table, showing 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. The facts 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 Transactons, vol. v., and Nichollon's Journal, vols. vi. and vii.

There will be found a valuable reference in all practical applications of steam, and will not be of less importance in allaying any inquiry into the procés of evaporation, as connected with the arts of life, and the natural evaporation in the air. With a view to affirm our conception of the nature of steam, or of the elastic vapour of water, we shall condense 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 elasticity is equal to 30 inches of mercury.

2. One pound of Newcastle coal converts four 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. A quantity of water evaporated is equal at 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 answering 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 mbs be uniformly of the same temperature.

When the force of vapour is 30 inches, and the temperature at 212°, this degree being most preferred, the depth evaporated is 1.3 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 quantity 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 112°, with the same quantity of caloric. Thus, agreeable to the 3d, 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 means 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 bifefted or reduced to 7.5, by the temperature falling to 150°.5. At 124°.5, 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°.5.

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.

We have 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.

T = its temperature.

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

d = the temperature of the steam.

q = the weight of condensing water.

n = capacity of steam for heat, water being 1.

Then, according to a theorem for finding the resulting temperature by mixing bodies of different temperatures together, \( t = \frac{qT + (b + d)CSn}{q + CSn} \); 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 1112°; hence the real temperature added to the latent heat will be equal t.

The conclusion from these facts will be, that \( \frac{b + d}{t} \) will be nearly in the same ratio with the density of the steam, before and after condensation, and, therefore, as the respective force of vapour. If p be the force of vapour of the steam before the experiment, and f that after condensation; then \( \frac{b + d}{t} = \frac{p}{f} \), and \( f = \frac{pt}{b + d} \). If we now
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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 \( C = 1 \) cubic foot.

\( S = 253 \) grains, the weight of a cubic foot of steam.

\( q = 253 \) grains of water.

\( T = 60. \)

\( b = 900. \)

\( d = 212. \)

\( n = .9. \)

\[ \begin{align*}
\frac{b + d}{t} &= \frac{f}{t} = 1112, \quad \text{or} \quad \frac{30}{558} = \frac{f}{t} = 15 \text{ inches of mercury.}
\end{align*} \]

Then \( q = \frac{b + d - t}{t} = 253 \times 60 + (900^0 + 212^0) \times 253 \times .9 = 558. \)

The quantity of steam of this density will be as \( p \) to \( f \); therefore, as

\[ 30 : 15 :: 253 : 126.5 \text{ grains; hence the whole weight, which is 558 - 126.5 = 431.5 grains, the weight of water.} \]

Hence, if the capacity of the steel-veil 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

\[ q = \frac{b + d - t}{t} = 253 \times 60 + (900^0 + 212^0) \times 253 \times .9 = 558. \]

We have before hinted at the vulgar idea of there being no medium between steam at \( 212^0 \) 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 \( 212^0 \), 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 \( 212^0 \) can exist independent of air, and where have we become acquainted with any rule, that souseous 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 confusively observed in heating copper-plates and sheet-lead. The odour of cast-iron is particularly striking.

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 often 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 shown 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 process would be greatly facilitated, as we observe in the drying of the ground in a brisk wind. This shows 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 inverely as the density, whether this difference of density arises from the nature of the gas, or from 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. See Nichol's Journal, vol. vii. p. 5.

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 anfwering 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 milky, when it is put into it. If no appearance of this mist 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 allow of vapour anfwering to the temperature of the atmosphere, or that of the mist 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 purposes, 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 \( \frac{3}{4} \) inches in diameter, and the other \( \frac{5}{4} \) inches. The former vessel, when the water in it was jilt made to boil, lost from \( 35 \) to \( 45 \) grains per minute; this difference being explained by a greater current of air over the second vessel. 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
\[ \frac{154}{40} = \frac{(60)}{(3-25)}^3 \]
which is very near; for if the small vessel had been 3.05, then the two squares would have been in the ratio of 154.

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.

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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 45°, 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 3.72 = 2.08 = 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 "less 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 part 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 have equal increments of heat, aqueous vapour at any temperature would become of half this density,
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Aty, by a decrease of temperature equal to 25°. And since, at the intervals of every six miles above the surface of the earth, the preasure, and of course the force of vapour, is halved; the quantity of water in a cubic foot of space will diminish very full 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 5th, before given, viz. If such vapour were compressed till its density was equal to 253 grains in the cubic foot, its temperature would be 12°, 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 rarest 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 furprised others, which is as follows. When steam, of very considerable density from preasure, is made to issue from the mouth of a pipe, a perfon may place his finger close to the aperture, without feeling any unpleasant effect from the heat. The feaible heat of this steam, which would otherwise act, 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 nozzel of a pair of bellows, and a blast fent through them, the mercury rises above the common temperature; but if the bulb be placed at a little distance from the nozzel, the mercury falls below the common temperature. In the firft instance, the air was compressed, and the heat given out; in the fecd, heat was abforbed, and consequently the temperature lowered. The cold produced by the exhaustion of the receiver of the air-pump is to be explained in the fame way. The change of temperature of the atmosphere is doubtlefs 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 condenfation. 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 condenfation. We can but, therefore, regard the water in the air as existing in two flates, namely, in the liquid and in the elastic state, between which there can be no medium: for evaporation or condenfation must be the refult of the flight of change of temperature; at least we may conclude, that one of these procedes will commence with the change, and will progresively go on till as much water is either precipitated or taken up as the temperature will admit. Evaporation, as we have before obferved, can never be instantaneous; even if the air did not mechanically refiit it, the presence of the vapour already formed would have that effeet. Although there appears to be no medium between water and steam, the actual precipitation of the water is progressive, and is more or lefs rapid at different times. The clouds which appear to be suspended in the atmosphere are condfuted by an affembly 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 refiance of air, their defcent is retarded, being dependent upon the ratio between their surface and solidity.

There are good reafons 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 flates of electricity, the condenfation will be much facilitated, as we perceive in rain immediately preceding thunder. In all thofe situations where fleam undergoes condenfation, we do not fee water immediately precipitated. The milky appearance is caufed by small globules of real water falling towards the earth with a small but progressive velocity. If the change of temperature causing the condenfation be very slow, the globules are extremely small in the firft infance, and are with more difficulty united. This is doublefs the cafe with all bodies which are perfect liquids. Globules of mercury are united with greater difficulty the smaller they are. The flate in which mercury exifts in lard in the form of union, is in thefes minute globules produced by the mechanical action in mixing it. If boiling water be poured upon mercurial ointment, the fat is feparated 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 flate of water forming the white fleey clouds which we frequently obferve at a great height; the dense dark-coloured clouds being compofed of larger globules, which seldom remain long before they are more completely formed into drops of rain.

The clouds, therefore, are not to be confidered as absolutely fepafed, 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 affignable 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 fecd, 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.
\( a \) = the diameter of the globule which is required.

Then, since the particle will ceafe to be accelerated when the reftaftance is equal to its weight, the velocity at that point will be \( a \), which it will uniformly retain, till other things remaining equal. The space fallen through to give \( a \), will be \( \frac{a^2}{4} \) : this, multiplied by \( \frac{\rho}{e} \), will give \( \frac{\rho a^2}{e} \), from which, the

\[ \text{U. 2} \]
content of the cylinder of air, and \( \frac{dF \cdot \rho \cdot r^2 \cdot s^2}{g} \) = the weight of the cylinder. This would be equal to the resistance, if the surface presented to the refilling medium had been a plane perpendicular to the direction. The resistance of such a surface to that of the spherical one, is as 1 to 2.

Hence the resistance will be \( \frac{dF \cdot \rho \cdot r^2 \cdot s^2}{16g} \).

The weight of a globule of water of the diameter \( a \), will be \( \frac{1}{6} \pi a^1 = \frac{dF \cdot \rho \cdot r^2 \cdot s^2}{16g} \). Then, since \( v = 1 \) inch, \( g = 194 \) inches, \( e = .0018 \), \( \rho = 3.1416 \),

\[
\therefore \ x = \frac{3}{8} \times 1 \times \frac{1}{194} \times .0018 \times 3.1416 = .00001643 \text{ of an inch, and in weight only .00000000000027 of a grain.}
\]

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 bell 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 cast with wood, or otherwise covered with some bad conductor of heat, which will not be attacked by the heat of 212°.

The boiler, which supplies the steam, should be placed lower than any receiver of water which it has to heat, as in that case the water, which may sometimes condense in the pipes, may run back into the boiler. This affords a little economy, by varying 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 condensing water not being allowed to get out of the way of the steam. For heating water in brewhouses, wash-houses, dyeing-vats, &c. the steam-pipe comes directly into the water, the steam passing into the same 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 baths or around the rooms, and the water shoul 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 out 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 900°.

\[ W = \text{the weight of the water to be heated by steam.} \]

\[ T = \text{its temperature.} \]

\[ t = \text{the temperature to which it is required to be heated.} \]

\[ b = \text{the weight of steam required.} \]

Then \( t = \frac{(L + h) S + W T}{S + W} \), and \( S = \frac{t - T}{L + h - t} W \).

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 raised for a dividend. Then to the temperature of the steam add 900, and from the sum take the required temperature of the water. This last 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° will raise 100 gallons of water at 60° up to 212°? \( \frac{212 - 60}{900} \times 100 = \frac{152}{900} = 17 \) gallons of water, formed into steam. This quantity of steam from a boiler containing about 27 cubic feet, with a fire applied to the belt advantage, will be furnished in 2 hours and 16 minutes, supposing no heat to be lost by the heated masts being exposed. The coal consumed for this purpose will be about 25 or 24 lbs., depending on its quality.

The theorem above given will apply to any temperature above 212°, when the steam is under greater pressure than 30 inches of mercury. It will also appear from the table of the force of vapour, that any degree of heat short of endoergic the vessels, may be given by steam under different degrees of pressure. Such means are at present employed for evaporating water from fagis, flax, and other fluids requiring a greater degree than 212. It will be equally obvious, that an uniform heat may be kept up below 212°, by adjusting the steam-cook through which the medium to be heated is supplied. In giving heats above 212°, 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 reef or 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 diffusion. This is capable of being elevated and depressed by a pulley and chain, having a counterpoise,
STEAM.

terpoile, in order to expel 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 re-
resulting from the condensation runs into the groove, and at
a point short of the top runs off. The water which re-
 mains forms a complete water-lute, to prevent the escape
of steam. The table being placed in a recce, 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 perpetually kept up by a supply of steam. For
this purpose a large cylindrical vessel of cast-iron should be
erected in a corner of the scullery, in order that water
may be drawn from it by a cock. This vessel should be
connected from the bottom with a cold-water ciline, the
bottom of which is level with the top 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, if any portion be drawn out
here, as much will come in at the bottom of the cylinder
from the refevoir 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-fifth that of the outer one. This inner
vessel must have no connexion with the outer one, and must
be for water-tight, that although it is surrounded with the
water of the outer one, none should get in. The inner
vessel is on one side connected by a pipe with a steam-boiler,
having another pipe to allow the condensed water to run
eff, which may be preferred as distilled water, and is valuable
for many purposes. The heat arising from the condensa-
tion is communicated to the water in the outer vessel, the
hotest 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 refevoir. This
useful apparatus is the invention of an ingenious economist
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 ex-
quisite 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 recess, 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 giv-
ing 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 56°, 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 36 lbs. of coal, including that required to
raise the 33 cubic feet of water from 32° to 212°, which
is always about 4th of what will afterwards make it into
steam.

Supposing the bath to have double doors, and a small sky-
light 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 restore this every day, will require
only 1/4th of what was required to raise it from 32°. This
will be about 23.5 lbs. Supposing the whole 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 boil-
ing 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 mullage in roots and seeds,
as in potatoes and flour-puddings, as well as in their leaves,
fluits, and flower-cups, might be rendered probably more
nutritive, and perhaps more palatable; but that many of
the leaves of vegetables, as the summits of cabbage-sprouts,
lose their green colour by being boiled in steam, and look
like blanched vegetables. This vitiation of some vegetables
by steam is probably owing to its diffusing their colouring
matter, which may then become decomposed, and may ren-
der them less agreeable to those who choose by the eye
rather than by the palate; which green colour is, however,
heightened by boiling them in some hard waters which con-
tain diffused lime of sea-salt, or by a flight 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
fame effect of making vegetables green, when boiled in an-
other 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 evap-
orates, is said to convert blueih 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 intention, to far as we know, has not yet been commu-
nicated to the public; it is, however, by some mode of flues,
pipes, and other contrivances for conveying and containing
it, so as that its heat may be unblurredly, equally,
and regularly afforded to the roots of the plants which it is
so desired to push forward into the fruiting state. It is said
to have been used in some instances in different parts of Lan-
cashire 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 a elegant mode of forcing plants
into fruit at early season.

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 be-
ing 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 actuated by
the fire which cauful 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 accessories, 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 stock of knowledge.

The steam-engine follows next to the ship in the scale of inventions; but in an English Cyclopedia 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 at an amazing degree, when heated above the temperature at which it becomes changed into steam, or vapour, which being an exceedingly elastic fluid, it 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 prehure 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, exerting a great force to escape. The prehure 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 prehure of the atmosphere may be made to give motion to a piston, by admitting the atmospheric air to prehure upon one side of the pylon, whilst there is a vacuous 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 pahes 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 leffer or greater degree of compreure. The ordinary prehure 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° in Fahrenheit's thermometer. If the heat is increased above that degree, and if the water is unconfeined, except by the prehure of the atmosphere, the water immediately assumes the aeriform state, and flies off in elastic vapour, which we call steam; but if the fame water is retained under the prehure of the atmosphere by enclosing it in a close vessel, and exhausting the air from it, a certain proportion 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 prehure 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 prehure which confines and retained it in its fluid state. On the other hand, water which is retained in a close vessel, under a greater degree of prehure than that occasioned by the prehure of the atmosphere, will not boil or rise in vapour, until it becomes heated to a higher temperature than 212°. It is even probable, that water might be compréllled 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 prehures upon the surface of the water, and against the interior surface of the vessel which contains it.

The following tables show 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. Betancourt, which do not differ from this 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 close 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 fiphon barometer tube, that is, an inverted glass fiphon filled with mercury, from one leg of which the preffure 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 fiphon would stand at the same level, because it would not be preffed upon at all on either side; but when any vapour was raised in the vessel, it would preff upon the interior surface thereof, and also upon the surface of the mercury in one of the legs of the inverted fiphon; and as the surface of the mercury in the other leg would not be preffed 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 elaltic force of the vapour, which was found to inerease with the inereace of the heat, according to the second column of the table. For the convenience of eflimating the force of the vapour, we have added the third and fourth columns to Mr. Dalton's table. The third, to eflpress the preffure by the altitude of a column of water, instead of mercury; and the fourth column to shew the preffure upon each square inch of the surface upon which the vapour acts, in pounds avoirdupois and decimals. The table also shews, in the three laft columns, the difference of preffure 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 flrst table, which is for every 10° of temperature up to 212°, or the heat of boiling water when in the open air, the three laft columns shew how high the preffure 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 immerfed in the mercury or water. And in the second table, which is for the degrees of heat above 212°, the same columns shew to what height the force of the vapour will caufe 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 of the expansive Force of the Vapour of Water, or Steam, when enclosed in a close Vessel, and relieved from the Preffure of the Atmosphere; taken at every 10° of Temperature, from the Congelation of Mercury, or 40° below the Zero of Fahrenheit, up to 212°, or boiling.

<table>
<thead>
<tr>
<th>Temperature in Degrees of Fahrenheit's Thermometer.</th>
<th>Preffure of the Vapour, or the Force which it will exert to enter into a vacuous Space.</th>
<th>Preffure 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>
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<tbody>
<tr>
<td>-----------------------------------------------</td>
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<tr>
<td>-40 (below freezing.)</td>
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<td>32 (freezing.)</td>
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<tr>
<td>110</td>
<td>2.53</td>
<td>2</td>
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<td>120</td>
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<tr>
<td>210</td>
<td>28.84</td>
<td>2</td>
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<tr>
<td>212 (boiling.)</td>
<td>30</td>
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</tbody>
</table>
TABLE of the expansive Force of Steam, when enclosed in a close Vessel, taken at every 5° of Temperature, from 212° of Fahrenheit, or boiling, up to 325°.

<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>
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<tr>
<td>212 (boiling.)</td>
<td>30.</td>
<td>33 10.75</td>
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<td>215</td>
<td>31.83</td>
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<tr>
<td>325</td>
<td>140.70</td>
<td>158 11</td>
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History of Invention of the Steam-Engine.—The great clastic force of steam has been long known in the instrument called the aeolipile (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 so little understood, that the steam which flowed 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, propofed to employ it for blowing furnaces. The first idea of employing this force of steam to produce motion was by Brancas, a philosopher of Rome, who contrived a great number of different kinds of mills to be worked by the steam coming from a large aeolipile, 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. Cenci, governor of Loretto, in 1628, 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 inconsiderable, 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 cy-inder; 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 propofed 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 a flight of 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
description which we have of a machine for raising water by fire, employed in raising steam from boiling water, is from the marquis of Worcester, who, in the reign of king Charles II., and in the year 1663, published a small pamphlet, entitled "A Century of the Names and Scantlings of the Inventions of Worester's Inventions," written in 1665.

This little work, it appears, was addressed to the king and parliament, and published with a view to obtain an encouragement from the public for the prosecution of 100 projects, which it details. No. 68. of this Century contains as follows:—No. 68. An admirable and most forcible way to drive up water by fire; not by drawing or sucking it upwards, for that must be as the philosopher calles it *iniria sphaerae adhibita*, which is but at such a distance. But this way hath no bower, if the vellid be strong enough: for I have taken a piece of a whole cannon, wherein the end was burnt, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole; and making a constant fire under it, within twenty-four hours it burnt, and made a great crack; so that having a way to make my vellids, so that they are strengthened by the force within them, and the one to fill after the other. I have seen the water run like a constant fountain stream forty feet high: one vellid of water, rared by fire, driveth up forty of cold water. And that a man tends the work is to turn two cocks, that one vellid of water being confumed, another begins to force and re-fill with cold water, and so successively; the fire being tended and kept constant, which the self-same perfon may likewise abundantly perform in the interim between the necessity of turning the said cock.

This passage certainly contains a description of an engine for raising water by the repellent power of steam; and from his expression, of one vellid of water, converted into steam, forcing up forty vellids of cold water to the height of forty feet, it is very probable that he had actually tried the experiment by a working model.

The marquis concluded his Century of Inventions by a promise to leave to posterity a book, wherein under each head the means of putting his several inventions in execution were to be described, with the affordance of plates; but as this work never appeared, we can only judge of his abilities by this specmen. He appears to have been a person of much knowledge and ingenuity; but his obscure and enigmatical account of these inventions seems not so much intended to instruct the public as to raise wonder; and his encomiums on their utility and importance are, to a great degree, extravagant, reminding more the puff of an advertising tradesman, than the patriotic communications of a gentleman. The marquis of Worcester was indeed a projector, and very important and mysterious with his applications for public encouragement.

It does not appear that he met with any public encouragement to his propositions; and though, at first sight, it seems surprizing that an invention, by which the steam of boiling water is lifted to be capable of producing a power equal to that of gunpowder, should be neglected for almost forty years; yet if we consider that the greater part of this Century of Inventions confunds of things highly in the style of legendarie, and some of them absolutely impossible, and contrary to all established rules of science, we need not so much wonder at the neglect which the whole experienced. For example, the 99th number of the Century is as follows:—"How to make one pound weight to raise an hundred as high as one pound falleth, and yet the hundred pounds defending the weight nothing less than one hundred pounds can effect."—Vol. XXXIV.

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 skilful 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 with it to be understood, that all the marquis's propositions, except the fire-engine, are of the same nature as No. 69: 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 escutcheons for locks, candle-moulds, &c. It is also probable that others may be brought to perfection yet the marquis's is so much in the style of the wonderful, that it is to be wished that the marquis had published nothing but No. 69, 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 fick and wounded, who, in the year 1698, obtained a patent for a new invention for raising water, and occaafioning motion to all sorts of mill-work, by the impellent 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, viz. No. 253, vol. xx. there is the following regifter:

"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 whence 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 preasure 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 stream, 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 an Engine to raise Water by Fire described, and the Manner of fixing it in Mines, with an Account of the several Ufes it is applicable unto, and an Answer to the Objections made against it," printed at London in 1702, by Thomas Savery, gentle-
STEAM-ENGINE.

This little book was separately addressed to king William III., to whom the engine had been shown 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 Captain Savery's own description, as given by Dr Harris, in his Lexicon Technicum. See Plate 1. Steam-Engine, 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, whole fire-places are marked B 1 and B 2, and their common funnel or chimney C.

These furnaces 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 pulling 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 feel 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 preying 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 preyness of the atmosphere on the surface of the water, in the lower part of the sucking-pipe T, wherefore it will be pressed up, and ascend into, and fill the receiver P 1, driving up before it, as it riles, the clack or valve R 3, which afterwards falling down again and fluttering close, hinders the descent of the water that way.

Then (the receiver P 2 being in the mean time emptied of its air) pull 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 presses 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 piaffage Q R 1, Q Q 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 2 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.

1. Only I should add, that after the engine begins to work, and the water is risen into and bath filled the force-pipe S, it fills also the little cittern X, and by that means feeds the pipe Y Y, which I call the condensing pipe, and which can be turned sidways over either of the receivers, and will then be open: by this cold water is conveyed down from the force-pipe to fall upon the outsi des of the receiver, 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.

Alfo a little above the cittern 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 almoft 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 will there grow prefectly hot; and when it boils, its own steam, which hath no vent out, preying on its surface, will force the water up the pipe H, through K, 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 as the bottom of the pipe H, and then the steam and water will run together, and by its noise, and rattling of the clack I, will give us 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 conflant motion and a continual supply of the engine, without fear of decay or disorder.

Alfo, to know when the great boiler wants replenishing or no, you need only turn the gauge-cock N, and if water come out there is no need to replenish it, but if steam only come, you may conclude there is want of water; and the like will the cock G do in reference to the leffer boiler D, showing when it is necessary to supply that with fresh water from S; for 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 Philosophical Transactions, but it is more neatly put into form, and improved in some of the minor particulars. For instance, the original engine had only one boiler, and there was no means of supplying it with water, to replace the water 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 risk the burning of the vessel. 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 subsidiary boiler, in which a quantity of water is reduced to a boiling heat in a short time for supplying the great boiler, and the power of the steam raised in the subsidiary 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 instantly performed, but being at a boiling heat, it is immediately ready to produce steam for carrying on the work. There is also another grand improvement in the construction of this engine. His first engine was worked by four separate corks, 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 with 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 to prevent or reduce the escape of steam from the 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 confidence, 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 fo raised; 3dly, the supplying cities and towns with water; 4thly, draining lands and marshes; 5thly, for ships; 6thly, for draining mines of water; and 7thly, for preventing damps 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 man 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 1692; 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 raifying 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. Defaguliers, by endeavoring 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. Defaguliers 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 him, though 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 drunk a flask of Florence at a tavern, and thrown the empty flask upon the fire, he called for a bason of water to wash his hands, and perceiving that the little wine left in the flask had filled up the flask with steam, he took the flask by the neck, and plunged the neck of it under the surface of the water in the bason, and the water of the bason was immediately driven up into the flask by the pressure of the air. Now he never made such an experiment then nor designedly afterwards, which I thus prove:"

"I made the experiment purposely with about half a glass of wine in a flask, which I laid upon the fire till it boiled into a bason; then putting on a thick glove to prevent the neck of the flask from burning me, plunged the mouth of the flask under the water that filled a bason, but the pressure of the atmosphere was so strong, that it beat the flask 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 contrariety 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 burling 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 contracled in an infant, as to leave the space it occupied in a vesel 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 1658. 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 instrute a person who was not sufficiently acquainted with the properties of steam to be able to invent the machine himself. Defaguliers seems to have been too hastily in concluding that the captain had never had any experience 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 condensation 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 confidered the marquis's engine, he would easilie 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; 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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celler; 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 affirment are very slight, and will never prevent the conclusion, that the great principle of obtaining force from the preßure 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 millwork 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 flewed 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 aeolipile, 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, confids of a number of clofe buckets, or chambers, placed in the circumference of a hollow wheel, and communicating with each other by valves opening in one direcHon; 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 it 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 paffes will be heated; and also the lower part of the wheel is immerfed in a ciferion of cold water, fo as to cool the fame bucket again. The action of the machine may easily be underflood. The air contained in the large bucket which is opposite the fire becomes heated and expanded, and by the pipe of communication it enters 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 direcHon 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 prepondering 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 defcended by the motion of the wheel; a continual succession is thus kept up, and the air-buckets which have paffed the fire defcend into the cold water, and the air is thereby cooled and reduced to its former bulk. By the communication with the water-buckets, the preßure of the expanded air is removed from within them, and puts them in a situation to repeat their action.

This machine is ingenious, and if a better application of fire, by rarefying water into steam, had not been discovered, it is poSSible that the invention of M. Amontons might have been further prostituted. From his computations it would appear, that the machine he proposed would act with a confiderable 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 any thing near the effect promised by his calculations. Leopold, in his "Theatrum Hydraulico." 1724, propofed an improved form of this fire-wheel; and steam-engines have been fince 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 never 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 Chambers' Abridgment of the Philofophical Hitory and Memoirs of the Royal Academy of Sciences at Paris, vol. i.

Papin's Patent for the Invention of the Steam-Engine.—M. Papin, to whom the French attribute the invention of the steam-engine, was a doctor of phyfic, and profeflor of mathematics at Marburg, in Germany, and in 1697 he was elected a fellow of the Royal Society of London. In the following year, and while in London, he invented and published a method of difolving bones, and other animal foulds, in water, by confining them in clofe veffils, which he called digefters, and which he made sufficiently strong to retain the steam and prevent all evaporation, fo as to acquire a great degree of heat. About the fame time Dr. Hooke, the moft inquisitive experimenfal phyfician of that inquisitive age, obferved that water could not be made to acqurie above a certain tempefrature in the open air, and that as soon as it begins to boil, its temperature remains fixed, and an increase of heat only produces a more violent ebullition, and a more rapid waft. Papin's experiments with his digefler rendered the elafic power of steam very familiar to him, and when he left England, and settled as profeflor of mathematics at Marburg, he made many attempts to emply 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 Hefse, but without effecting any thing. This is all the reafon the French have to confider him as the first inventor of the steam-engine. Nine years after Savery's paient he published an account of his invention, in a tract, entitled "Ars nova ad aquam igni cannabinoids efficacilem elevandum"—"A New Method of raising Water by the Force of Fire," printed at Caffel, 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 left perfect than Savery's: it works wholly by the repellent power of steam; the only advantage is, that the receiver being made cilindrical, the steam is separated from the cold water by a floating piston, and that the water is made to flow in some degree constantly, 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 1707, 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. On viewing this draft to the landgrave, he ordered Papin to reuse 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 shew the world its obligation to the landgrave, in having form'd a design so noble, and in having brought it to its present degree of perfection; and he labours much to shew that his engine is preferable to that of the steam, which was now in 1707, to permit the steam which has performed its office; then the weight of the water with which the velfel 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 not to be considered in this effect, 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 velfel Y, the cock F is to be shut, and E is to be opened; the steam comes again to pref 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 furmishing the resistance arising from the elafficity of the air of which it comes to occupy the place.

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 elafficity capable of making it furfern a column of water of 64 feet, in addition to the 32 feet with which it is in equilibrium in its ordinary state of condenfation; under these circumstances, if the cock Q is opened, the water will fly out as high as the piston, and the fame velocity as if it was 64 feet high in the cylinder M N; but by degrees, as the water paffes out, it will be driven with less velocity, because the air occupying a greater space, its elafficity 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 condenfation, should not occupy more than two-thirds of the space which it occupies in its natural state; and in that cafe it will have a sufficient preffure to furfern a column of 16 feet of water.

M. Papin's machine is, on the whole, far inferior to the engine of captain Savery, as it wants the advantage of the grand principle of condenfation, 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 diafphragm, 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 condenfing water could be as well applied to run down the outside of a cylindrical velfel 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, of which we shall hereafter speak; but the con-
sumption 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 Miners’ 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 dif-
ficulties and expense to instruct handicraft artisans to form my engines according to my design; 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 right, 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 cum-
erbomeloses 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 oddeff and almost insuperable difficulties, I spared neither time, pains, nor money, till I had
absolutely conquered them.”

Application of Savery’s Engine, and its Defects.—Repea-
ing the real use which was made of captain Savery’s in-
vention, it appears that the number of small engines were
erected, under the authority of the patent, for the supply of
noblemen’s and gentlemen’s feats in different parts of Eng-
land, and for such purposes they succeeded very well; but for
the supply of towns, and the drainage of mines, where great
quantities of water, and great perpendicular preßures were
required, they were not well adapted. With respect to the
raising water for turning mills, an application which readily
suggested itself to the ingenious inventor, we do not think
it was ever attempted, for at that period there were nearly
any mills which could have supported the expense of the erec-
tion, and maintenance of such engines, even where coals
were cheap.

For the drainage of fens they were not well adapted, be-
cause the height to which water is most generally required
to be raised in such cafes 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
compartment.

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 22 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 fuction in this engine cannot extend
more than 26 feet, the ret 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 preßure
equal to the atmosphere must be exerted on the inside of the
boiler and receivers, tending to burst them open.

It is not found practicable, in constant work, to force
the water by steam of more than three atmospheres’ preßure,
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 de-
renged, the rest must flop likewise.

Another difficulty was in the quantity of water which
could be raised with safety: the size of his large boiler did
not exceed 30 inches diameter, and the capacity of the re-
ceiver 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
preßure within the vellum must be more than three atmo-
spheres; and it will be seen by our table, that every square
inch of the interior surface of the boiler and receiver will
be preßed with a force of more than 32 pounds, tending to
burst them open. This moderate height, will therefore,
require very strong vellums, and all the joints must be made
with the greatest care; for although it is true that the preß-
ure 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 vellums being burst by
steam of such great elasticity, than by an equal preßure of
a column of water; because the force of the steam is always
hable to be suddenly increased to a very great extent, on
any accession of the heat; and the heat also tends to weaken
the vellums, 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 285° 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 continue 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 fast as it came in contact with
the water, will begin to press upon the water; and as the heat
and claffity increase, it will lift the column. But when it
has expelled any of the water from the receiver, a new force
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 even more rapid than
the former, because the vellum, 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,
as well as if it were transparent; for as far as the steam
is contained within the vellum, so far it is dry without, and
so hot as fiercely to endure the least touch of the hand; but
as far as the water is, the said vellum will be cold and wet
where any water has fallen on it, which cold and moisture
vanish.
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Vapour as fast as the steam, in its descent, takes the place of the water. Also, he says, the force of the steam proffes upon the surface of the water, which surface, being only heated by the steam, it does not confide.

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 incompressible 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 till 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 obtained until after a short space 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 flower 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 receiver is to be condened. But it must be observed, that water cannot enter through this cock into the receiver the first instant that it is opened, because the preflure of the water in the force-pipe must be less than that of the steam within the receiver; but, therefore, the injection will not commence until after the walls of the water is free from yeat, and then the condensation, or lots of heat, which always takes place within the receiver from the coldness of the water, will very soon diminish the heat, and consequently the preflure of the steam so far, that it will no longer balance the preflure of the 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 flower through the steam contained in the receiver. The sudden effect of this flower to produce the condensation is really surprising. The injection, being a portion of the steam, 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 preflure as to endanger the rupture of the vessels. The safety-valve, which is shown in the figure of Papin's engine, fg. 2, is nothing more than a valve opening outwards, and well fitted to close any 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 opening upon the lever in the manner of a level yard; so that the pressure 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 pressure 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 Worceher; but this was found of very little service, because, on account of the condensation of the steam, it is much better to divide the boiler into 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, fo as to have a column of a sufficient height to overcome the preflure of the steam, and also enter into the boiler with a considerable force; and by the radiating spouts it is dispersed in a flower 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 1717, Dr. Defaguliers made an engine on Savery's plan in an improved form. He says, that in considering Savery's engine with Dr. Gravfando, 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 prefled up one receiver full of water, instead of being thrown into another, it should be confined in the boiler till the receiver was refilled by the atmophere, and thus turned upon the water, the steam would have acquired so much force from its confinement, that it would pref suddenly upon the surface of the water, and dil»charge a confiderable portion of it even before it had heated the surface. In purfuit 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 fame time that two could be discharged once. They also learned that captain Savery had made an engine at Kenfigton with only one receiver, which acted very well. Defaguliers then made feveral 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 faddle-pajaged 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 pafages could be open at the fame time. The small branch from the force-pipe which conveyed the injection-water to the double-pajaged cock, had another cock in it to adjuf the aperture, and regulate the quantity of water which should flow into the receiver. The fuction-pipe and force-pipe were the fame as Savery's; but the valves were conveniently situated, fo as to be readily accelfible when they required repairs. Dr. Defaguliers tells us that he made feven of these engines: the firft was for the czar Peter the Great, for his garden at St. Peterburgh, where it was fett up. The boiler of this engine was spherical (as they were all in his way where the steam was fo 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 fuction, or the preffure of the atmophere, twenty-nine feet high out of the well, and then prefled up eleven feet higher. The pipes were all of copper, but felled to the fuction-piece withfof 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 that quantity; for if the quantity was larger than above, the boiler muft have been greater, and the steam of the fame force would have had a greater surface to act upon, which might have burft the boiler, or would have required it to be made much thicker. Another engine of this fort, 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 cifern holding thirty tons, placed at the top of a tower, in order to run down again through a pipe or conduit, and play feveral jets in the garden. But sometimes, no jets being played, the water was defcharged 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 fefs strength of steam than what drove the water into the tower; or if the fame 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 cifern. Upon the safety-valve there was a fleeyard, the place of whose weight fved 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 fleeyard, the steam, being then very ftrong, 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 fleeyard, 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 fleeyard, the steam not being able to lift the safety-valve, the fleeyard, loaded with all this unufual weight, burft the boiler with a great explosion, and killed the poor man who found near with the pieces that flew almoft.
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cock, and a third short arm has a piece of chain, to link it to the chain before-mentioned, at the part where the same extended horizontally between the two pullies. The arms, which act upon the cocks, are so placed, as to shut 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 counter-weight of the chain will bring the balance over to the right side, and in motion will open the steam-cock, and shut the injection-cock: also open a small gauge-cock in the top of the receiver, that the air may be discharged by the entrance of the steam into the receiver. This being done, shut 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 motion will shut the steam-cock and open the injection-cock, to admit a small jet of cold water into the receiver, which presently condensing the steam into water, in a great measure leaves a vacuum in the receiver. In this situation the pre rare of the atmosphere will cause the water to mount through the injection-pipe into the receiver, where, as follows, the receiver makes the other ascend, and depreting 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 ever suddenly by its own gravity: in falling, the roller of one of its arms takes hold of the handle of the steam-cock, and opens it, whilst the other one shuts the injection-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 subsides, and suffers the float to descend. This takes place as soon as the steam ceases to be condensed 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 descends 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, when it falls of its own accord; and in falling, the one arm takes hold of the handle and shuts the steam-cock, whilst the other opens the injection-cock, as before.

In the "Machines approvées par l'Académie for 1744," is a description of an engine by M. Genflanes, which very closely resembles M. De Mora's, but is more completely described.

Mr. Blakey's Engine on Savery's Principle.—Long after steam-engines superior to Savery's had become general, an ingenious engineer, Mr. Blakey, made many attempts to introduce Savery's engine in an improved manner. 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 pillow or disc 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 same 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 condenstation.

Mr. Blakey afterwards made some alteration in the form of his engine, which is described as follows by Mr. Fergusou: (see Plate I. fig. 3.) E is the boiler, set in a furnace so as to be surrounded with flame; F is the gauge-cock, to ascertain the depth of water in the boiler: D the steam-pipe, to which is soldered the cock and funnel C, for filling the boiler before the engine is set to work: I is an air-valve, and T T an injection-pipe, which passes 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-valve 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 through the pipe D, and supply the boiler: V is a receiver, communicating with the air-valve I by a pipe: in the upper part of it is a cullinder S, with small holes to discharge the injection-water, which falls from the air-valve 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 injection-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 needles to say anything of the scaffold or the well, they being left to the builders, 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 at work, the receiver and pipe 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 is then to 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 vell I into the lower receiver V; the air is also forced out at the cock H, the steam following it with great velocity. In a second or two the cock H must be shut, and instantly the injection-cock L must be opened, which lets cold water run through the end of the pipe T T, 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 T T, into the air-valve I, and falls on the cullinder S: this cold water makes a sudden condensation in the vessels I and V, and forms a vacuum, which causes the atmosphere to press on the water in such quantity of water to be forced up that the N is immerged, and the air water ascends the said pipe with great rapidity, and passes through the clack N, and through the pipe Q, into the receiver V, till it rises up to O, where is a floating-ball fastened to a handle or lever, which rising turns the key of the cock P, and opens it: there is a valve at that end of the cock which is within 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-valve I; and as the steam increases, being much lighter than air, it keeps uppermost, 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 up the pipe A, and empties itself into the receiver at top. When all the water is expelled out of the receiver V, the air follows, and ascends with
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 action, 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 compree 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. Blakey'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 friction, and with a very slight pre-pressure for the remainder; but it is the most advantageous way to raise no more than 24 feet, and perform the whole lift by the friction, and even to allow the water a sufficient depth to empty the receiver by its own gravity, without forcing it in the leak by the steam. In this form of the engine, the steam need have no greater elastic force than the atmospheric air, or jull 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 215°, and consequently the loss by the condensation is not so serious; and as the steam is not prepped 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 manufactury of coach axletrees, near Pancras, where, without any material repair, it has almost constantly been worked to produce, to raise water and turn a water-wheel. The proprietor flatters 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. R represents an oval boiler, seven feet long, five feet wide, and five deep. Mr. Kier considers 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 sufficed a float to subsidence, which by its actual weight suffices 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 cillen 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 cillen, into which the water is delivered through the pipe F, which is provided with a valve H, opening outwards; I M represents an overhot water-wheel, 18 feet in diameter, moving on the axis K L, and communicating its motion to the lathes, and other machines used in the manufactury. The water in both the cillens 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 cillen 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 figure.

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 overhot 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 correspondent block, e, s, f, g, b, 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 an steam-valve by a bar of communication reaching to the handle of the axis g, c, 2. The steam consequently passes into the chamber E, and the steam-valve shuts again, as soon as the cleat has passed. Speedily after this, the correspondent 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 condenes the steam. The pre-pressure of the atmosphere then forces the water from the cillen 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 rear-entrance of the steam-furners the whole body of water, above the valve H, to flow out of the chamber E, by its gravity.

The water which is raised is furnished by the steam upon the overhot water-wheel, I M, through a sluice; and by that means keeps the work in motion, and replenishes the lower cillen. There is no resevoir 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 well 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 ad-

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STEAM-ENGINE.

million of steam. It may be premised, 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 defeces. To get rid of this air, the steam in the boiler must be made so much stronger than the atmosphere, as 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 flint, to prevent the air entering when the vacuum is made, except for an instant before the steam is admitted, when it is opened by the machinery. The motion of the overflow 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 perpendicular 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 flume of the upper ciftern; the flume, 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 ciftern is immediately diminished; and, on the contrary, the quantity of water is rendered greater, when the slowness of the movement throws that more 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 six 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 437 lbs. raised 20 feet high, which being doubled, to reduce it to Defaguliers’ standard height of 10 feet, will amount to 875 lbs. raised 10 feet high; and this divided by 550, the number of pounds 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 pillow of fuel fire as to be equal to 20 or 25 horses. Philos. Journ. vol. i.

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 warming it before entering the boiler, so as to economize the whole: for instance, for the purpose of raising water into the boilers for a salt-work or for 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 fuction 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 ciftern, to receive the water raised by the different engines. Each engine consists of a vertical fuction-pipe, with the lower end immered in the water of the ciftern of the engine below it, and a receiver at the upper end, which communicates with the fuction-pipe through a valve, to prevent the descent of the water from the receiver through the fuction-pipe. There is also a small spout or pipe leading from the side of each receiver into each ciftern, 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 cifterns. All these receivers communicate with a common air-pipe, which leads up to the top close receiver, or air-vessel, situated at the top of the pit, which vessel is of at least double the capacity of all the receivers and the common pipe together.

Immediately above the air-vessel is the steam-receiver, of equal capacity, and communicating with the air-vessel by a pipe, which descends through the top of the vessel, and reaches nearly to the bottom of the air-vessel, so that if there is any water in this vessel, the end of the communicating pipe will be immered therein.

Suppose the cifterns at the different stages, and also the lower or air-vessel, 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 concedes the steam, and forms a vacuum in the upper receiver; this being the cause, the air contained in the air-pipe and receiver, by its elastic pressure upon the surface of the water contained in the great air-vessel, 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 ciftern; it therefore forces the water up the respective fuction-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-vessel above, comes to its equilibrium. The steam is now admitted a second time into the steam-receiver, and prilling upon the surface of the water therein, allows it to descend by its gravity into the air-vessel 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 down in the pit, and bearing upon the surface of the water in each, suffers it to flow out by its own weight through the spouts into their respective cifterns. When they have thus discharged the water which they had before drawn up, the steam in the upper receiver is again condensed, and this rarefies the air in the air-vessel and several receivers, and draws up more water from each ciftern; and thus the action of the machine continues as long as the boiler affords steam. In this plan, the water in the upper receiver is never changed; but the same water is constantly subjected to the action of the steam, and will thereby become heated so as to avoid the loss of steam by the condensation. But this at the same time introduces another difficulty, which the inventors had not foreseen; viz. that the heat of the water will prevent a sufficient condensation.

G 2
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 preasure 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 a 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 effcacy or compreability 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 preass upon it equal to 15 lbs. upon the square inch, or to suck up water 30 feet, the air contained in the air-reCel and pipes will expand itself so as to balance one-half of that preasure; 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 refill the air to its original density, before it will balance the preasure 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-reCel: this last communicates with the vessels M, L, K, T, each of which, except the lower one, consists of two vessels; first, an external cisterm, open at the top; and secondly, an interior receiver, immersed in the water of the cisterm, and closed on all sides, except where it communicates with B, by the branches of the receiver, the pipe FGH descending from B, and where the pipes P, O, N, I, enter the upper part of each, and descend withinide 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 preass upon the surface of the water in the lower receiver T, and drive the flame up the pipes into the vessel or cisterm K, but not into the receiver K, because the preasure 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 re-action 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 cisterm 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 to the cisterm, K, by the steam, as before, and the receiver, K, will discharge its contents through the pipe, N, into the cisterm 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 as before, by the water from the exterior cisterm 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 preasure 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, 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 Laufanne, M. Francois has described a steam-engine on Savery's principle, by which he proposes to be used for draining fens or marishes, 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 preasure 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 shown 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 preasure of the steam only, on the marquis of Worceester's plan, and not to attempt condensation, which it 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 Leupold's Theatrum Machinarum Hydrostaticarum, vol. ii. 1724.

The last improvement which we have noticed in Savery's engine, is by Mr. James Buzza, 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
he proposes to employ such an arrangement of the force-pipes, 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 provides 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 pressures. 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 operation, 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 stopped at the lower extremity. If this last aperture is open, the piston will defend 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 that case the piston will not defend 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 prelure of the atmosphere, amounting to about 14.5 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 frequent defence 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 prelure from its elaticity, and by the indirect confluence 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 fifthly, 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 snifting-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 snifting-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 prelure 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 pressure on the under surface of the piston affiys it to rise, and also affiys 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 snifting-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, supposing a common sucking-pump placed in the pit to lift the water fifty yards high. If the pump is 10 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 long
long lever or working beam; and at the opposite extremity of the same beam another chain must be attached, to suspend the piston of the cylinder, which we have just described.

To give this piston a sufficient power of decent 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 380 square inches. In this case, if each square inch is puffed with a weight of eight pounds, it will balance the weight of the water in the pumps within 20 pounds; for 380 x 8 = 3040, instead of 3060: 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 14.2 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 boiled by the injection down to 140°, it will be seen by our first table, fourth column, that it will leave the cylinder filled with a vapour of an elastic force equal to 2 lbs. 13 oz. per square inch; which force acting beneath the piston, will deduct from the pressure of the atmosphere, and reduce the next prelure on the piston to 11 lbs. 13¾ oz. per square inch, as shown by the last column. The excess of prelure 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 (5 x 380 =) 1740 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 152 gallons per minute, or 182 hogheads 13 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 prelure of the atmosphere, steam being employed merely as the most expeditious method of producing a void, into which the athermographical prelure may impel the first mover of his machine. The elaticity 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 prelure of 55 pounds per inch, and of a temperature of 315 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 elaticity, 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 aoever a mine may be, a cylinder may be employed of such dimensions, that the prelure of the air on its piston may equal in appearance 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 purpoze. Savery’s engine could not admit of such an immediate application, and was restricted to raising of water.

Invention of Newcomen’s Engine.—Reflecting the invention of this engine, it was no 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 aocation with them in the patent which was granted in 1705, but it does not appear that they made any perfect engine until 1711.

Defagullis, 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 propofals to drain the water of a caillery at Griffin, in Warwickshire, where the proprietors employed 500 horses at an expense of 1500l. a year; but their invention not meeting with the reception they expected, in March following, through the acquaintance of Mr. Potter of Brom Borgrove, in Worceftershire, they bargained to draw water for Mr. Back of Wolvampton; 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 luckily, by accident, found what they sought for.

“ They were at a loss about the pumps, but being so 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 they at first were working, they were surprised 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 condense the steam in the inide of the cylinder, whereas before they had always done it on the outide. They used before to work with a buoy in the cylinder, includef in a pipe, which buoy rove when the steam was strong and opened the injection, and made a stroke; thereby they were capable of only giving six, eight, or ten strokes in a minute, till a boy, Humphrey Petter, who attended the engine, added (what he called foogom) a catch, that the steam always opend, and then it would go 15 or 16 strokes a minute. But this being perplexed with catches and thirings, Mr. Henry Bighton, in an engine he had built at Newcalk 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 pillars and cylinders by a vacuum and the prelure of the atmosphere; but he was not the first inventor of either of these. Otto Guericke and the marquis of Worescher having discovered the same things long before him; and further, he had no pretentions 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 first engine was for the purpose of transmuting the action of a water-wheel to a great distance, by means of air in pipes. Papin proposed this principle enigmatically, as a new way of raising water, to the Royal Society in 1685; and after many solutions had been given by the English academicians, he showed the real application and use of it, to raise water out of a mine by the power of a river at a considerable distance.

For this purpose, a water-wheel was to be placed in the river, to work the pistons of two large cylinders of pumps, from the lower ends of each of which small pipes were conducted down into the mine, to convey the air into small cisterns or receivers, which were each furnished with a furnace-pipe and a forcing-pipe, and valves to prevent the defect of the water. By the motion of the pistons of the pumps, the air was to be alternately rared and compressed in these chambers; and thus he intended to draw water into the receptacles through the furnace-pipes, and then force it up through the forcing-pipes; but he forgot that, in this method, the elasticity of the air he employed would wholly defeat his end; for when the piston of the pump was depressed, it would not compress the quantity of air contained in a long pipe sufficiently to produce any sensible condensation to force or raise water out of the receiver; nor, on the other hand, could a sufficient rarefaction of the air be produced by the ascent of the piston to obtain any efficient suction in the receivers.

Papin afterwards made some alterations to obviate the objections which were urged by Dr. Hooke and other English philosophers, and in 1688 he published another machine in the Acta Eruditorum, which is more complete, and is a most valuable invention for conveying the power of machines to a distance. Within these few years it has been employed in this country, though secretly, for a very important purpose.

In this method, the two pumps, which are worked by alternate cranks on the axle of the water-wheel, are provided with valves similar to those of an air-pump, and they draw air alternately from the conveyance-pipe which leads to the mine, so as to make a vacuum in the pipe. At the mine are placed two cylinders, with pistons fitted into them; and a rope, which is fastened to each of the pistons, is wrapped several times round an axle or horizontal shaft, which is extended over both cylinders, and is put in motion by their pistons.

Upon the middle of this axle is a large wheel, for the reception of a cord, which descends into the mine, and has at each end a bucket; therefore, by turning the axle first one way round, and then the other, the two buckets are alternately drawn up or lowered down in the mine, to draw either water or ore. The ropes from the piston of the cylinders are wrapped round the axle in opposite directions; and when one piston is pressed down, it will draw the rope and turn the axle, which winding up, the other rope will draw up the piston of the other cylinder. A single conveyance-pipe leads from both the air-pumps at the water-wheel; but when the pipe arrives in the mine it divides into two branches, one for each cylinder; and at the intersection of these branches a double-paßaged cock is placed, which will admit the air from either of the cylinders into the conveyance-pipe which leads to the air-pumps, or it will admit the atmospheric air into the cylinders; and these passages are opened alternately by the cock, so that whilst the air from one cylinder is drawing off through the conveyance-pipe by the air-pumps, the atmospheric air shall have free entrance to the other cylinder.

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 passes 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 constant reciprocation of the motion of the axle is kept up, and the power of the water-wheel is transmuted 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 Verailles, instead of the cumbersome machinery employed at Marly 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 suppressed 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 shuts 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 inside 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-wall.
G, the
G, the piton, 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.

II, the chain and piton-ank, by which it is connected to the working beam by an arc of a circle.

III, 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 piton and pump-rods, which are suspended 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 cifer, 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 suspended by a chain at the outer end. This pump commonly stands near the corner of the front of the house, and raises a column of water up to the cifer O, into which it is conducted by a trough.

O, the jack-head cifer, 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 cifer has a waife-pipe on the opposite side for conveying away the superfluous water.

P P, the injection-pipe, of two or three inches diameter, which descends from the cifer 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 fixed upon the end d, which is within the cylinder, with three or four ajutage holes in it, to caufe the jet of water from the jack-head cifer to fly up as many steam against the under surface of the piton, and conduces 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 or leakage, because the engine stands still; but before the engine is let to work, this valve must be lifted up, and kept open by a string.

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

Q, 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 fit 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 lefatorial piece of brass, 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.

ii, the spanner, which is a long rod or bar of iron, for conveying motion to the handle of the regulator, to which it is fixed by means of a pin in the latter, and some pins put through to hold 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 two thronds q, p, 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, depressing the thrond k, throws the loaded end, k, of the Y from the cylinder into the position represented in the plate, and causes the leg, l, 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 piton immediately rises by the weight of the pump-rod, on the admixture of the steam: the motion of the working beam, II, also raises the working plug; and another pin, which goes through the flat, raises the thrond, 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 sector 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 the regulator, as above described, a pin catches the end, g, 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 condensed in the steam, makes a vacuum within. Then the preflure of the atmosphere, forcing down the piton into the cylinder, causes the plug-frame to descend, and another pin fixed in it catches the end of the lever, g, in its descent, and by prefling 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 reduction-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 closes 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 cifer 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 immered 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
STEAM-ENGINE.

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 poppet-valve, which is a braze value at the end 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.

S, the steam-valve, by which, at every act of the piston, the air is discharged from the cylinder which was admitted with the injection, and would otherwise obstruct the due operation of the engine.

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

U, the cylinder cup of lead surrounding the top of the cylinder, to prevent the water upon the piston from flashing over when it riles too high.

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

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

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

Z, two friction-wheels or fectors, on which the godman, or centres of the great beam, are supported; they are the third or 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 exceedingly very large for so heavy a lever, would otherwise be very great.

Operation of the Atmospheric Engine.—When this engine is to be let 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 preasure of about one pound beneath each square inch of the safety-valve, it will lift up the valve and escape. The water in the boiler being suffocated 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 retorting 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 tumbler-bob into the position of the figure; and the leg of the fork thrashing back the spanner t, opens the regulators or steam-cock, when the steam from the boiler immediately rushes in, and flies away 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 eduction-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 snuffing-valve s, and illude 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 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 supposes, at first, that the water was boiling briskly, so that the steam was illuding by the safety-valve, which is in the top of the boiler. The opening of the steam-cock are an end to this at once, because the cold cylinder draws off the steam from the boiler with sufficient rapidity, until it becomes heated so as not to condense.

When the manager of the engine perceives that not only the blast at the snuffing-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 s or p, till the tumbler-bob, Y, falls over the perpendicular towards the cylinder, and its leg striking the cross-pin of the spanner, t, 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 distent steam immediately expands; and by this very expansion its capacity for heat is increased; or, in other words, as it grows cold, it abstracts the heat more powerfully from the steam, and it 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 insensible mafs 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 snuffing-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 l 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 lightest yielding in its suspension, it will have upwards a little by the preasure of the air on the bottom. Its own weight is not at all equal
Steam-engine.

Equal to this prelure; 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 walls. This heating of the cylinder flew the instantaneous commencing of the condensation; and it is not till after this has palled, 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 rarefied to the same 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 same pitch as at the beginning, the elasticity of the remaining steam cannot 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 friction, 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 commensurate 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 feels the piston as low as he thinks proper, he shuts the injection-cock, by depressing the lever q; and at the same time he opens the regulator, by forcing down the handle s, which overflies the tumbling-bob, and its leg catching the cresfs-pin of the fpanner, s, 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, when it immediately blows open the knifing-valve, and aflets the water which had come in by the former injection, and what arose from the condensed steam, to defend 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 caufe of some waste of steam at its first admissiion, 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 wanted than what will warm the cylinder; for the eduction-pipe is made of large dimensions, and receives some of the injected 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 greatest part of it, by increasing its elaticity. It may be disengaged by simply removing the external prelure 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 prelure, 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 rife by the counter-weight, the moment the steam-cock is opened; for at that instant the excess of atmospheric prelure, 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 lost 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, 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 rife, 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 3th of the prelure of the air on the piston, the piston would not rife until the elasticity of the steam was equal to 30 - 2, that is, to 26 1/2 inches nearly; but if the steam was just equal to this quantity, the piston would rife 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 acfent 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 fuction within the cylinder greater than the steam-pipe can supply, or it would diminish the prelure of the steam within the cylinder lower than the atmosphere, and prevent it from nistfing 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 acfent of the piston; for as the descent of the piston was only to condeence of the vapour occasioned by the interior of the cylinder being sufficiently cooled to condense the steam, this cooled surface must be again preented to the steam during the rife of the piston.
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 quitting has been warmed up to the boiling point, and much steam must be expended in this warming; for the inner surface of the cylinder must not 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 buck 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 sensibly 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 pump-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 ash-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 extremity at the chimney; and the section of the chimney at that place should not exceed the section 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 this means, after the fire in the furnace has heated the water by its effect on the bottom, the flame 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 bell 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 casioanalves 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 size 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 fame 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 flue on the outside of the engine-house; by this means the height of the building is considerably reduced; and as the wall which supports the beam-centre does not require to be carried to so great a height, it is more enabled to withstand the violent shocks to which it is constantly subjected from the working of the engine. Another and
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in a long will not be necessary, both the steam-cock being movable round an upright axis Q, which is accurately fitted into a conical socket coming through the lid of the beam-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 beam-pipe, which spring presses it strongly towards the beam-pipe, causing it to apply very closely, 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 in fig. 1, 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 fixed in a horizontal bar, on which the end of the handle rests.

The tumbling-bob of the Y has a long lever check-ftrap fastened to it by the middle, and the two ends of the ftrap 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 ftrap, the Y may be moved in any desired position. The two legs of the fork spread out from each other, and also from the line of the fknife, thus J, and they are of such length as to reach the horizontal pin, which crosses the fork or ftrap of the spanner below.

Now, suppose the pin of the spanner hanging perpendicularly beneath the axis, and the fknife of the Y also held perpendicularly, carry it a little outward from the cylinder, and then let it go, it will fall farther out of its weight, without affecting the ftrap of the fknife, till the inner leg strikes on the horizontal pin of the ftrap, and then it pulls the pin of the ftrap and the fknife towards the cylinder, and stops the regulator. It thus lets the regulator in motion with a smart jerk, which is an effective way of overcoming the cohesion and friction of the regulator against the mouth of the beam-pipe. This push is adjusted to the proper length by the check-ftrap, which stops the Y when it has gone far enough. If we now take hold of the fknife 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 ftrap. 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 ftrap of the spanner in the opposite direction, till the bob is checked by the ftrap.

The motion of the beam-pipe to the regulator is open and shut suddenly. This opening and shutting of the beam-passage are executed in the precise moment that is proper, by placing the pins in the plug-beam, which acts 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 beam-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 force of the piston, without expending steam all the while, and by leaving the steam rather less elastic than before, the infrequent 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 F, or lever q, 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 relieving 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 dash 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 accension of some is absolutely required for completing the condensation as the capacity of the cylinder diminishes, and the water which is already injected becomes warmer. 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 injection: if the engine makes a six-feet stroke, then the jack-head cistern should be at least twelve feet perpendicular above the top of the cylinder. The size of the cistern must depend upon the capacity of the cylinder, as we shall flow by a table; 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 dispers'd 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 the common source from which all the parts of the machine receive their respective supplies of cold water. In the first place, the small branch f, which proceeds from the pipe P, 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 almost boiling-hot, and it was thought proper to employ a proper curvature of the handles 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
coming from the cylinder, must be still hotter than that above the piston.

This contrivance required attention to several circumstances, which will be easily understood by considering the perspective view. The ejection-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 palling 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 ejection-pipe S, and opening 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 waste in steam-engine requires.

The small quantity that is necessary to supply the boiler might be immediately taken from the cold ciston, without sensibly diminishing the production of steam; for the quantity of heat necessary for raising the sensible 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 ejection-pipe is far preferable to that from the top of the cylinder, because it has been in a measure boiled and diffilled.

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 belt engines on Newcomen's plan, caufed the lower surface of the piston to be always planked with elm or beech, about 24 inches thick. The planking confisted of two broad planks, crofing each other at right angles, and halved into each other at the interfection, fo as to come to an equal thickness: the remaining parts or fectors between the arms of this crofs were filled up with pieces of the fame plank, well tongued and fitted together, and bolited fast to the caft-iron of the piston with one or two iron rings, let in flat under the lower surface to make it frong: the whole was surrounded with an iron hoop, a quarter of an inch less than the internal diameter of the cylinder. In this cafe, the cast-iron piston was made less than the wood which formed the bottom of the groove, to receive the wadding, which the edge of the cast-iron formed the upright fide thereof. The wooden bottom was screwed 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 left liable to conduct heat; and the wood, being placed with the grain radiating in all directions from the centre, was not likely to expand by the heat. The flank 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 flank 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 flank must be suspended, by which means the train 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 flank 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 sustain 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 between them, 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 on 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 shewn 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 leaf; and, in this cafe, the beams act as ties by the longitudinal strength rather than their flexibility. The great beams which furnish the cylinder, and extend across the house, are compounded of several pieces, in the same manner; and the cylinder has a projecting flanch from the middle of it, to bolt it down to the beams.

The pump-rods or spears, K, are made of wood, with iron flaps let in and bolted to them at each end, to join them together: they are made of fir, which is very good wood, as it will bear a great train endways, if the iron flaps are well fitted, and can be obtained in very long pieces. When a mine is of a confiderable 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 ciston, 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 cafes, 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 fluctuating: the blow which they then make is like the stroke of a forge-hammer, and forms a beat every thing to pieces. The only effectual remedy is the addition of an air-reticel at the side of the pump; but in general the miner makes a hole in the suction-pipe of the pump, just below the clack, and fixes in a cock, with a small valve opening outswards: through this they admit a certain quantity of air every time the pump draws, and this air, mixing with the water in the barrel, condenses, when the valves that 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 Griff, 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 furious 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 bell 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.

Defaguelers 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 half figure, and then call it long hundred weights; and writing a cypher 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 half figure from the square of the diameter, is to divide the number of superficial circular inches on the piston, into portions of cubic inches each; and as the pressure on each of these portions is estimated at a long hundred weight, or 120 lbs., the pressure will be 120 ÷ 10 = 12 lbs. per circular inch, or 15.3 lbs. per square inch: 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. If, instead of the long hundred of 120 lbs., Newcomen had taken the common hundred of 112 lbs., he would have had 112 ÷ 10 = 11.2 lbs. per circular inch, or 14.4 lbs. per square inch, which is still nearer the medium pressure of the atmosphere.

Defaguelers says this rule will agree pretty well with the work at Griff engine, there being lifted at every stroke between two-thirds and three-fourths of the weight of the atmospheric column precluding on the piston; i.e., between 10 and 11½ lbs. on each square inch. To give the estimation in round numbers, the diameter of the cylinder of Griff engine will be 32 inches; this squared is 1024; cut off the half figure, and we have 48 cwt. 40 lbs. for the preasure of the atmosphere. The column of water in the pumps weighs about 27½ cwt. to which adding the weight of 75 yards of iron rods, equal about 9 cwt., the weight lifted at the end of the beam would be 36½ 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 32½ cwt.: so that the weight of the atmosphere being 48 cwt. 40 lbs. raises a weight of 32½ cwt. with a velocity of six feet in two seconds, confidering 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 burthen 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 burthen, 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 at 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 preasure 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 preasure 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, that of a coal or a copper mine, we find that we must, beside the altitudes and the diameters, take into the account the friction of the buckets, and of the water on the sides of the pumps; the opening
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opening of strong double-leathered valves, together with the dones and gravel that enter at the foot of the pump; the inertia of the pump-rods, the chains, the massive lever placed between the cylinder and the pumps, all to be overcome by the pressure 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 pressure of the atmosphere to 105 or 115 lbs. per square inch. When this is the case, the vapor which remains in the cylinder must be equal in pressure to 4 or 5 lbs. per square inch; and this, by our first table of expansion, will indicate a temperature of from 155° to 160° Fahrenheit.

In general, the water in the hot-well indicates a lower temperature than this; but although we have but little information concerning the state of the water 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 pressure of 8 lbs. per inch: for an engine carrying a load of 7½ lbs. on the square inch of the piston, together with the friction and inertia, even in large engines, cannot be less than 11½ lbs. on the inch. Mr. Horblower informs us that he tried the vacuum of several engines in the county of Cornwall; and in one, which was reckoned the least, the vacuum in the cylinder brought the barometer-gauge to 23, and sometimes 24 inches, instead of 30 inches, at which it would have stood 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 operations, 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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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. 7 oz. avoirdupois; and a superficial inch, on a vacuum, takes in about 14 lbs. 13 oz. of the atmosphere, when the mercury stands at 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 fix 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 go for any other. Henry Beighton.

This estimation of 8 lbs. pressure 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 excels of pressure which could be obtained above the 8 lbs. was appropriated to overcome the friction and the 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.
STEAM-ENGINE.

Mr. Brighton expected his engine to move 16 strokes per minute, of fix feet each, or 96 feet of motion per minute; but succeeding engineers found them seldom to do so, and then began to diminish the burthen 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 perpacs as great a degree of perfection as its principle admitted. Having constant occasion to employ large steam-engines in the great works 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 1767, 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 center, and make the stroke of the piston nine feet, while the pump which lifted 36 feet should work with only a fix 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 presure of 10.4 lbs. per inch. Thus, area of piston (18 inches diameter) 25.4; weight of the column of water 36 feet in the pumps, 18 inches diameter, 3960 lbs., of which take 3 lbs for the difference of the length of stroke, and it 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. pressure per inch. Having once seen a common engine struggle under this burden, I thought myself (says this ingenious engineer) quite secure under these advantages; but how great was my surprize and mortification, to find that, instead of requiring less injection-water than common, although the injection-pump was calculated to afford as much injection-water as usual, in proportion to the area of the cylinder, with a sufficient overplus to answer all imaginated 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 answer'd 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 105 lbs. to 83 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 injection-water came out at 180° 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 condenfation 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, and whether it is upon the medium, so as upon the whole to do work, 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 represented 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 Cronstafft.

Mr. Smeaton's Experimental Engine.—Plate III. contains an elevation of this engine, showing 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, ground-fills, extending from the wall B, to the wall of the boiler or furnace F; D are strong upright timbers, to support the cross-beam a, on which the centre of the beam is joined; E 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 M the great beam, rattling on its centre, and formed to arcs of circles at the ends, to which are suspended the chains b for the piston, and the chain of the main-pump fpear 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, f, 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 fiddles or pins h, h, which reach out from each side of the arch-heads, and stop on pieces of wood, supported by the beams S, called the spring-beams. These beams also, which support 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, 13 the injection-cock, and X the piston water-cock, branching off from the injection-pipe N. L is the injection-cillem, 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 white pipe, at which the excess of water runs off. The pipe T leads down to the small cillem n, which will always be kept full, and the overflow will run down the waste-pipe l l, 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 pails into the chimney; x is a small door at the bottom of the chimney, to clear the foot, and there is also a damper to regulate the draft: z is the boiler, and its figure below is shewn by the dotted lines: v 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: n is the steam-cylinder, and the white piston, which contains mercury, and shews the pressure of the steam. The cylinder C, besides the bored part in which the piston works, has a bottom W, screwed on by a flange at the lower part, and from this bottom part defends the steam-pipe S. The short pipe, 12, joins to the lower end of the injection-pipe NN; and opposite
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opposite to this is a similar short pipe, for the exciting-valve. Also from the bottom of the cylinder there descends the sink, or ejection-pipe, which enters the hot-well R, and then is covered with a valve. S is the waste-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, R, 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 1. When its weight or bob, 3, falls over on either side of the perpendicular, it is checked by the stop 9; and 2 are the arms or handles by which the 4 is moved when the pins in the plug-beam, Q, act upon them, and 6 is a weight to balance the weight of the handles.

10, 11 is the F, 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 contained in the cistern V, called the cataract: it was very commonly used in the engines for the mines in Cornwall, to regulate the motion of the engine to any given number per minute, so that the defcribed quantity of water could be drawn, without waiting the steam in drawing more.

The cataract is nothing more than a small tumbling-bob, moving on a centre within the box V, in the same manner as the A; but instead of the weight or bob at the top, it has a small box or cup, which is filled with water by a small stream dropping continually from the small cistern z, through a cock. The lever, on which the cup is fixed, has a second lever and counter-weight applied to it, which makes it always assume the vertical position, or nearly so, except when the cup is full, and then it is of sufficient weight to make the cataract-tumbler fall over, and in that position the cup inclines to such a magnitude, that it discharges its contents, and the counter-weight causes its immediate return. The cataract, when it falls over, strikes a piece which is connected with a wire 15, and this by a lever, 16, and the second wire, 17, draws up the catch 12.

When the engine works with the cataract, the wire 14, before mentioned, is detached; and in this state we will suppose the regulator open, the injection-cock shut, and the piston to have just arrived at the top of the cylinder. A pin in the plug-beam, Q, feizes the handle 1, overthrows the tumbling-bob, 3, of the 4 towards the cylinder, and the prong, 5, of the fork of the 4 draws the rod 5, and shuts the regulator. In this situation the engine will remain, until the steam, which flows from the cistern z, through the cock, fills the cup at the top of the cataract, and causes it to fall over; it then strikes suddenly on the piece of the wire 15, and by the lever 16, and wire 17, it raises the hook-catch 12. This lets fall the weight 11, and opens the injection-cock, to throw a jet in the cylinder, which condenses the steam therein, making the piston to descend; and when it arrives at the bottom, the pin in the plug Q depresses 10, which shuts the injection, and then, by depressing 2, overthrows the tumbling-bob, and opens the regulator. This admits steam again into the cylinder, and the counter-weight makes the piston return. The cataract returned the piston that its cup inclined so much as to throw out its water, and the cup then began to fill again; but it will not again act, or discharge the injection-cock, until it is quite filled; and the injection-cock will not open till this happens; so that the engine waits at the top of the stroke till the cataract is ready; and this time of waiting can be regulated, by diminishing or increasing the steam which drops down the cock, so as to draw up exactly as much water as drains into the mine.

In 1765, Mr. Smeaton made a portable steam-engine 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, whilst the cylinder and pump were bolted down to the ground-fills, 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 third 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 1782, 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 of the pump, 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 pressure on each square inch of the piston, 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, \( (67.6) \times 18 \) feet, the pressure per square inch in feet of water, \( = 12168 \times 76.21 \) feet, the journey per minute, \( = 927323 \), the great product per minute, as per table.

The table is calculated upon the proposition that the pressure upon each square inch of the piston 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 fixed engines, shewing the advantages of large engines in respect to small, in the quantity of work they will effect in proportion to the coals 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 this three times the square of the diameter, to allow for the piston 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.

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Lately, 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 22.63, which, multiplied by 135 inches, the length, gives 30650 square inches; and adding there to 15552, which is three times the square of the diameter, we have 46102 superficial inches; and the content of the cylinder is 549652 cubic inches, which is 11.9 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 = 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 lifting-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 what degree water is expanded, when converted into steam, at the pressure of the atmosphere; 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 rarity of water when converted into steam, but without determining the temperature. The pressure of the steam was just one pound upon the square inch, as he determined by the feel of his yard of the safety-valve; and by our second table, we find this to denote a temperature of about 216°. The cylinder of the engine contained 113 gallons of steam at every stroke, which, at 16 strokes per minute, is equal to \( 1868 \) 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 pressure, and the water from which it was produced, were as \( 5 : 14464 \), or as \( 1 : 2803 \) nearly. By an unaccountable mistake, Defaguliers, who relates the above experiment, deduces from the same data, that the expansion is \( 13388 \), 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 Defaguliers 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 througly, 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,
experiments, it gave the proportion of the bulk of the steam to that of the water; this, by a mean of six different experiments, he determined to be as $\frac{1}{7}$ : 1. But supposing that some air was contained in the flask 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 described 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 2459 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 9.5 inches diameter and 50 inches long; making the requisite additions to its bottom and piston, the internal surface was 2242 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 8.5 cubic inches: therefore, $3940 \div 8.5 = 463$ 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 $\times 1800 = 15300$ 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 4.96 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 leven or eight pounds upon the inch, and are of a middle size, the quantity of steam which is condensed in retorting to the cylinder the heat which it had lost, is equal to the full contents 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 the piston; or to take it more simply, 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 coals, and found by a mean of a great number of experiments, that a bushel of coals evaporated 1700 cubic inches of water, or 7.35 cubic feet; and estimating the expansion at 1800 times, the bushel of coals will produce 13230 cubic feet of steam, of little more in elasticity than the atmosphere, and about 21.4° of Fahrenheit's thermometer.

The work actually performed by atmospheric engines in proportion to the coals.—We shall next give the results of the performance of some old engines, according to Mr. Smeaton, before he began his improvements. The engine at Long Benton colliery, which was considered as one of the best in the neighbourhood of Newcasttle, 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 3 inches stroke, which raised water 58 feet. This engine consumed 8 bolls (of 2 cwt. 1 qr. 211bs. each) of coals, such as are generally used for engines, in two hours and two minutes, when working at the rate of from 7½ to 8 strokes per minute, or 7½ 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 : 64 :: 58 feet high : 25.7 feet; that is, the whole load of the injection-pump will be equal to 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 7-feet stroke, or 84 inches, $\frac{75.7}{21} = \frac{67.5}{21}$ in. :: 25.7 ft. :: 20.7 feet of the column of the main pumps, 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 figure of the pump's diameter 144 inches $\times$ 387 feet lift = 55728, which multiplied by a 7-feet stroke = 39296, and again by 7.75 strokes per minute = 3023244, the whole product or effect of the engine, without regard to coals, or without any allowance for the weight of the pump rods, and the counterpoise of the engine.

The quantity of coals was 2 cwt. 1 qr. 211/2 lbs. = 2753 lbs. $\times$ 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 :: 12.2 bushels per hour.

Lastly, the whole product 3023244, divided by 12.2, gives 2474601 for the produce or effect of one bushel of coals 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 12.2 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, 2 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 12.2 inches the diameter of the main pumps 148.84; square of 7 inches the diameter of injection-pump 49; its lift 70 feet. Then say as 148.84 :: 49 :: 703 :: 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 + 18 feet, viz. 314 feet lift.

To obtain the great product, multiply the square of the pump's diameter 148.84 by 314 feet; the height lifted $=$ 75.7. 46735.76,
STEAM-ENGINE.

The pump, kept in a London waterway, has 3.05 buhles of fluid in 22 minutes, during which time it worked 12 strokes per minute; it is therefore 164 strokes; then say, as 3.05 buhles : 1 buh : 86.5, the number of strokes which the engine will make for each buhle 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 buhle of coals, and we have 365955, the number of pounds of water lifted 314 feet by each buhle of coals. And lastly, 365955 x 314 = 9,636,660 lbs. of water lifted one foot high with each buhle of coals.

Mr. Smeaton's Directions for making Engines. — Mr. Smeaton made his engines with a wooden bottom to the pilon, as we have before noticed. This was because wood communicates heat much less rapidly than metals. The pilon 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 air into the cylinder, but also because it receives the first and mott direct action of the cold injection-water; and as the steam in entering the cylinder through the pipe-plant first meets the cold surface of the pilon, 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 pilon 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 pilon, will be less heated by the contact of it, the wood acting as a neutral body on the fluids, which alternately act against it.

The injection-cap, or jet, according to Mr. Smeaton, should be a square hole through a brafs 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 pilon bottom, but it should rise perpendicularly, so as to strike the pilon bottom at right angles. That part of the injection-pipe which is within the cylinder should be made of wood, or of metal, wrapped round with tarred marline, or small rope, to separate the metal of the pipe from the contact of the steam, or hot water, which not only saves the condensation of some steam, 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 fitting-valve, with a cock in it, which being partially closed, the asting 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 education-pipe, or some other part having free communication with the cylinder, for the largest engine. This was to be only of the size of a small common beer-cock; and when the steam was properly regulated, this cock was to be opened as much as it could be, to allow the pilon 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 pilon when it arrived near the bottom of the cylinder, and thus diminish that acceleration of the pilon, of which we
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 1 1/2 lbs. 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 1 1/2 lbs. 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 smaller cylinders and pumps, smaller engines must have 1 lb., and the smallest engines 2 lbs. 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-rods not being immersed.

Mr. Smeaton expected his engines, which were calculated to be loaded with a neat burden of 8 lbs. 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. Boffut; 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 adjutment 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 fitting to work. Supply 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 fast, 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 there are performed punctually, the engine soon ceases to work. Now neither the air nor the water can be discharged instantaneous 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-rods; but as the mine or pit becomes of greater depth, and successively 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 quantity 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 suppos'd, with a small portion of its full load, the injection must be very sparingly applied, so as to condense imperfectly within the cylinder, or the piston will descend with such velocity, and stroke 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 accurately regulated to this quantity of water, as to stop it up at every stroke. Now if this supposing up is violent, the air will be driven 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 counterpoise, which we have before described.

Even when the engine continues 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 beam, on the lower side of the piston, from one to two pounds on the inch, greater than the pressure of the atmosphere, which in a sixty-inch cylinder will amount to 2800 pounds, and is a sufficient latitude to make 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 flown, 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 machinery of the fire-engine. The boiler he proposed to be made of wood and iron, with a cast-iron flue or fire-place within of it, and surrounded...

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rounded on all sides, so as to give its heat to the water. The chimney was an iron pipe or tube, also immersed 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 slack, 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 flaves 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-Lyne 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 conveyances the consumption of fuel necessary for working a steam-engine was reduced one-half. He introduced also into his engine water 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 Hulks had a patent in 1736, 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 rotatory motion of his 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 air. He considered 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 flated that it may easily be made to turn a mill to grind corn, or a wheel to raile 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 fecker 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 the same direction, by both the ascending and descending stroke of the arch; and by shifting the ratchet, the motion could be reversed at pleasure. This engine had no fly-wheel, and went happily 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 applying a steam-engine to the purpose of rotative motion, by a chain going round a pulley, and also round two bars 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 Walbrough, 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's 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 rotatory motion, was by employing the 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, it will remain 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 stroke. This will be the case, provided that the refulence exerted by the machine during the whole of the working stroke of the steam-engine, under the influence of the friction of both, does not exceed the whole preulence 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 refulence 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 conformant 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 away. The weight of the connecting rod, therefore, by pressing on the crank aright 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 rotative 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 abbc
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Arnal Canon of Alais, in Languedoc, entertained a thought of the same kind, and proposed it for working lighters in the inland navigations, a scheme which is now successfully practiced in America, and in this country. His brother, a major of engineers in the Austrian service, carried the proposal much farther, and applied it to manufactur- 

es; and the Austrian chamber of mines at Vienna patented the project. (See Journal Encyclopédique, 1781.) But these schemes are long posterior to Mr. Hull's patent, or to Mr. Fitzgerald's proposals, and are even later than the erection of several machines driven by steam-engines by Mefirs. Watt and Boulton.

When the more improved engines of Mr. Watt came into use, many persons tried to improve the atmospheric engines by adopting some of Mr. Watt's ideas: one of these was to employ valves to close and fill perpendicularly into a conical seat, for the alternate admission of steam and cold water into the cylinder, instead of the sliding regulator and injection- cock. Mr. George Burr, who published his Practical Coal- 

Viewers, or Engine-Builders Companion, in 1796, at Sheff 

cfield, gives drawings of such an engine, and tables for the proportions of all the parts, from which, as they contain information not given before, we have extracted the following particulars.

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 and 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-Engines.—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 a 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. Robbuck, and Dr. Robbison, 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. Smeeaton'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 exced 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 Bighton.

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 was then to be heated again by the re-entrance of the steam; this, he saw, could not happen, unless the heat was abstracted from the steam, which must occasion the condensation and waft of a considerable portion. His first enquiry was, what portion of the steam was thus wasted; but to very 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 progression they observed under various pressures, before he made his experiments on that subject. These experiments pointed out 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 preflure of the atmosphere upon the piston, and lessens 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 fill-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 condensation of steam in a greater proportion than they gained power. Though it appears they were ignorant of the cause, they were so capable 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 preflure 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 caused his metal cylinders in a wooden case with light wood-albes; 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 atmospheric preflure.

It was not until the next year (1762) 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 still remain, and draw off the remaining steam from the cylinder until none 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 descent of the piston, the subsequent re-afcent could be obtained by cutting off the communication between the cylinder and the condenser, and admitting steam into the engine. The boiling of water in an exhausted receiver at low heats, which had been discovered, was about this time communicated to Mr. Watt; 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 snift 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 degrees, and could not be so easily evaporated; a small pump must then be applied 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 preflure or expansive force of the steam to actuate the piston in its descent, instead of the preflure 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 vacuum there, 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 feebly inferior to the preflure of the atmosphere on the piston could hinder its 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 atmospheric preflure, 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 12th Jan. 1769, and is for his method of lessening 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 period 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 slowly; secondly, by surrounding 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 prelure 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 axes, like the wheels of water-mills. Within them are placed a number of valves, which suffice 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 vessels, 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 action 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 discharged 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 contracting 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, resinous bodies, fat of animals, quicksilver, and other metals, in their fluid state, as described.

Soon after his patent, Mr. Watt became associated with Dr. Roebuck, who established the Carron iron-works. They proposed establishing an extensive manufactury for such engines under the patent; and Mr. Watt began his first real engine of 18 inches cylinder, at Kinneil, 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 upon 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 Brunam 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 moulder; and though it inferred 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 embarrassed, from the failure of his vail undertaking in the Borrowstounness coal and salt works, was unable to prosecute the manufactury 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 foundery, 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 specimens 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 assistance in systematizing the manufacture of the parts, Mr. Watt soon produced many capital engines, which were erected in Staffordshire, Shropshire, and Warwickshire, and a small one at Stratford near London. He found it necessary to admit a small jet of injection into the condenser, and to employ an air-pump 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 ample for the power requisite to work the air-pump.

The condensing of the steam, by injection into the education-pipe, was an idea as early as the other kinds of condensers, and was tried in the very first engine built at Kinneil; but the other imperfections of that machine, owing to its leaks and bad workmanship, made a bad vacuum; 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 expense of the tubulared condenser for large engines, made him resolve to facilitate 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 them in the middle: this third one received the hot water lifted up by the other two; and by levelling the surface exposed to the prelure 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 engine, one being double the area of the other, and in succeeding engines used only one, as a preface, which is the air-pump of Smeaton.

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

Steam-Engines, 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 12½ pounds on the square inch. The cylinder was very accurately bored withinside, 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 from 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-rod, 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 fame, 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 interface, 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 ejection-pipe M, which conducted to the condenser L. The condenser, L, was a close vessel, made of tin, 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 the air which 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, d, of the bucket passed through a flapping-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 exhausting-valve, K, from the condenser is opened, when the steam rushes from the space of the cylinder A, below the piston, through the ejection-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 immersed 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, pretexts 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, allowing 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 to the top of the cylinder, ready to commence another stroke.

The advantages that arise from this construction are:

1. 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.

2. 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.

3. The efficacy of the steam being employed to press down the piston, instead of the prelude of the atmosphere, the air does not enter the cylinder, or cool its interior surface; and the engine is not conformed, as in 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 an 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 superior to its task; the only mode is, as we have described, by the supply of a scanty injection; 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 accommodated 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 on it; it is only necessary to administer steam of a proper elasticity. At the first erection of the engine,
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, steam of half this elasticity may be continually supplied, and the water will continue boiling, although its temperature does not exceed 185° of Fahrenheit's thermometer. This appears, by inspecting our first table of vaporous dilution.

The method now proposed has one inconvenience; for, while the steam is weaker than the atmosphere, there is an external force tending to squeeze in the sides and bottom of the boiler, which could not be refilled in a large boiler, if the difference were 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 constructed, that its mechanism will lift it more or less high from the conical seat 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 exhaustion-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 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 steam in the top of the cylinder, and in the space of the jacket, must expand itself to fill a greater space, and thereby become more rare than before, and pref upon the piston with less force. And this mode of regulation, by diminishing the quantity of the supply of steam, rather than diminishing the elasticity in the boiler, that is, a very considerable increase of the load of the engine cannot stop its motion, although it may retard it, because the closing of the throttle-valve only diminishes the velocity of the motion, not the force which the engine is capable of exerting when moving under a still less velocity. Suppose the load is so increased as to make the engine move very slowly, it will flow through the valve into the jacket, and top of the cylinder faster than the descent of the piston will make room for it, and in consequence it will accumulate, until it has acquired the same pressure as within the boiler, or a sufficient pre pressure to overcome the resistance to the piston, and make it descend. The form of the engine represented in fig. 4, was that which Mr. Watt first employed in his single engines for pumping; and, in some cases, where atmospheric engines were altered to this plan, the old cylinder, being inverted, served for the jacket, or external cylinder, the new cylinder being little more than half the area of the old one. He afterwards adopted another form for the arrangement of the parts, in which the steam for the supply of the cylinder does not pass through the jacket, but enters from the steam-pipe through a valve immediately into the top of the cylinder; and though the jacket has a communication with the boiler, the steam admitted within it is only for the purpose of keeping up the heat, and preventing any condensation of the steam within the cylinder. In this way the jacket becomes less essential to the engine; and about the year 1778, Messrs. Boulton and Watt began to make the jackets of wrought-iron plate, about 1½ inch from the cylinder all round; and, in some cases, they laid the jacket aside, but found this an ill-judged economy, and returned to it again, as they perceived that it made a difference in the fuel.

This engine is represented in Plate IV. fig. 5. The cylinder, A A, like the former, is closed at top by the lid or cover C; but this lid is screwed to the top flange of the cylinder itself, instead of the top of the jacket, which may be omitted or not in this form, because the current of steam from the boiler, for the supply of the cylinder, does not flow through it, as in the former engine. The steam is brought from the boiler to the cylinder by the pipe F, which appears like a circle, being cut across in the direction of its length: j is the regulating or throttle-valve in that pipe, and d the communicating passage into the top of the cylinder, immediately beneath the valve, so that through this the steam has always entry into the top of the cylinder to press upon the piston, in such quantity as the opening of the regulating-valve, f, will allow. W is the steam-pipe, which defends to the bottom of the cylinder, for the purpose of establishing a communication between the top and bottom of it, when the piston is to ascend; and O is the steam-valve, which opens or shuts that communication at pleasure. F is the exhausting-valve, which being opened when the steam-valve, O, is shut, allows the steam to pass off to the condenser, which may be considered as the same which we have before described.

Suppose the piston at the top of its cylinder, and all the parts (except the exudation-pipe M, and condenser, which are vacuous) full of steam; if the valve O be shut, the exhausting-valve K, being opened, will permit the steam contained in the lower part of the cylinder to pass by its elasticity, and rush into the vacuum of the exudation-pipe and condenser; and being there condensed, the rest will follow till none remain; 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 suffers the steam from the boiler to rush in 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 pressure 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 Messrs. 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 variation is, that 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 defends in consequence of the preasure of the steam being made...
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 preface 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. 3, 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 upstroke. K is the exhaust-valve, placed close beneath the steam-valve F, 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 into 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 prefilling 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 instant, the exhausting-valve, K, being opened, the steam from the top of the cylinder presses off to the condenser, and this makes a vacuum above the piston, the fame 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 of 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 elacticity 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 elacticity 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 preface of the atmosphere whilst the load is constant, or even greater 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 opened 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 flooding 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 preface on the piston is continually diminishing as the steam 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 preface on the piston at the beginning of the stroke may exceed the refusance of the load, yet when the piston is near the bottom, diminution of the preface may occasion the refusance to exceed the preface; in this case the motion can only be continued by the momentum of the moving parts. Whatever may be the law by which the preface 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 preface to lift the pump-rods, or that the machinery shall vary its force 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 fuste, transmits an equal preface to the wheel-work, from a very unequal action of the main-spring. In like manner, by making the communication from the piston to the pump-rods by means of chains, which wind upon arch-heads, 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 12, 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 and 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 decimally divided, viz. into ten parts, and each subdivided, the varying preface of the expanding steam on the surface of the piston at each division will be according to the following table,
applied to its fullest extent, would, we think, be impracticable: we mean, when steam of great caloric preasure is employed, and when the stoppage of the supply is made to take place at a very small portion of the defcent. In this cafe, the ftrain upon the centres of the fnaifs 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 Printing.) But in fo small a machine, worked only by the strength of one man, the long call-iron frame of the press has been frequently broken.

We fuppofe it is for fuch reafons, that Meffrs. Boul- ton and Watt have not, that we know of, applied these contrivances to any of their engines, but have contented themselves with employing steam a little more than the prefire of the atmosphere, and stopping the supply at one-fourth or one-third of the defcent, according to the circumftances under which the engine works. In this cafe, the decafing prefire 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 rifing column of water, produces nearly uniform motion. Mr. Hornfley, about 1781, had a patent for a method of applying the expafive principle of Mr. Watt in two fuccefive cylinders in fuch a manner, as to approach more nearly to an equality of force, by which item of great prefire can be employed to act by its expansion. This kind of engine, of which a defcription is to be found in Mr. Watt's Specifica- tion of 1782, has since been brought to a great degree of perfection by Mr. Woolf, as we fhall notice.

Description of Meffrs. Watt and Boulton's complete Single Engine. — Plate III. fig. 1, is taken from the engine at Chefses water-works, for pumping water for the supply of London; it was erected in 1804, and is estimated at fifty horfes' power. — We have hitherto confidered Mr. Watt's engine as being fett up with the great woofen beam, and arch-heads, chains, and pumps, the fame as the old engine. This was the form of the engine for fome years; but from 1784, 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 call-iron working beams instead of wood. A B C is the beam, which is made of call-iron instead of wood, and is composed of two large plates, of the fhape represented in the figure, put together at twelve inches dis- tance from each other, leaving a space between them, the centre or axis B paffing through the middle of both plates. The axis lies on the floor D, which is fupported by the wall E, built beneath the centre. Q is the cylinder, contained within a fteam-jacket, composed of segments frewed to- gether. F is the fteam-pipe coming from the boiler G. a b is the pilfon-rod, connected with the end, C, of the beam by links C, 6; and whilft the upper ends of the links move in the arc of a circle, with the end of the beam, the lower ends, b, are made to accommofate themselves to the vertical motion of the pilfon-rod a, by means of the rods, c, extenfing to the smaller links, d, which form a parallelogram. The motion of the parallelogram is governed by the bridge-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 prefent purpofe to un- derftand, that the lower ends, b, of the links, b, C, will afcend and defend 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 plug-beam, R, attached to it, which has pins, or chocks, lrcwed on to it to actuate the handles, x, y, and z, of the mechanifm for the valves, which mechanifm is very different from that employed in the old engines, and even from that of the first engines of Mr. Watt. But to define all the varieties which have been adopted, would occupy a volume, and afford information of but little value.

The pump-rod, p, is fuspended at the end, A, of the beam by another parallel motion, and the upper part, S, of the rod is made of call-iron, and very malleive, to have a fufficient weight in itself to draw up the pilfon, and make the return stroke. The real pump-rod, p, is joined to the heavy counter-weight S, and is polished, like the pilfon-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 rafes the water in ascen- ding, but it forces it through the air-well T, and pipe X, which leads to a refervoir two miles diftant, 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 communica- tion with the river.

The cylinder, Q, is kept down by the weight of a pier of mafonry, on which it is placed, and large iron bolts, m, defcend from the lower flanch to the groundfills, upon which the mafonry is built. Immediately before the pier is the condening ciftern, M, which contains the air-pump N, the condener L, partly concealed, and hot-well g, and is kept fuppiled with cold water by the cold-water pump I, worked by the beam at the outer end, and the waftes runs oft again into the well, so as to keep the water in the ciftern always cold.

The valves, which muft be opened and shut to produce the action of the engine at four in number viz. the upper fream-valve at F, the lower fream-valve O, and the exhauffion-valve K, fig. 2, and a small valve K', beneath the water in the ciftern M, to admit the injection into the condener; but these parts are better explained in fig. 2, which is a fection of the cylinder, air-pump, and condener on a double fcale.

A, the fection of the cylinder, in which the pilfon X, moves; F, the fream-pipe coming from the hoiler; L, the condener; N, the air or difcharging-pump; m, a pallage or pipe from the pump L, to the condener N, in which the fream is an occafional communication by a hanging-valve at m, which muts towards the condener; f is the injection-valve, to be lifted by the engine at every stroke, for the purpofe of condening the fream in the condener L; c, q, and the fuffing or blowing-valve, placed outside the condening ciftern (of which M M is a fection, on purpofe to fhew the contents); the injection-valve, c, communicates with the condener by a pipe paffing through the fide of the ciftern M, and is inferted at the fide of the condener; K is the exhauffion-valve, to be lifted by the engine, and open a communication between the cylinder A and the condener L; O is the fream-valve, to be lifted by the engine, and open a communication between the lower part of the cylinder, and upper part thereof, through the fream-pipe r, which is the upper fream-valve of the fame kind, opening a pallage 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 muft now attend to the mechanifm by which the engine is made to feed itfelf, 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 open- ing in the ftem of the valve; and afecond 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 spindle \(x, y, z\), by which it is moved, either by the hand, to start the engine, or by the clock-s 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, \(n\), at the lower end to turn round the spindle, each upon its axis, in that 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, \(z\), to descend. Both the axles of the lower handles, \(x, y\), have small levers, or catches, \(t\) and \(u\), which act in the hooks of a double latch, or detent, \(t, v\), 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 the handles, \(y, z\), from moving by the action of their respective weights, until the detent is moved on its centre, so as to release the catches of the levers from its hooks \(t, v\). But it is evident, from fig. A, that when only one catch, \(z\), is hooked by the lower hook, \(v\), of the detent, and consequently the weight of its spindle is held up, if the other catch, \(y\), is moved by depressing its handle, \(y\), so as to raise its weight in the act of entering the hook, \(t\), of the detent, it will press the end, \(u\), of the detent forwards upon its centre, and this at the same time pressing back the hook, \(v\), at the opposite end of the detent, releases the catch, \(z\), of the lower handle, \(z\), therefrom, 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, 2, with the lever, 3, of that valve; so that by depressing down the handle \(x\), it will shut the valve \(F\). The weight \(o\), 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 4. The weight \(o\), 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, \(u\), 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 14, when the handle, \(z\), is suffered to fall down, and shut when the flame is up, being held by the catch 2, and hook 3. 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 equivalent is a rod, 5, jointed to that lever of the middle axis which has its weight and rod, 6, suspended from it.

The upper end of the rod, 5, is made with a loop, or long flat pin, which works a pin at the end of a lever, 6, projecting from the upper end of the axis. The consequence of this is, that while the middle axis is detained by its catch, and detent 4, to keep the exhausting-valve \(K\), shut; the lever, 6, of the upper spindle will be borne up by its pin resting in the bottom of the loop of the rod, 5, 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 4, of the middle axis is discharged, and its weight has opened the exhausting-valve, the looped rod, 5, will no longer support the lever, 6, 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 flat, or loop, in the top of the rod, 5, 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, 9, 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, 7, 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 depressing 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 quiescent 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 \(r\), 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 condenses all 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 be 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 known when the cylinder and other vessels are properly heated, and the air discharged by a very smart crackling noise at that valve, like a violent decimation of guilt in the fire; this noise being occasioned by the water in the small cistern producing a sudden and rapid condensation of the suffling steam when the air is all gone.
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It 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 further 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 it opens the injection-valve, the valve is lifted at the same time with the exhausting-valve; this admits a jet of cold water into 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 pressure of the steam on the piston being now balanced by any thing beneath the piston, it descends and draws up the pump-buckets, and columns of water in the pumps, with a velocity proportioned to the pressure of the steam, and the diameter of the piston, compared with the height of the column of water in the pumps, and the diameter of the bucket: but the piston having defended about one-third of its stroke, a check of the plug-frame, $R$, meets the upper handle $x$, and pressing it down, shuts 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 defend farther, and slide against the perpendicular part of the handle, which is straight, without producing any farther depression of the handle, at the same time that it keeps it down to the same point, fo as to hold the valve shut. The piston, therefore, continues its descent by the further expansion of the quantity of steam at full jet into the cylinder; but having arrived at the bottom of its stroke, a check on the opposite side of the plug-beam, $R$, seizes the middle handle, $y$, and presses it down, which pushes the rod, 4, until it shuts the exhausting-valve $K$, and also shuts the injection-valve by the stop and rod 9. When the catch, 1, of this handle, $y$, presses on the upper hook, $i$, of the detent $r$, it relieves the catch, 2, of the lower axle $z$, and then the weight, $n$, causes the handle, $z$, to fall, and pulling the rod 14, opens the lower steam-valve $O$. Let us now consider the position of the engine; the middle handle, $y$, will be held down by its catch, 1, holding in the upper hook, $i$, of the detent, $r$, as to keep the exhausting-valve, $K$, shut; and the upper steam-valve, $F$, is also kept shut, by the same means which keep 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 through the pipe $x$, and enter the bottom of the cylinder, as far 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 shorter lever, 6, of the upper axis $x$; and thus the motion continues, till the piston arrives very nearly at the top of the cylinder: in this state 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, $d$, of the detent, moves it on its centre, so as to release the catch, 1, of the middle axis, $i$, of the detent. This being the case, the longer axis of the middle axis causes its handle, $y$, to fly up, and by the rod, 4, it opens the exhausting-valve; and by drawing the stop 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 beneath the piston rushes into the condenser, where being met by 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, discharges the other two 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 boiler, have accumulated in some quantity in the condenser; then at every descent of the bucket, $d$, of the air-pump, it dips into the water contained in the bottom of the barrel $N$, and the water passes through the valves in the bucket; these 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-water $g$. 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, with which it will be, if the condenser contains either air or steam, it will press by its elasticity 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 elasticity 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 reft upon the bucket $d$. When the bucket ascends, it carries before
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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 it through the valve, \( g \), into the open air.

The acent 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 \( g \), fluids, 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 retreating 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 behind 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 flated 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 construction, having a valve at \( g \) to keep off the pressire of the atmosphere, it is certain its bucket can have little weight upon the engine, until the bucket is near the highest limits of the stroke; and taking the sum of the retreat, 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 resistence 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 resistence is only that of compressing the vapour; an operation which begins at nothing, but increases by an ascending proportion referre 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 eilter 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. Also, 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 instant 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 push to the air through the hanging-valve, between the pump and the condenser; and hence it is reasonable 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 cylinder 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 cylinder, it will take the water in the coldest state. The injection-valve and cock are seen in fig. 2.

As the condensing apparatus is immered in water, to be kept cold, 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 sides 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 wetness a moisture 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 impair 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 transformation 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 transformation more or less. Some of Messrs. 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 fully 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 derange 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 ejection-pipe is carried sideways from the box in which the ejection-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 lost its load, or resistance, 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 at last the piston striking the bottom of the cylinder, the momentum of the beam forced down upon the rod so violently, as to bend the great piston-rod quite crooked. To prevent similar accidents, a smaller steam-pipe was added at the side of the vertical steam-pipe, communicating with the passage into the bottom of the 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 also 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 edgways in the pipe, prevents any resistance to the passage of the steam; but when turned flat across the pipe, it flows its bore; and although it is not fitted with any 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-vessel 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-vessel than the main pipes, X, will carry off, it must make a greater preflure and condensation of the air in the air-vessel, until the water is forced to run quicker through the main-pipe, and this preflure 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 preflure in the air-vessel 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 contrived, that it will increase in force as the piston ascends, and diminish 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 relieves the piston from its 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 preflure of the water in the air-vessel.

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 this quantity 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 preflure in the air-vessel, 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 M'Fers, 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 check that flows 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 check 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.

One of the main properties of the engine, by which it regulates itself, and provides for all its wants, that the great beauties of the invention consist. M. Behord, 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 its tubes a 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 useles, and draws from its own labours all which is necessary to its own sufficiency." To purify the idea, we may now say 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
defied 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 supercumbent 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 by Newcomen's engine; but Mr. Watt applied in his first engines 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 tube, 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 engineer 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 hole a whistle or mouth-piece is formed: then, if the water in the boiler sinks too low, the steam will issue from 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 wane of evaporation, by means of a small pump 20, which draws hot water from the hot-well 8, and raises it to such a height, that the water will run through a pipe, shown 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 subside, and shews 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, 16, of this lever suspends, by means of the wire 16, a flone or piece of metal, which hangs just below the surface of the water in the boiler. The wire passes through a small flussing-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 flone in the boiler. Now it is a maxim in hydrostatics, that when a heavy body is suspended in a fluid, it looses 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 conveyance of part of it into steam, the upper surface of the flone will be above the fluid, and its weight will consequently be increased in proportion to the quantity of its mass that is not immersed. By this addition to its weight, the flone 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 flone, 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 flexibly at work, the flone 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 flopped at pleasure, and to effect this, a small rectangular lever, with equal arms, is fixed upon the float of the valve, and connected with its top. To one of these arms a chain is attached, which is conducted into the engine-house, and passes 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 flopped.

There is also another valve of safety, for the receiver 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 fuses 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 prefling on the surface of the water in the boiler, and the atmosphere prefling 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 elasticity of the air and the steam: and if at any time the preflure 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 as there is a flone-float in this pipe, balanced in the same man
ner as the feeding-float before described, the defcent of the
flone 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 flone recovers the intended
premure, and restores the damper to its place. On the
other hand, when the premure of the flone is on the in-
crease, either from the engine being retarded or stopped,
or from the furnace burning too fast, the premure of the flone
on the surface of the water in the boiler rarifies the water in
the open pipe; and the flone-float, then rising by its balance-
weight, closes the damper, and diminishes the draught, till
the flone subsides to its deifined force. By this means, the
flone is always preferred to the flame intensity; a circum-
stance very necessary to the regularity of the motion of the
engine.

Steam-Gauge.—To ascertain the premure of flone with
a greater degree of exactitude than by the load on the sur-
face of the safety-valve, which is liable to many uncertain-
ties, Mr. Watt employs a steam-gauge, consisting of an inverted
fiphon, or bent tube, of glass or iron; one leg of which is
jointed to the steam-pipe, and the other is open to the at-
mosphere. 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 ex-
posed to the premure of the flone, while the external air
acts upon the other, it is evident that the difference of level
of the two surfaces will express the premure of the flone in
the height of a column of mercury.

When the tube is of glafs, 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 case the divi-
sions, 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 vauum in his
engines, an addition which is of important consequence to
the good performance of the engine, to the profit of the
proprietors, and the credit of the engineer; yet in many en-
gines in London, we fee this important instrument either
out of repair, or wholly laid aside.

The form of this barometer can be uniplowed without a
figure: it is a tube of glass 30 inches long, filled with mer-
curry, and applied to a scale of inches, the lower end being
immersed in a cup, in the fame manner as the common baro-
meter, or weather-glass; it is, in fact, the fame thing as a
barometer in every refept, except that the vacuum is not
made in the top of the tube, in the Torricean manner,
but by the engine. For this purpofe, a small copper tube is
conducted from the condenser, and connected to the top of the
glass tube, by which means the surface of the mercury in the
tube is relieved from the premure of the atmosphere; and
the weight of the atmosphere, which preffes upon the surface of
the mercury in the bafon, will caufe it to mount up in the
tube to a greater or lefs height, according as the vacuum is
more or lefs perfect, or as the atmosphere is more or lefs
heavy; which will be shown by a common barometer placed
at the fide of the engine barometer.

The pipe which lead from the condenser to the top of the
barometer tube must be provided with a cock, which fhould
be fhut when the engine is blowing through, to prevent the
flone entering the tube, and blowing the mercury out of it;
but the bafon 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 de-
scend into the bafon.

It has been proposed to make the barometer in the form
of an inverted fiphon, jufi the fame 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 rife of the mercury in one leg produces a corre-
sponding fall of the mercury in the other; but on this ac-
count, if the scale is applied to one leg, the divifions muft
be only half inches, that is, provided the two legs are of the
fame bore; but if they are of different bores, the scale muft
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.

The flone tubes may be made of glafs; but if the quickfilver
is not very pure, the alloy with which the venders of this
article adulterate it is by constant action brought to
the surface, and, together with the vapour, make the tube
fo foul, that no precision can be obtained. Iron is the best
material for both parts of the tube, which fhould be cor-
rectly 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 flop-cock be placed between the gauge and condenser.
The index in this instrument is the fame as in the steam-gauge,
that is, a light deal rod, which is put into the shorter tube; and
quickfilver being poured into it within three inches of the
end, the rod is put into the tube, and floats on the quick-
filver. It is almoft needless to remark, that the graduation
on this inftrument must be inverted with regard to that of a
fingle tube.

The barometer fhews the perfection of the vacuum, or
the premure of the atmoilphere to enter into the condenser,
whilft the steam-gauge fhews the premure of the flone to
ecape into the air. By adding the height of these two co-
 lumns together, we have the premure of the flone upon the
pifton, provided the throttle-valve is fully open, fo that
there is no obftacle to the entrance of the flone from the
boiler into the cylinder. It would be interefling to have a
fingle gauge made to express this in one: nothing would be
more easy than to have a long glafs tube bent to an inverted
fiphon, and one of the legs being connected with the steam-
pipe, and the other with the condenser, the difference of level
between the tow surfaces would at all times express the pre-
ferve on the pifton.

Counter.—In many of Mr. Watt's engines, a little ap-
paratus is attached to the beam, to afcerfin the number of
frokes 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 froke made by the engine moves one tooth, fo that
the index tells how many frokes have been made since last ex-
aminced. This is fuch that in a box, that no perfon 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 caufe
the pendulum to vibrate every time the engine makes a froke,
and thus moves the counter round one tooth for every froke.
In other cafes, the box containing the counter is fixed to
the spring-beam floor, and at every froke the beam frikes a
fmall detent, and moves the counter one tooth. It was
by the account of this inftrument that Morfes, Bolton and
Watt charged their portion of the favings for working their
engines during the term of Mr. Watt's patent.

Conftitution of the Valve.—The flone and eduction-
valves are of that kind called button or conical fplindle-
valves.
STEAM-ENGINE.

values. Mr. Watt, in his first essays, employed cocks, and also lifting-valves, such as the regulator or 'steam-value' of the old engine. But he found them always lose their tightness, after a short time. This is not surprising, when we consider that they are always perfectly dry, and almost burning hot. He was therefore obliged to change them all for spindle-valve, which being truly ground, and neatly fitted in their motions at first, are not found to get out of order by any length of time. Other engineers now use them commonly in the old form of the steam-engine; where, however, there is left need 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 cold 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 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 e, which is freely moveable up and down in the hole of a cross-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 female, and the other side of which is inserted into a toothed rack.

A is the section 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, is made to surround the outside 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 valve when the sector is moved. K K is a cover, which is fixed by screws to the top of the box F, and may be taken off, in order to get at the valve when it needs repairs. 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 pressure of the steam upon its upper surface while there is a vacuum beneath it. The valves of the Chelsea engine are nine inches diameter, and therefore contain (9 x 9 = 81 x .7854 =) 62½ square inches, and each being pressed by at least 15 lbs., makes 82½ 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 fixed on to clothe 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 evident that the action of the piston to ascend will counteract 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 slightest 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 effectual 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 run more than a tenth of an inch; the force is, therefore, no impediment to the engine, but would be an inconvenient labour to the man who starts and stops it.

By Mr. Watt's contrivance, the lever is put in such a position that when it begins to raise the valve, that its mechanical energy is almost infinitely great. Let fig. 3, represent the valve flint, which is supposed to have been just closed by the chock on the plug-beam in its deficient coming in contact with the handle x, and depressing it, which is moveable with the axis X: on this same axis is another arm, X 2, connected by a joint with the leading rod 2 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 x, and turns the arm, X 2, 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 2, 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 axis A, upon which the fector is fixed. In this situation the valve is kept closed by the catch or detent before explained, which holds down the handle x, until it is wanted to be opened; the plug-beam then, by lifting the lower handle, releases the catch, and the weight, x, applied to the axis turns it round into the position of the dotted lines, and the lever, X 2, draws the rod 2 3, and, by depressing the lever 3 A, as before the valve.

From this arrangement, the intelligent mechanic will perceive that, in this position, the force exerted by lever X 2 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 prehure, however strong, applied upon the valve to open it, would be ineffectual, as that force would be exerted to turn the lever X 2 endways, in the direction of the axis X, instead of turning it round, as shewn by the figure, which represents the valve flint, and retained in that position by the lever X 2.

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 effectual method, by water lying on it, was inadmissible. 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 hot 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
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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 pressing upon it, the plate is forced down by screws. The lower part of the groove round the piston being made rounding, with a curve, this prelude on the packing forces it against the inside forlace 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 by the fides of the piston during its deficient. If the piston is packed too tight as totally to prevent the loss, 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, sensibly diminished, by a small want of tightness in the piston. In the atmospheric engine, if air enters in this way, it immediately puts at ftrap to the work; but in the new engine, although even a considerable quantity of steam escape past the piston during its deficient, 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 Theatrum Machinarum Hydraulicum, 1724.

The actual Performance of Mr. Watt's Engine with respect to Coals.—At the first establishment of their engines, Meflrs. 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 ellimate Mr. Watt's engine at one-half the consumption of fuel as his own for the same work, in large engines, or a full 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 1776, when Mr. Watt first established his engine, we find his proposals, deduced from experiment, whole length, 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 24½ millions. Thus, 500,000 cubic feet × 62.5 lbs. the weight of a cubic foot of water, = 31,250,000 lbs. of water raised by 112 lbs. of coal. They say, as 112 lbs. : 31,250,000 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 expansive method.

Mr. Smeaton, who was defirous of promoting Mr. Watt's discovery, made an experiment in 1778, on an engine on the Birmingham canal, for returning into the refervoir 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 9 inches length each. It worked for an hour with 65 lbs. of Wednesbury coals.

When reduced, this experiment gives about 18 millions lifted one foot by a bushel of coals. Thus, the area of the pump is (20 × 20 = 400 × 7.854 = ) 314 square inches, X .434 lbs. = 136.27 lbs. weight for every foot in height, X 27 feet = 3679 lbs. the total weight of the column. The motion per minute is 634 feet (11 strokes of 5 ft. 9 in. each), or 379 feet per hour, X 3679 lbs. = 13,601,805 lbs. raised 1 foot high per hour. The coals consumed in the hour was 65 lbs.; therefore say, as 65 lbs.; 13,601,805 lbs. :: 88 lbs.; 18,903,156 lbs. raised one foot high with each bushel of coals of 88 lbs.; load on the piston 27 ft. of water, or (27 ÷ 400) = .0678 lbs. per square 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 belt construction, and working 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 Meflrs. Boulton and Watt, taking the average of nine engines, haul, good, and indifferent 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 began 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 duey 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 viz. 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
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I employ the steam after it has acted 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 immered in a vessel of water. Fifthly: To discharge the air which enters the steam-vessels with the condensing water or otherwise, I introduce it into a separate vessel, whence it is protruded by the admission of steam. Sixthly: That the condensed vapour shall not remain in the steam-vessel in which the steam is condensed, I collect it into another vessel, which has open communication with the steam-vessels, and the water in the mine, resort, 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 entering in between the piston and the sides of the steam-vessel.

The following is a description of this engine by the inventor, as it was published in the Encyclopaedia Britannica. Let A and B (Plate V, fig. 1) represent two cylinders, of which A is the largest; a piston moves in each, having their rods, C and D, moving through collars at E and F. These cylinders may be supplied with steam from the boiler by means of the square pipe G, which has a flange to connect it with the rest of the steam-pipe. This square part is represented as branching off to both cylinders: c and d are two cocks, which have handles and tumblers as usual, worked by the plug-beam W. On the fore-side of the cylinders (that is the side next the eye) is represented another communicating pipe, whose section is also square, or rectangular, having also two cocks a, b. The pipe Y immediately under the cock b, establishes a communication between the upper and lower parts of the small cylinder B, by opening the cock b. There is a similar pipe on the other side of the cylinder A, immediately under the cock d.

When the cocks c and a are open, and the cocks b and d are shut, the steam from the boiler has free admission into the upper part of the small cylinder B, and the steam from the lower part of B has free admission into the upper part of the great cylinder A, but the upper part of each cylinder has no communication with its lower part.

From the bottom of the great cylinder proceeds the education-pipe K, having a valve at its opening into the cylinder; it then bends downward, and is connected with the conical condenser L. The condenser is fixed on a hollow box M, on which stand the pumps N and O, for extracting the air and water, which last runs along the trough T, into a cistern U, from which it is raised by the pump V, for re-cranking the boiler, being already nearly boiling hot. Immediately under the condenser there is a spigot-valve, at S, over which is a small jet-pipe, reaching to the bend of the education-pipe K. The whole of the condensing apparatus is contained in a cistern, R, of cold water; a small pipe, P, comes from the side of the condenser, and terminates on the bottom of the trough T, and is there covered with a valve, Q, which is kept tight by the water that is always running over it.

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Lastly, the pump-rods, X, cause the outer end of the beam to preponderate, so that the quiescent portion of the beam is represented in the figure, the piftons 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. L., the beam 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 pressure 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 pressure of the steam coming from the boiler, and preffing 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 far; for the cylinder A is larger than B, and the arch of the beam, at which the great piston is suspeded, 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 piftons 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 frame, and the piston B will act to depress the beam with all the difference of these pressures.

The flightest view of the subject must shew 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; the condensation will again operate, and cause the piftons 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 piftons 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 fectorial 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 solid part of the one covers the aperture of the other, the cock is shut. Such regulators are now very common in the cast-iron boxes for warning rooms.

Mr. Hornblower's contrivance for making the collars for the piston-rods air-tight, is this; 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 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 plated 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 when 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 slips 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 preffure of steam is invariably as the space into which the steam is expanded; this is the case with air, and for the present we shall grant it to be so with steam, and reason from the same data as the ingenious inventor gives us.

To explain clearly what passes in the two cylinders, we must deviate from the precise form of the engine, and divest ourselves of one complication of ideas, by reducing both cylinders to the fame stroke; therefore, suppose the engine to be made 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 preffure of steam, we will suppose the engine to be worked by the preffure of atmospheric air instead of steam; and for the convenience of round numbers in our calculation, we will consider the preffure 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 preffure 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 preffure 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
pose the space between the two pistons filled with air of the same density, while there is a perfect vacuum made in the lower part of the great cylinder, beneath its piston.

Under these circumstances, the two pistons will begin to descend with something less than 2000 lbs. of load upon the outer end of the beam, because there are 2000 lbs. of preface on the great piston by the air contained in the space between the two pistons, bearing on the 200 inches of surface with a weight of 10 lbs. per inch; and beneath this piston there is nothing to counteract the preface. At the same time, the small piston, having air of equal density above and below it, is in equilibrium.

This force would balance a load of 2000 lbs.; but suppose we diminish the load to 1900 lbs., then the pistons will immediately begin to descend; but they will soon flop, 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 preface on the great piston must diminish. Now as this same diminution occasions the small piston to have a power of descent, we will first consider the pistons separately, and then conjointly, in their power of descent, 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>
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<tr>
<td>In consequence of the preface of 10 lbs. per circular inch upon its upper surface, and no preface beneath.</td>
<td>Because the piston is in equilibrium, having 1000 lbs. pressing upwards, and 1000 lbs. downwards.</td>
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<td>At one-fourth of the descent, the power will have diminished to 1600 lbs. by regular decrements, to 1333⅓ lbs.</td>
<td>At one-fourth, the power will be 200 lbs.</td>
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<td>Because the air between the two pistons must occupy three-fourths of the small cylinder, and one-fourth of the great cylinder, which is a 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 preface on the great piston must be as four to five, or ⅘th of 2000 = 1600.</td>
<td>Because the equilibrium does not continue, and at one-fourth of the descent the preface 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 preface above the piston continues to be 1000. The power is, therefore, 1000 − 800 = 200.</td>
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<tr>
<td>At one-half of the descent, the power will have diminished to 1142⅔ lbs.</td>
<td>At one-half of the descent, the power will have increased to 333⅓ lbs.</td>
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<tr>
<td>Because at this position the air between the pistons occupies one-half of the small cylinder and one-fourth 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 six to four, and the preface on the great piston as four to six, or ⅝th of 2000 = 1333¾.</td>
<td>Because the preface beneath is diminished by the increased rarity of the air to ⅝th of 1000 = 666⅔, while the downward preface continues to be 1000. The power is therefore 1000 − 666⅔ = 333.</td>
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<tr>
<td>At three-fourths of the descent, the power will be only 1000 lbs.</td>
<td>At three-fourths of the descent, the power will be 428⅔ lbs.</td>
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<tr>
<td>Because the air must now occupy one-fourth of the small cylinder, and three-fourths of the large cylinder, which is a space equal to one and three-fourths of the original space. Thus the spaces will be as seven to four, and the preface on the great piston ⅖th of 2000 = 1142¾.</td>
<td>Because the preface beneath is reduced by the rarity of the air to ⅙th of 1000 = 571¾; therefore the power is 1000 − 571¾ = 428¾.</td>
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<tr>
<td>At the bottom of the cylinder, the power will be 1000 lbs.</td>
<td>At the bottom, the power will be 500 lbs.</td>
<td></td>
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<tr>
<td>Because the air must occupy the whole of the large cylinder, a space equal to twice the small cylinder which is as first filled. The preface will therefore be ¼ of 2000.</td>
<td>Because the air beneath the piston is reduced to one-half of its preface, or 500, which deducted from 1000, leaves 500.</td>
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<tr>
<td>Sum of the powers exerted by the great piston in its descent is 1076 lbs.</td>
<td>Sum of the powers of the small piston is 1461 lbs.</td>
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<tr>
<td>Sum of the combined powers is 8538 lbs.</td>
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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 deficit, and leaving the remainder of the deficit to be accomplished by the expansion of the air already contained in the upper half of the cylinder.

\[
\begin{align*}
\text{At the beginning, the power of deficient will be} & \quad 2000 \\
\text{At one-fourth, the power will fill be} & \quad - \\
\text{At one-half, the power will be} & \quad - \\
\text{At three-fourths of the deficient, the power will be} & \quad \{1333\} \\
\text{diminished to} & \quad - \\
\text{Because the air must occupy one-fourth of the length of} & \\
\text{the cylinder, in addition to that half of the cylinder which} & \quad \text{it occupied before the expansion began; therefore the} \\
\text{space is one and a half times the former, or as three to} & \quad \text{two, and the preffure will be two-thirds of 2000}. \\
\text{At the bottom the preffure will be} & \quad -1000 \\
\text{Because the air is expanded to occupy twice the space it} & \quad \text{filled before.} \\
\text{fills} & \quad 833.3 \\
\end{align*}
\]

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 let out with the preffure 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 deficient, or between the other points at which we have chosen 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 less 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 see 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 necessity of those ingenious contrivances for equalizing the action in Mr. Watt's patent of 1782.

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 proposed 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 flattening off the air, or from a double cylinder, when air is used to press the piston nor could they gain any advantage from the expansion of steam in their engines, if the preffure 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 preffure 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 to 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 condensed in a close vessel, when heated until the thermometer indicates a certain temperature, will have a certain preffure 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 undoubtedly proportioned to the quantity of water contained in the same bulk of 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.

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 six-feet stroke. The only account we have been able to obtain of the performance of this engine, is from a pamphlet published by Thomas Wilson, an agent of Melfiae. 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 14,222,120 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 diametar, with lengths of stroke in each suitable to the occasion: viz. 6 feet and 8 feet respectively. The condensing 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 576 feet, 4500 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 3/4 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 4500 lbs. \times 6\text{ feet stroke} = 27,000 lbs. which the engine raised one foot high at every stroke; 27,000 lbs. \times 14\text{ strokes per minute} = 378,000 lbs. raised one foot high each minute; 378,000 lbs. \times 60 = 22,680,000 lbs. raised one foot high per hour, or with 70 lbs. of coal. As the coals are fitted to be light, we will take them at only 84 lbs. per bushel, instead of 88 lbs. as Mr. Siemens did, and say as 70 lbs. = 22,680,000 lbs. = 27,240,000 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 presented themselves to the advantage 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 the steam enough to keep the engine going; but no former 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, that is, when the detent, which kept the exhausting-valve shut, happened to miss its action, the piston would be checked, as it were, not being permitted to rise through the whole of the returning stroke; and it would, 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 Mellor, 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 1834 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-preteriore 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 preffure 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 mallees or quantities of steam of the like expansive force of fix, seven, eight, nine, or ten pounds preteriore square inch, can expand to fix, seven, eight, nine, or ten times their volume, and still be respectively 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 vacuum state 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 preffuring 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-preffure; 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 preffure 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 1/2°, 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 its invention. Various other pressures, temperatures, and expansive forces of steam, are shewn in the following table.
STEAM-ENGINE.

And so in 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, 300, or more times its volume, without any limitation but what is imposed by the fragilable 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-veffel or cylinder must be a guide for the larger. For example, if a steam of forty pounds the square inch is fixed on, then the smaller cylinder should be at least one-fortieth part the contents 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 larger 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 halt 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, 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 had last moved it has a communication with the larger steam-veffel 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 prelude 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 valve 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 action as Mr. Hornblower's, which we have before described. The novelty consists in the application of steam of a high prelude 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 placing them in the boiler, or in a steam-cunoenating with the boiler, a separate fire may with advantage be made under the steam-veffel containing the cylinders, in which 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 included, the steam-pipes, and generally all the parts exposed to the action of the expansive force of the steam, shall have a strength proportioned to the high prelude 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 the 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 forty of the capacity of the larger or working cylinder,
STEAM-ENGINE.

nder, 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 size of the small cylinder or steam chamber.

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 ascertains the force of the steam, in order that the strength of steam belt adapted for the engine may be ascertained, for it may turn 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 enclosed, 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 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-fortieth 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 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, 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 so great, from the strong steam acting upon the whole 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 fire 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 the upper 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 this piston, 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 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 flame into a receiver 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 oxidized, 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-valve, or working cylinder, excepting where the packing, or other fattings, is necessary to be applied; so 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 precluding against the inside of the cylinder is very great.

In 1810, Mr. Woolf had a third patent, the object of which is to prevent the waste of steam, from leakage by the piston. For this purpose, he does not allow the steam to come to the piston at all, but cauets it to act in a different way, and transmits the action thereof to the piston by oil or fluid metal: thus, at the side of the cylinder,
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, these, being admitted into this vessel, will press 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 fame upwards; a vacuum being at the same time made in the upper part of the cylinder, to give effect to the preflure. The fame is then made to press upon the upper surface of the piston, which is always covered with a quantity of the fluid; and at the fame time a vacuum is made in the separate vessel, so as to relieve the surface thereof from all preflure: in conquence, 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 refhit the passage of steam, particularly when it is so rare as the expanded steam which Mr. Woolfe sometimes used in his engine. The separate vessel of which we have spoken, is in some cafes to be the jacket or space which surrounds the cylinder, which is then to be open at bottom.

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. Woolfe's Engine.—Since his first patent, Mr. Woolfe has erected several small engines, which performed well, and with an evident economy of fuel. But these engines being 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. Woolfe's engines did not come to a direct and indispensible 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 Mefli's T. and J. Leaks 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 engines at $49,980,882$ lbs. lifted one foot high for each bushel of coal; and since that time they have done more than $50,000,000$ lbs.

The engine at Wheal Vor has a great cylinder of 55 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 $37,082$ lbs. weight, 7½ feet high, which is the length of the stroke in the pumps. This makes a preflure of 14.1 lbs. per square inch on the surface of the great piston, and it makes 7.6 strokes per minute. With respect to its consumption of coal, 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, 43,500,000 lbs.

From the fame 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 24,050 lbs., which it raises 7 feet at each stroke. Its performance during the above four months was 50,000,000 lbs.; 50,908,000 lbs.; in May, 56,917,512 lbs., which, we believe, is the greatest performance ever made by a steam-engine; and in June, 51,000,000 lbs.

We have before given a similar account of Mr. Watt's engines; but at the fame time we must observe, that the variation in the performance of different steam-engines, which are constructed upon the fame principle, and working under the fame advantages, is the fame 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 effects 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 fame engine, when in bad or good order, from all the parts being tight and well oiled, fo as 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 cafes, 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 shew 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-cake. 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-cakes, 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-cake, 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 piston thereof is to be preyed 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 three upper valves, F, G, I, open at the fame 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 equilibrium 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 passages of the steam, as above described, from the upper to the lower side of each of the pistons respeftively, that the engines at Wheal Vor, and at Wheal Abraham, are at present working with a little stroke. Were these engines working double, the steam would, on the down-stroke, be made to pass, the fame as before described, from the under side of the small, to the upper side of the large piston, 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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Mr. Woolf's Boiler for raifing Steam of a High Preffure with Safety.—The boilers which Mr. Woolf employs in his engines are different from thoé of other engines which work with feam of a low preffure, the water being contained in several cylindrical tubes of call-iron, which are filled with water, and exposed to the flame nearly in an hori-
zontal position.

Mr. Woolf has a patent for this boiler, which the fpecifi-
fications relates to conflit of two or more cylindrical vessels, properly connected together, and fo dipofed, as to confit-
tute a strong and fit receptacle for the water intended to be
converted into feam of a temperature and under a preffure
uncommonly high, and also to prefent an extensive portion
of convex furface 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 purpofe of containing fome water and
the feam.

These cylindrical vessels are feated in a furnace fo adapted
to them, as to caufe the greater part of the furface of
each of them, or as much of the furface as may be con-
venient, to receive the direft action of the fire, or heated
air or flame.

Plate V. firs. 4 and 5, reprefents one of these boilers
in its moft fimple form. It conflits of eight tubes, marked
a, made of call-iron, or any other fit metal, which are
each connected with the larger cylinder A, placed above
them, as is fhewn in the fide view, fig. 5, in which the fame
letters refer to the fame parts as in fig. 4. In fig. 5, is
also fhewn the manner in which the fire is made to act.
The fufpens on the grate-bars at B, and the flame and heated
air, being reverberated from the part above the two firft
smaller cylinders, go under the third, over the fourth,
under the fifth, over the fith, under thefeventh, and partly
over and under the eighth small cylindrical tube, all
which tubes are full of water. The direftion of the flame,
until it reaches the laft-mentioned tube, isfhewn 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
fide of a wall, built beneath the main cylinder A, in the
direftion of its length, and the flame then returns under the
opposite end of the feventh smaller cylinder over the fith,
under the fifth, over the fourth, under the third, over the
fecond, and partly over and partly under the firft, when it
paftes into the chimney. The wall before-mentioned, which
divides the furnace longitudinally, answers the double pur-
pofe of lengthening the courefe which the flame and heated
air have to traverfe, giving off heat to the boiler in the
paflage, and alfo of fecuring the flanges, or other joinings,
employed to unite the smaller tubes to the main cylinder,
from being injured by the fire. The ends of the small cylindric

r tube
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steam-engine.
working with fuch boilers, the water carried off by evapo-
ration is replaced by water forced in by the ufual means of
a high-preffure boiler, that is, a foreing-pump; and the
feam generated is carried to the place intended by means
of pipes connected with the upper part of the cylinder A.
In the specifications, means are pointed out for applying
this plan to the boilers of steam-engines already in use, by
ranging a row of cylinders beneath the prefent boiler, and
connecting them with each other, and with the boiler.
Directions are alfo given for constructing boilers com-
posed of cylinders dipofed vertically. In every cafe the
tubes composing the boiler fhould be fo combined and ar-
 ranged, and the furnace fo constructed, as to make the fire
and flame act around and over the tubes, fo as to embrace
the largest poftible quantity of their furface. It must be
obvious to any one, that the tubes may be made of any
kind of metal; but call-iron is the moft convenient. The
size of the tubes may be varied; but in every cafe, care fhould
be taken not to make the diameter too great: for it must
be remembered, that the larger the diameter of any fingle
tube is in a boiler, the ftronger it must be made in
proportion, to enable it to bear the fame expansive force
of steam as the smaller cylinders. It is not effential, however,
to the invention, that the tubes fhould be of different sizes;
but the upper cylinders, especially the one which is called
the steam-cylinder, fhould be larger than the lower ones,
it being the inftrument, as it were, into which the lower ones
fend the steam, to be thence conveyed away by the feam-
pipe. The following general directions are given refe-
pecting the quantity of water to be kept in a boiler of this con-
struction; 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 al-
lowed to reach; and in no cafe fhould it be allowed to get
fo low, as not to keep the vertical necks, or branches,
which join the smaller cylinders to the great cylinder, full
of water, for the fire is only beneficially employed when ap-
plicated, through the medium of the interpoled metal, to
water, to convert it into steam; that is, the purpofe of the boiler
would in fome meafure be defeated, if any of the parts of
the tubes which are expofed to the direft action of the
fire, fhould prefent a furface of feam in their interior, in-
stead of water, to receive the transmitted heat. This muf,
more or lefs, be the cafe, whenever the lower tubes, and
even a part of the upper, are not kept filled with the
water.

Refepting the furnace for this kind of boiler, it fhould
always be fo built as to give a long and waving courefe to
the flame and heated air, forcing them the more effectually
to ftrike againft the fides of the tubes which compose the
boiler, and fo to give out the greateft poftible portion
of their heat before they reach the chimney. Unless this
be attended to, there will be a much greater waste of fuel
than neceffary, and the heat communicated to the con-
parts of the boiler will be lefs from a given quantity of
fuel.

When very high temperatures are not to be employed,
the kind of boiler just defcribed is found to anfwer very
well; but where the utmost force of the fire is defirable for
producing the moft efficacious fteam, the parts are combined
in a manner somewhat different, though the principle is the
fame. In the Philosophical Magazine, vol. xvii. p. 49, are
a defcription and drawing of a boiler of this kind, two of
which were created in 1803 at Mefians, Moux's brewery.
In every cafe Mr. Woolf uses two fafety-valves, at leat,
in his apparatus, to prevent accidents; a precaution which
cannot be too strongly enforced, as it may happen, when

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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 flames, communicating by perpendi-
cular necks or branches with the large cylinder above,
which has water in the lower part, and flæm 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;
and the flæm proceeds in the same direction of their length,
instead of crossing them; the lower or water
holes are 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 flæm, by
a number of small tubes, which can be made longer than
one large vessel, is not original with Mr. Woolf; Mr.
Blakey, of whom we have before spoken, having proposed
it in a small tract which he published in French, at the
Hague, in 1776. 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 in-
clined tubes, and became converted into flæm.

Woolf's Regulating Steam-Valve.—Besides the common
safety-valves, Mr. Woolf has also introduced a valve of a
new construction into the flæm-pipe itself, to regulate the
quantity of steam that shall pass from the boiler. In fact, it is
a self-acting steam-regulator, and extremely ingenious. A
(fig. 6.) is a part of the great or flæm cylinder of one of
Mr. Woolf's boilers; B B, the neck or outlet for the flæm,
furmounted by a flæm-box C, which is joined to the neck
B B, by the flanges u u. The top or cover of the flæm-
box C, marked with the letter D, is well secured in its
place, and has a hole through it for the rod of the valve
for passing; and the interior of the hole is formed to a box to
hold a stuffing, and make the rod work up and down flæm-
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 b, and the two vertical pieces c, c,
the flæming-valve rod is made fast to m, which is a close
cover to the hollow cylinder n n. The cover, m, fits
flæm-tight into the conical seat, at the upper end of a
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 n, is open at bottom,
having a free communication with the flæm in the boiler A;
and it has three vertical flits cut out through the sides, one of
which, S, is shown in the plate. The sum of the area of
all these flits or openings is equal to the area of the opening
of the flæm or collar o o, in which the cylinder, n n, works.

When the flæm acquires a sufficient degree of elastic
force to raise the valve, (that is, the cylinder n n, with its
cover m, and the rod R,) together with whatever weight
the rod may be loaded, then the openings S, rising above
the flæm-tight collar or flæm o o, allow the flæm to pass
into the flæm-box C, and to flow off to the engine through
the pipe N. But the quantity of flæm that passes is pro-
portioned 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 propor-
tion.

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, is
joined by means of a chain to a quadrant of a circle Q,
with an arm projecting from it, as represented in the plate,
for the purpose of carrying a pendulum weight Z, that ad-
mits of being moved nearer to or farther from the centre of
the quadrant, according as the preflure of the valve is wished
to be increased or diminished.

As the valve rifies, the weight moves upwards in the arc a a,
giving a continually increased Reidance to the farther riving of the valve, proportioned to the horizontal
distance of the weight from the centre of Q, of which the
weight attains a continual increase by its rise in the arc,
according to the horizontal distances measured on the line
Q Q, passing through the centre of the weight by per-
pendiculars from the horizontal line.

Thus, if the weight Z produces down the valve m, with
a force equal to 20 lbs. on the square inch of the aperture
in o o, in its present position, when it rifies to the position
at i, it will presse with a force equal to 30 lbs. ; and at p,
with a force equal to 40 lbs. on the square inch; so that
the rod, Z, may be made to serve at the same time as an
index to the person who attends the fire, nothing more being
necessary for this purpose than to graduate the rod Q Z, by experimental trials. In
the side of the flæm-box C, there is an opening, N, to
allow the flæm to pass from it by a pipe to the flæm-
engine.

It is plain that the adjustment of the positive preflure on
this valve can be determined by fliding the weight, 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 flæm,
the radius of the quadrant, Q, must be apportioned to the
diameter of the valve, and the opening of the flits S, so
that the amount of the weight, Z, in its quadrant will be cor-
respondent to the varying preflure. 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, by a nut and screw; by means of
which, any part of the arc can be used that is found most
corespondent with the varying preflure, because the rate
at which the refiltance of the lever increases is more rapid
when the pendulum is near to the perpendicular, than when it
approaches the horizontal position.

The same effect may be produced, by making the flits in
the side of the cylinder narrower at the lower part of the
cylinder, instead of being parallel.

Edelecrantz's Safety-Flæm.—The chevalier Edelcrantz
conceived 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 cy-
linder is fixed on the boiler, and fitted with a piston, which
moves with very little friction, in order that it may defend
by its own weight, after it has been raised up, without
however, permitting the flæm 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 passes easily. This cover
serves the double purpose of guiding the rod, and pre-
venting the piston from being blown out. The piston-rod
is furnished with a shoulder, which serves to support dif-
ferent 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
this
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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 having palled the first hole, some vapour will escape.

If this aperture be of sufficient size for the passage of the quantity of vapour continually produced, the piston will remain there stationary, 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 larger, that, by giving the proper means of escape to the vapour, all accidents may be prevented. This is 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 in common use is once raised up, nothing indicates whether or how much the present state of the vapour far-palies 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 $\frac{1}{4}$th of a square inch, each ounce of weight placed on the shoulder of the piston 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 determinate, and consequently more comparative.

The application of this piston to the boiler of the steam-engine needs no further 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 diffusion 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 fire for the current of air which maintains the combustion of the fuel be provided with a regifier, 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 regifier, in such a manner that when the former ascends, the latter descends; so that when the piston is at its greatest elevation, the regifier 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 preferred 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 before those of Mr. Hornblower and Mr. Woolf.

Messrs. James and John Robertson had a patent for one in 1800. The so-called object of the double cylinder was to make that portion of steam, which in the bell constructed steam-engines escapes past the sides of the piston in the time of working, and is lost without producing any mechanical effect whatever. MR. Roberton'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 Diverell 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-velvel at the end of the stroke; at the beginning of the next stroke, the valve 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-velvel. 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 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-velvel, and then from the steam-velvel 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-velvel being full of the steam delivered to it by the former stroke of the smaller 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-velvel, the steam in the smaller cylinder will be, as before stated, at about 54 lbs.; in the steam-velvel 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 33 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-velvel be made larger, the difference at each end of the stroke will

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not be so great. If the fleam was let out at 54 lbs. from the smaller cylinder to the open air, there would be but 39 lbs. upon each inch of the piston, in consequence of the re-action of the atmosphere, equivalent to about 15 lbs. per inch; thus, by letting the fleam pass from the smaller cylinder to the fleam-vellet, 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 fleam 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 9 lbs, on the inch on the piston of the smaller cylinder, there will be but about 30 lbs. on the inch neat power, when the larger one will work about 12 lbs. 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 disengaging the large piston from the fleam; on the other hand, if the smaller piston be out of order, the large one may still be worked, while the other is disengaged. The fleam-vellet 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. Davenport'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 fleam-vellet for the fleam to expand itself in, is advantageous in regulating the preasure, provided the heat is kept up; and for this purpose, the fleam-vellet in one of the engines we speak of was inclosed in the boiler, and we think would, in that case, receive a considerate addition of heat to the expanded fleam 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.

Mr. Fox and Lean have also a patent, dated Dec. 10, 1802, for improvements on fleam-engines, the principal part of which is a double-cylinder engine, very much resembling those which we have described. See the Repertory, vol. xxix. p. 200.

Application of Reciprocating Engines to produce a rotary Motion for turning Machinery.—We have hitherto considered the fleam-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, mutt 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 quantity of injection, and consequently the vacuum and velocity with which the piston would descend. The boilers 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 the coal-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 fleam 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 flteam, as is usual. All these circumstances reduce the performance of the engine with respect to coal, and the consumption is very great in comparison with the work they perform. Such engines act very well when the work or resistence is constantly the same throughout the day; but the engine cannot work regularly, except when the counter-weight of the connecting rod is halved, and 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 fleam at the returning stroke, the discharige 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 effected 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 fleam by any contrivance that will prevent the valve, which admits fleam to enter 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 aërate machinery had early occurred to him, he did not seriously fix about reducing his ideas to practice until the year 1778 or 1779. In the first model he then made, in order to equalize the power, he employed two cylinders, acting upon two cranks fixed upon the same axis, at an angle of 120° 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 to satisfaction; 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 Edinburgh Review, by a workman employed to make a model, to the persons engaged about one of Mr. Walsworth'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 reciprocating motion of fleam-engines to produce a continued 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 luminaries. Mr. Watt's patent is dated October 1782, and entitled, a new method of applying the vibrating or reciprocating motion of fleam-engines to produce a continued rotary or circular motion. It contains six different methods, but the two which have been since brought into ufe

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are
are the crank, and sun and planet wheels. The crank is applied in the belt 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, so as to urge round the fly during the returning 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 brevices; the first was at Mr. Good-wyn'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 sun and planet wheels, and used a massive 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 all directions, is obvious. The first double-acting steam-engine was proposed in 1789, by Dr. Falck, who published an account and description of an improved steam-engine, which will, he says, with the fame quantity of fuel, and in an equal space of time, raise above 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 his proposed engine, which was on Newcomen's principle. The chief improvement which he fuggests is to unite 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 faw that this was necessary, in order to perfect the application of his steam-engine; he therefore applied the power of the steam to prefix 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 1782 and 1784. Some of these are highly ingenious; a few may have been first ideas, not reduced to practice, and others were not doubt inferred for the purpose of guarding against evasion.

Moffet-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-case 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 C D E, by a five-lever b, c, d, m, called 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 rotary 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 I, is a strong and stiff iron rod, D, 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 flap (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 quit 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
For instance, when the piston-rod, \(a\), is caused to ascend by the preasure 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 \(D\), causts 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 fan-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 preferred 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 or steam-cane 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 cylinder, to fall on the bottom. In the centre of the top lid is a fluffing-box, \(l\), for holding a packing of hemp, through which the piston-rod, \(a\), pails, 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 pail by it. The piston is fixed to the rod, \(a\), with a cone, and fast keyed in; the cylinder has a flange or projecting rim 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. 2, it is marked 21: it introduces the steam from the boiler, at all times, through a throttle-valve, \(25\), 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 into the short paffage 14, which leads to the top of the cylinder. A branch, 12, descends perpendicularly from the steam-pipe, just before it enters the upper steam-box, and conveys steam to the lower steam-box \(i\); 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 paffage 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 \(l\), 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 \(h\), and where it pails by the lower box \(l\), has a small branch leading into it.

These two exhausting boxes are situated immediately beneath the paffages, 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 paffages, in the same manner as the steam-valves are in the partitions between the steam-boxes and the flame paffages, as is clearly shewn 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 condenser.

The steam and adution-valves, 7, 8, 9, \(a\), are opened and shut by the levers called spanners, 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 constructed that the steam and adution-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 the 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 ciltern 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 detent 3, 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 fixed upon the axis of the upper handle 1; and when this handle is raised, as in the figure, it opens both valves at once, \(f\) as to admit the steam above the piston and exhaust it from beneath it, as is shewn 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, \(f\) as to shut the valves, it is held down by the catch entering the hook, 3, of the detent 4. As this detent moves upon a centre-pin, it must be observed, that when one lever catches into the hook it pulls back the detent, and this motion releases the other catch from the hook at the opposite end of the detent, 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 vell of cast-iron, immered in the cold water of the condensing ciltern \(L\); 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 pails in a fluffing-box; also at the top of the pump is a short pipe of discharge, opening into the well-water \(n\), 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.
STEAM-ENGINE.

The cylinder is bolted down to two strong beams, which cross over the top of the condensing cillin L, and are united at the ends to two vertical posts S, which are framed into another piece situated beneath the cillin, and supported upon a pair of brick-work R: by this means the whole weight of the water in the cillin is applied to hold the cylinder firmly down. X are beams which support the flume of the beam-centre, by bearing up the floor F, on which the centre bearing reits; 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 groundfils, on which the cillin reits, and with which the beam T, for the centre of the flywheel, 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 flairspace 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 section, 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 in combination with the water causes it to expand, and form flume; in this state it rises and fills the boiler, and thence passing through the pipes 21, enters the lower flume-box g; it also enters between the jacket, and warms the cylinder; and by the defending branch, 12, of the flume-pipe, enters and fills the lower flume-box i. Before the engine can be worked, the flume 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 1, and depressing the handle 2; this admits the flume 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, driving the air therein contained through the valve m, and the valves in the bucket of the air-pump, which it opens, and passes into the cillin n, through the discharge-valve, where it is open to the atmosphere, the lid of that cillin being only laid on, and not fitting tight. This operation (called blowing through) being continued for a few seconds, expels all the air from the condenser, and fills it with hot flume. All the four valves are now closed, by pressing down the upper handle 1, 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 cillin, L, to enter into the condenser, and condenses the flume 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 flume, and the cold water injected into the condenser.

The engine-man now opens the upper condensing valve 8, and lower flume-valve 10, by allowing the lower handle, 2, to fall down. The communication to the condenser being thus opened, the mixture of air and flume in the upper part of the cylinder will expand itself into the condenser through the pipe 14, and valve 8, by the exhausting-pipe 13; as it occupies more space than it did before, it will be considerably rarefied, and press lightly upon the upper side of the pilon. The flume from the boiler entering through the open valve, 10, is all the while pressing with its full force against the lower side of the pilon, and will perhaps, now a rarefaction is made above it, overcome the resistance of the work and friction, and cause the pilon 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 flushes the lower flame-valve 10, and the upper exhausting-valve 8; and by means of the catch prefling back the hook at the lower end of the depet 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 flume-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 flume from the boiler going through the valve 7, and passage 14, into the cylinder above the pilon, as shown by the arrows, fig. 1; and that flume which is beneath the pilon going through the passage 15, and valve 9, to the condenser, where the flume will be condensed, and a vacuum will be formed beneath the pilon: the flume now preffles it down, moving the beam, and turning the fly-wheel and other machinery which it has to drive. When the pilon is at the bottom, the pin, f, on the air-pump rod arrives at the handle 1, and preffes it down; this flushes the upper flume-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 3, 4, disengages the lower hook thereof; and the weight 6, which is applied to the lower handle 2, immediately throws open the lower flume-valve 10, and the upper exhausting-valve 8: the flume entering at the lower passage 15, the pilon will be driven up again.

At each stroke of the engine, when the pilon 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 cillin 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 pilon, 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 preffling 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 n, 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 flume 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 inhauting-valve is opened, to as to establish a communication from the cylinder full of flume to the condenser, the elasticity of the flume causes it to rush through the valve, down the pipe 13, into the condenser: when it arrives there, it meets the flume of the injection-water, which condenses it, the remaining flume in the cylinder following it surprizingly quick; and in an instant, an almost perfect vacuum is formed in the cylinder, so that the flume acts with its whole force upon the pilon 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 flume, and that small quantity of air or gas which goes from the boiler with the flume, and will not be condensed by the cold water. These are delivered by
by the air-pump into the hot-well, \( r \), from which the air escapes; and the water, which still continues hot, runs off, when at a certain level, by a valve-pipe, which is not represented.

The water which is boiled off in steam from the boiler, is renewed from the hot-well by means of a small pump, \( p \), in the elevation, which draws the water from it by a pipe \( s \), 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 it, going through a small flting-box into the boiler, where a flite is hung to it. This flite is balanced by a weight suspended at the other end of the lever, so that when the flite 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 flite 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 flite, so as to close the valve.

The cistern 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 condensing cistern runs off by a valve-pipe at the back of the cistern, but not seen in the figures. The safety-valve is contained in a short pipe fixed upon the boiler, with a lid and a flting-box, through which a rod passes to open the valve within, and discharges the steam when the engine is not to be worked any longer. When at work, the valve is profiled 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 resistance is very variable. The throttle-valve, which regulates the supply of steam, is placed in the steam-pipe at \( z \) (Plate VII. fig. 2.) : it is a thick circular vane in the pipe, 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 vane and vane within the pipe are turned also. When the vane is set, so that its plane is perpendicular to the axis of the pipe, it nearly fills the circular pipe, and allows very little steam, if any, to pass by it: but when the vane is turned edgeways, it presents a very small surface, and the steam passes by without obstruction to the steam-boxes \( g \) and \( l \). 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 resistance 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 \( b s \), for procuring uniform velocity. (See also Regulator and Mill-work) 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 \( x z \), 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 heaved wheels, \( r \), the motion is communicated to the vertical axis \( x z \), 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 \( a w \) draw out a collar, \( x \), which slides on the square part of the axis, and operates on a lever \( x \), and by another lever \( y \), and rod \( w \), communicates with the flite 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 us suppose that too much is admitted; then the velocity of the fly-wheel is increased, and the velocity of the vertical axis \( x z \) will also increase, and the balls \( b, s \), will recede from the axis by the augmentation of their centrifugal force. By this recedes of the balls, the extremity, \( z \), of the lever is depressed, its contrary action on the vertical axis \( x z \) causes the vane of the throttle-valve to present more surface, 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 exhibited to the public 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 ascent to the descent. 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 same defect of the jerk, by the looseness 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 wear 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 piston has no action at all to turn the crank; but as the crank begins to make a sensible angle with the connecting rod, the force of the piston begins to operate upon the crank to turn it round, and this with a force increasing with the angle at which the connecting rod acts upon the crank, until they are at right angles to each other; and then the whole force of the piston operates to drive round the crank. To show the increments and decrements of this varying force, we have made out the following table from a projection of an engine on a large scale.

**A Table**
STEAM-ENGINE.

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, 1:1 length of the beam, 2:1 length of the crank, 3:1 length of the connecting rod, 3:1.

<table>
<thead>
<tr>
<th>Decimal Portion of the Defect of the Pileon, the whole Defect being 1.</th>
<th>Angle between 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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<tbody>
<tr>
<td>.0</td>
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<td>0</td>
<td>.0</td>
</tr>
<tr>
<td>.0.05</td>
<td>151½</td>
<td>.46</td>
<td>.128</td>
</tr>
<tr>
<td>.10</td>
<td>141</td>
<td>.62</td>
<td>.158</td>
</tr>
<tr>
<td>.15</td>
<td>131½</td>
<td>.74</td>
<td>.238</td>
</tr>
<tr>
<td>.2</td>
<td>123½</td>
<td>.83</td>
<td>.271</td>
</tr>
<tr>
<td>.25</td>
<td>117½</td>
<td>.89</td>
<td>.308</td>
</tr>
<tr>
<td>.3</td>
<td>110½</td>
<td>.94</td>
<td>.342</td>
</tr>
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<td>.35</td>
<td>104</td>
<td>.976</td>
<td>.377</td>
</tr>
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<td>.4</td>
<td>97½</td>
<td>.986</td>
<td>.41</td>
</tr>
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<td>.441</td>
</tr>
<tr>
<td>.5</td>
<td>85½</td>
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<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The third column of this table also shews the force which is communicated to the fly-wheel, expressed in decimals, the force of the pileon 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 los of power, because, when the crank has but light power, on arriving towards the top or bottom of the stroke, the pileon defeces proportionally slow; and, in consequence, the beam has more time to flow into the cylinder, and pres upon the pileon with a greater power; therefore, what the pileon loses in force upon the crank, it makes up in some degree by an increase of its force; and, from moving slower, it consumes less time than when moving with its whole velocity, and acting with full force upon the crank. Hence both the power and velocity of the pileon 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 pileon 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 equal 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. 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 pileon must act upon it at all times with a sudden shock, which in course of time destroys the bell contrived mechanism.

In the Philosophical Journal is a description of a contrivance by Mr. Samuel Clegg, for producing a rotative 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 parts of this rack are joined by a femicircle at the top, and both parts are teethed on the infide, 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 femicircle uniting the double racks. The wheel and racks 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 pileon-rod must be gradual, the change from the downward to the upward motion must be instantaneous; or at least the pileon-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 Mr. Meux and Co., where the alternate power of two reciprocating 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 120° of the whole circle, and thereby determined the end of the lever, which, in its action upward to 6, and downward to f, ascended and receded to and from the centre of motion; and had it traversed through the remainder of the femicircle, 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 preface on this pin in the crank-wheel, it would have demanded a degree of strength in that part which would have been preposterous, 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 los 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 fides of this, the rods, x, y, were suspended by chains. The air-pumps were open at top, and the preface of the atmosphere always acted upon their pistons; but as the two were acting in opposite directions, they balanced each other, and threw power;
power: in this the inventor adopted the common double-barrelled air-pump of Haukbee, instead of the more perfect air-pump of Smeston, which Mr. Watt employs. This engine was considered of 36 horses' 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 as 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 Repertory of Arts, 2nd series, vol. xvi.); but we have not had an opportunity of ascertaining the performance of an engine to 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 circumstance of the single air-pump or not, we are unable to determine; but it appears that double-acting engines do not in general produce so great an effect from the fuel they consume as single engines of the same dimensions.

In Melfirs' reports of the engines in Cornwall, which generally contain the accounts of 20 or 25 engines, there are several enormous double engines for pumping the mines, with cylinders of 66 and 65 inches, and four of 63 inches. The belt of these appear to be on Williams' mine; cylinder 63 inches diameter, and working with a stroke of 6 feet 9 inches, under a pressure of 16.6 lbs. per square inch; it works 10 pumps, which are a load of 704.41 lbs., at the rate of 61 strokes per minute, of 6 feet 9 inches each. Its performance with respect to coal was, in June 1816, 30,074.507 lbs. lifted one foot high for each bushel 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 exposed to condensation, the vis inerter of the parts in motion is much less, and the friction of the piston is very much reduced, although the friction of the joint for communicating the motion must be increased, because they must be bound tight, so as to have no shake or looseness; but this must be considerable.

Before quitting the subject of double engines, employed to give a rotary motion to machinery by a crank, we must notice the remarkable difference, shown by Melfirs' 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 rotary 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, 32, 4, and 5 millions. The belt engine they have drawn only from 9 to 11 million pounds one foot high for each bushel of coal, which is only one-third of the produce of the belt 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 bushel; but another at Wheal Vor mine drew six millions.

**Elimination of the Force of Steam-Engines in Horses' Power.**

—The method of expressing 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 energy 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 rotary motion, the great manufactories of the kingdom had their mill-work put in motion by the agency of water, 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 sublimate the power of steam for that of horses, to flate the number of those animals, to which the new power, under given conditions, ought to be equivalent; and it is probable that Melfirs, 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, as on many similar occasions, a more minute measurement would have been less useful. But to give this unit all the accuracy which can be defined, 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 32,000 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 accuracy of the result. In forming 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 Melfirs. Watt and Boulton suppose a horse capable of raising 32,000 lbs. avoiding one foot high in a minute; whilst Dr. Defagghers makes it 27,500 lbs. and Mr. Smeston only 22,383 lbs. 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 pressure 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 piton:
pilum; thus, \(24 \times 24 = 576 \times 0.7854 = 452.4\) square inches, which are exposed to the preflure of the beam. Now if we multiply this area by 10 lbs., the preflure upon every square inch, we shall have \(452.4 \times 10 = 4524\) lbs., the whole preflure upon the pilum, or the weight which the engine is capable of raising with a certain velocity. To find this velocity, we fay that the engine performs 20 double strokes, each of five feet long, in a minute; the pilum must, therefore, move through \(20 \times 5 \times 2 = 200\) feet in the fame time; and, therefore, the power of the engine will be reprefented by \(4524\) lbs. avoirdupois, raised through 200 feet in a minute, or by \(9\frac{1}{2}\) hogheads of water, at mean fpeed, raised through the fame height in the fame time. Now this is equivalent to \(4524 \times 200 = 904,800\) lbs. or \(9\frac{1}{2} \times 200 = 1848\) hogheads raised through the height of one foot in a minute. This is reduced to the horse-power of Meffrs. Boulton and Watt, by dividing by 32,000, their estimate of the horse-power: thus, \(904,800 \div 32,000 = 28\frac{1}{2}\) horsef.

According to Smeaton, \(904,800 \div 2916 = 32\frac{1}{2}\) horsef.

According to Daferger, \(904,800 \div 27500 = 33\) horsef.

In this calculation, it is fuppofed that the engine works only eight hours a day, fo that if it worked during the whole 24 hours, it would be equal to twice the number of horsef found by the preceding rule.

Other Constructions of Mr. Watt's Double Engine.—A great mass of matter must neceffarily be put in rapid motion at every stroke of the reciprocating engine, and the motion muft be altered and returned at the end of the stroke. This is an evident difadvantage under which the double engine labour; for though all objection to the reciprocation, on account of the irregularity of motion, is done away by the application of a fly-wheel, the regularity thus attained is at the expence of the power, as we have fhewn in the practical refults of the large engines for pumping, and the engines for drawing from the mines. The most obvious improvement in this particular, is to lighten the mass of the great working beam, or to difpence with it alto-gether. The enormous strain exerted on its arms requires a proportionant strength, and this requires a vaft mass of matter, not less indeed (in an engine with a cylinder of 52 inches diameter) than three tons and a half, moving with the velocity of three feet in a second, which muft be communicated in about half a second; fo that this mass must be brought into motion from a flate of rest, and muft 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 pilum, and prefer a fufficient quantity of motion, fo as to make 12 or 15 seven-feet strokes in a minute. Many attempts have been made to lighten this mass, by using a light framed wheel, or a light frame of carpentry, in place of a solid beam.

An example of this is fhewn in the beam of Newcomen's engine (Plate II.), a method which was introduced by Mr. Smeaton; and another is fhewn in Mr. Hornblower's (Plate V., fig. 1.) The form of this beam is fuch, that it would be stronger than a solid beam containing a great many times the quantity of timber, as there is fearely any part of it which is exposed to a tranverse strain, but every piece is either pushed or pulled in the direction of its length. The only evident improvement of which it admits, 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 fuch 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 complain (as the carpenters express it,) before it breaks. In all great engines, there-fore, Mr. Watt at first employed fuch solid beams as were found the most durable, and leeft likely to break in a long course of work.

They were sometimes strengthened, in a very fimple and effective manner, by placing a king-poit perpendicular to the length of the beam, over its centre, and extending iron tie-bolts from the top of the king-poit to the two extremities of the beam, fo that the beam thus framed forms a triangle, of which the beam is the base, the king-poit the perpendicular, and the iron ties the fides, meeting the perpendicular at the vertex of the triangle.

This was an expedient generally refered to, when the beam was found to yield from a long continuance of the action. There is, perhaps, no example, except the mill of a ship, in which a piece of timber is exposed to such a severe strain as the beam of an engine, becaufe it is neceffarily made as small as poiffible; and it is relieved from the strain 15 or 20 times every minute, fo that all the fibres are tried to the utmost: we accordingly fee old beams, full of cracks lengthwise from the fibres, separating laterally, and after this the beam lofs its strength.

Of late years, wooden beams have been altogether difdifed, and cast-iron beams substituted. We have already defcribed the mode of making the beam for the largest engines, by two plates or fitches put together parallel, and leaving a space between them. For double engines, which are not of the very largest dimensions, it is ufual to have the beam call in one piece, of a form bent adapted to give the greatest strength in the leaff 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 fitted sockets or pieces, which have other pins projecting from them to form the joints of the parallel motion and connecting rod; fo 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 tide of the focket: 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: thus, in the direction in which the joints of the parallel motion and connecting rod are required to bend for the motion of the beam, as fhewn 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 caufe, 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 perpendicular motion, and the flapping-box and joints. In Mr. Murray's belt engines, the crankpin 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, and
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and crank, in short, all the moving joints of a double engine, must be fitted with brass sockets, which may 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 composed of a flar 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 pocket, which is fixed on the top of the piston-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 inlets: 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 piston-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 piston-rod a tendency to move from its perpendicular towards the centre of the beam, which must move towards it, was not the link, b, attached to the beam and piston-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 moveable on a fixed centre n, also rises at the same time, and the angle between m and e increases, and likewise the angle between b and c increases slowly; so that the vertex of the angle between b and e 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 b. While m, therefore, rises upon its centre, the adjoining bar, d, moves round the joint at its upper end, and draws e, 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 e 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 e in a contrary direction; but as the beam, B, falls into a horizontal position, all these motions are reversed. In adjusting the parallel motion for work, when the piston-rod, a, is found to rub much upon the side of the collar of the flaring-box nearest to m, the fixed centre point, m, must be shifted a little in the contrary direction, w.r.t. 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 all the bars which have been mentioned are made double, which cannot be shown in the figure, and that the two levers, m, m, are placed at a sufficient distance from to allow the links b, and the rods e, 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 collar, 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 collar L, to support the center of the beam: the fly-wheel is supported by small cast-iron standards rising from the ground; and the center of the lever m, of the parallel motion, is supported by a small bracket or flanean 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 on this plan is fully described in the British Encyclopedia, vol. vi.

The engine represented in Plate VIII. fig. 4. is perhaps the most complete of all. It is of the form in which Messrs. Murray and Wood construe 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 piston-rod at once with the connecting rod, and to place the crank over the centre of the cylinder: the piston-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 piston-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 piston acting always at one side wears the cylinder irregularly. Mr. Murray included this plan in his patent of 1799, which we have before mentioned, for producing the rotatory motion without a crank; and he proposed to place rollers in the piston 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 piston-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 alcent and descent of the piston-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 piston-rod.

In this way the crank must be placed behind the piston-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 piston-rod has an opening in it for the crank-pin to pass through, and a connecting rod is placed on each side of the piston-rod, so that it is worked between the two. It is evident that the opening through the piston-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 opening, without influencing
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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 touched 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, R, 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, acrofs 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, F, being placed in a proper point of the circumference of the small wheel, and the top of the upper end of the perpendicular arm 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 Mellers, Boulton and Watt began to make soon after the expiration of their patent.

The cylinder is supported by brackets from the caft-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 cistern; and beneath the cylinder, the hypotenuse 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 crofs 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 same, at right angles; and to the two ends of this two rods are fixed, which are jointed to the beam, and are jointed to it at the ends. By this means, the ascents and descents 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 cranks. 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 piston-rod to the ends of the beams,
are of finc length, 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-rod perpendicular. The fame of the air-pump,
which is placed in the middle of the cylinder, and is worked
by two rods jointed to the horizontal arms of the beams, at
half the distance from the centre of motion at which the
cylinder-rod 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 repre-
vented in Plate VII. fig. 9, is used: the motion is commu-
nicated 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 cillern, 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 spindle 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 fame which was for the
improved air-pump.

The arrangement of the pipes and passages is the fame,
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 con-
centric 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 levers are there applied to
lift them, instead of the lever or sector within the box, as
defcribed 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 fame as
for the former; the only difference is in the mode of commu-
nicating 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
furnished 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 them-
sefes exactly to their seat. It is necessary for the two
valve-fields, and the flushing-box through the lid, to be made
precisely on a common centre, line, or axis; and for this pur-
pose, the upper part of the cylindrical box which contains
the valves is bored out correctly within and, and the conical
sockets in which the bell-metal seats 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 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 neccessary
in general 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 with-
out any flange, but it is exactly fitted into a small recess 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
it tight, and at the same time keeps the lid flat; but by
removing the ring, the valve can be taken out of it, to repair them.
Mr. Murray's patent was reflected by a writ of jeire facias, at the influence of Mellers. Boulton and
Wat., 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 this compartment is the upper condensing
valve, 9, which is moved by a rod passing through the rod or
spindle of the upper steam-valve 7; the valve 9 is for opening
a passage from the top of the cylinder to the condenser,
through the exhausting-pipe 13. In the latter manner, the
upper valve, 5, of the lower box is called the lower steam-
valve, and is for the purpose of admitting the steam which
defends through the pipe, 12, into the bottom of the cylinder,
below the piston. The valve 5 is for connecting the
bottom of the cylinder with the condenser, and is 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
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 pressure 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
defend. One of the rods which connect the valves must be al-
lowed to defend by its weight an instant before the other is
lifted,
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lifted, otherwise the steam will have a free passagé from the boiler to the condenser, a fault which is called blowing through, but is an operation practiced 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 the two rods, L, M, both together.

Fig. 6, represents an ingenious form in which Mr. Murray makes the eccentric movements for working the valves, so that they shall move 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 triangle can move round a certain part of a revolution before the rod will be moved at all, and then it will rise all 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-paffaged Cock.—Of late years, instead of the four valves invented by Mr. Watt, cocks and slides 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 slider is made to answer the purpose of the four valves.

What is called the four-paffaged 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 Dickinson, 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 cafe of cast-iron ecc, which is constantly supplied with steam from the boiler by the pipe e f f', which is a pipe, cast at the same time with the cylinder, leading from the top of it, and by a crooked passagé to the cock E; g g is another similar passagé from the bottom of the cylinder to the cock, and entering it diametrically opposite to the other passagé: h is an opening, bringing steam from the jacket ecc, by means of a short pipe, not seen in the figure, being behind the cylinder, but cast at the same time with it, and joining at bottom to the flange, by which it is held in the jacket. The bore of this short pipe is, however, continued through the flange, and opens into the jacket; and when they are screwed together, the steam has free access from the boiler through the jacket into the short pipe, and thence into the passagé h, which advances horizontally forwards, as represented by the dark circle h, fig. 6, and turns into the cock; the short pipe has a thin circular vane in it, turning upon a pivot to form the throat-valve, as we have before described.

When the steam is not made to pass through the jacket, the circular passagé, h, may be considered as the continuation of the steam-pipe coming immediately from the boiler; and then the throat-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 piston 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 ecc 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, e, from the boiler, it enters between the jacket, ecc, and the cylinder, passes through the short pipe and throat-valve into the opening h, thence through the crooked passagé in the cock E, to the pipe f f', 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 passagé of the cock E, and by the pipe p p, into the condenser. When the piston arrives at the bottom of the cylinder, the pin on the air-pump rod carries down the handle, K, which, with its rack acting in the piston 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 h, 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 f f', and the cock E, by the pipe p p, into the condenser. When the piston 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-engines; and Leopold, in his Theatrum Mechanicum Hydraulicae, vol. ii, has shown the manner of its application to a high-pressure 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 wasted every stroke without any advantage; but in the four valves, there is no greater loss than of the small quantity of steam which is contained in the passagés at the bottom of the steam-pipes, when the cock is open, and which are purposely made as narrow as they can be to admit the steam freely. Secondly: The passagés cannot conveniently be made large enough to admit a full supply of steam, though it should be under-foot, 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 passagés through the passagés; hence the steam in the boiler must be made stronger than it is intended to be used in the cylinders, 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 passagés are; and as the surface which is interposed between the passagés is so small, they leak immoderately from one passagé to the other, unless the setting of the cock is perfect. For these reasons, the four-paffaged cocks have been confined to small engines, and principally those which work with high-pressure steam, because that will pass through very small openings.

Mr. Bramah has made several steam-engines, in which he employed a four-paffaged 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 cock of
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 pressed into its seat by the force of the steam acting upon a surface equal to the small end of the cock, from which the prelude is relieved. This keeps the cock always tight; and to prevent the movable part from being fixed by the prelude, 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 fame 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 fame way round one-fourth at a time; by which means the frame effects are produced as by turning it backwards and forwards, but the wear is rendered more equable.

Mr. Maudslay has adopted in his engines a four-paflaged cock, in which the steam is made to pass the cone into its feet.

**Sliding-Valves by Mr. Murray.**—With a view of remedying the inconveniences of the four-paflaged cock, the frame 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 A represent the cylinder, included in a cast-iron jacket, and surrounded with frame; it is furnished with a pinion-bid, and 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 e, the passage into the bottom, to admit steam below the piston. The steam is conveyed from the boiler by the pipe B, passes through the throttle-valve c, and into the steam-box d d, from which it is distributed to the cylinder by its different passages, as required. This steam-box is secured 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, m n o: the upper one, m, communicates with the top of the cylinder, through the passage a; the middle opening, n, communicates with the condenser by pulling out ladders to the ejection-pipe, as at the dark circle at p; and the lower opening, o, communicates with the bottom of the cylinder by the passage b: c 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 slider is moved up and down by the small sector s, acting in the teeth of a rack, fixed to the back of the slider. 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; consequently the steam enters below the piston, through the neck b, causing it to rise, and escapes from the top of the cylinder through the neck a; 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 n, 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 h, and by the connection of the passage a 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 embracing it. By this a motion backwards and forwards is communicated by the rod D 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 Messrs. 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 A is the steam-cylinder of the engine; B, the piston, and C, the piston-rod; D is the upper opening or steam-way into the cylinder; E is the steam-cage: 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 cylindric, 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-cage, or with the cylinder itself, where no steam-cage is used.

This tube has an opening, H, on its side, with a regulating valve for the admission of steam from the boiler; and another opening, I, at bottom, which leads to an opening on the top, which 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 fixed 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 H, and filling the interstices between the steam-tube G G, and the sliding-tube L M, p asses 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 the cylinder, a bracket, attached to the top of the pis-
pton-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
up and down along the projections D and E of the cylinder, so as to
be beneath them; and the steam, which is above the piston,
flows at the upper opening, and passes down the inside of
the tube L, M, into the condenser. At the same time, the
steam continuing to pass from the boiler through the pipe
H, and the interface between the steam-pipe and the
sliding-rod, 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 raise the
tube, L, M, into its former position of the figure. The
operations are then repeated. This is the plan used in
Mefirs. 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 cork 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 Mefirs. 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 change.

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 unnec-
essary 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 sink 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 improve-
ments in the steam-engine. These improvements consist,
first, in lining the steam-cylinder with a soft metal, of a suf-
cient thickness to admit of finishing the inside of the cy-
linder of such metal, by drawing, boring, or otherwise;
secondly, in applying a hollow piston-rod, answearing the
purpose of an education-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 un-
derstood from the following description. Upon an horizontal
arbor, which we will denominate the main arbor, are placed
three wheels, a drum or harrel, 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 main teeth both upon the exterior and in-
terior periphery of its rim. Within the circle of the interior
cogs 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 di-
diameter is rather less than the exterior diameter of the main
wheel, and it carries a cord, with a weight hanging at its end,
which is called the barrel-pinion; its teeth work in the teeth 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 acted 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 barrel turn the pinion
of a scapement-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 acted upon by an end-
less 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 steam-valve in such a manner, that
the degree of opening of that valve depends upon the altitude
of the weight which 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 con-
ected with it. By this contrivance it happens, that when
the weight is highest, the valve is least opened; and when
the weight is lowest, the valve is most opened. Hence it is
evident, that should the engine wind up the weight, by
turning the worm faster than the pendulum permits it
to descend 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 ac-
curately 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, these serve
not only to prevent the weight from drawing the line off the barrel,
but also to regulate the speed of the engine at work, and
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, be-
cause he found it better to employ injection. We have also
described his single engine, in which the piston rises in
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. By these means, the 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 pis-

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tion; 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 habituating 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 are 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 ejection-pipe that conducts the steam into the condenser $w$, 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, the 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 $e$, 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 pressing 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, presses down the top part of the piston, and thus the steam-valve $c$, 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 pressure, is drawn up in the cylinder by the fly-wheel. The piston $c$ of the air-pump arriving at the top of the barrel, in which it works at the same time with the working piston, draws the air from the condenser, and on its return at the next stroke, presses upon the condensed water, flushes the valve $f$, and forces the water up the pipe $g$, into the box $b$: the air which is disengaged from the water rushes to the top of the box, and by its elasticity forces the water through the pipe $a$, 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 opens a valve in the top of the box, which suffurs some of the air to escape.

When the piston arrives at the top of the cylinder, it presses up the steam-valve $c$, which admits the steam again from the boiler, to force it down as before; and the valve, $r$, in the piston flushes by pressing up beneath the top of the cylinder. The pressure of the steam is now above the piston, and a vacuum beneath; the piston therefore descends, and when at the bottom, flushes the steam-valve $c$, 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.

$i$ 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 piston-rod 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 not 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 fill 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 piston-rod that passes 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 conical 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 the rings, when the frame is brought to the 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 sides of the spring act are pressed, in the direction of the circumference, against the ends of the third piece; so that the three pieces are thus kept uniformly in contact with the cylinder, that the longer the machine is worked the better the rings must fit.

To prevent steam palling 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 piston-rod was proposed to be done in the same manner.

The metallic piston has been found advantageous, and Mr. Woolf uses it in his engines, 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 Oftel. $A$ is the piston-rod, and $B C C$ 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.
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Woolf's improved 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 twitted into a soft rope, which is pressed into a pretty compact form by a ring, and worked down by the 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 paffing between the piston and the cylinder. In the ufual method, whenever the piston, by continued working, becomes too easy, and fo occasions a want of steam, it is necessary to take off the top of the cylinder, even when fresh 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 onwards against the side of the cylinder.

This being heavy laborious work, it is generally deferved, by the man that attends the engine, as long as the engine can possibly be made to work without taking this trouble; and in confeguencc of this neglect, a great and unneceffary waste of steam is occafioned, and a waste of fuel in proportion.

Mr. Woolf's improvement on the piston is fuch as to enable the engine-man to tighten the piston, without the neceffity of taking off the cover of the cylinder; except when new packing becomes neceffary. He accomplishes this by either of the two following methods. He faltens on the head of each of the fcrews a fmall cog-wheel, &c., &c., (Plate VII. figs. 12 and 13,) which wheels are all connected with each other by means of a central wheel $d$, which works loofe upon the piston-rod in fuch a manner, that if any one of the fmall wheels and its fcrew be turned, it turns the central wheel, and the latter turns all the other three wheels and screws. That one which is to be firft turned is furnifhed with a projecting square head $f$, which rife up into a recefs in the cover of the cylinder. This recefs is furnifhed with a cap or bonnet, which being eafily taken off, and as eafily put again in its place, there is little difficulty in fcreening down the packing at any time, by applying a key to the square head of this fcrew. The parts are fo clearly expreffed in the plates, that no farther defcription is neceffary to make any perfon comprehend it.

Mr. Woolf contrived another method for fmall pinions, which is fimilar in principle, but a little different in construcfion. Instead of having feveral fcrews, all worked down by one motion, there is in this but one fcrew, 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 furnifhed with a fquare head, which wheel is turned round, and screwed down by means of a pinion, which is furnifhed with a fquare projecting head, rife into a recefs of the kind already de-

feribed. The upper ring of the piston is prevented from turning with the wheel by means of two steady pins.

High-Pressure Steam-Engine.—The operation of the high-pressure steam-engine is effected solely by the expansive force which is not condenfed in the manner of the atmospheric or Watt's engine. To this end, water is put into the boiler, and heated far beyond the boiling point, to acquire a great expansive force, and exert an immense preffure to escape from any vessel in which it is confined, even as great as four or five times the preffure of the atmosphere. This steam being allowed to enter into one end of a cylinder, while the other end of the fame 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 polifhes in particular fuitations over other engines: firft, from the simplicit of its construction and cheapnefs; secondly, the small space which it occupies; thirdly, its requiring no condenfing water, which in some fuitations is very difficult to procure, and in one inftance is altogether impracticable; and for drawing of carriages, for which purpofe this engine has been fucceffully used. To fet a-gainst these advantages, the high-pressure engines are extremely liable to blow up, if not attended very carefully, for they are frequently worked with a preffure of from fixty 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 consequentfly are not worked with advantage in a fuitation where coals are dear.

The firft application of high-pressure steam to an engine, is what we find defcribed in 1724, by Leupold, in his Thesaurus Machinarum Hydraulicae, 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 purpofe 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 has been defcribed in the former part of this article. The engine defcribed by Leupold confifts of two fingle cylinders, placed at foine 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 fame as defcribed 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 fupported beneath the two cylinders, and communicates with the cock by a short upright pipe. The action of this engine is very fimple: the steam being raised very strong in the boiler, is allowed to enter through the cock into the bottom of one of the cylinders, at the fame 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 preffure of the steam caueth the afcent of the firft-mentioned piston, and the other defends by its counter-weight. By turning the cock round one-fourth, the operation is re-verted, fo that the steam enters the bottom of the fecond cylinder, and the steam which was contained in the firft escapes through the pipeage 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 practifed it, finding his own invention fo much fuperior.

The high-pressure engines at present in ufe were introduced by Mr. Trevethick, in conjunction with Mr. Vivian, who obtained a patent for the fame in 1802: this was princi-
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principally for their application of the engine to the purpose of driving of carriages upon rail-roads.

This engine contains no novel 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 with its axis horizontally upon short feet or pillars of cast iron: the boiler has a flanch 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. Sweaton'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 flanched 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 aft-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 paffles 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 tube enters the boiler, there is a small door, to remove any foot that may have accumulated. On the top of the boiler is a safety-valve, kept down by a lever and weight, to allow the steam to escape in case it becomes too strong as to endanger the bursting of the boiler. The steam-cylinder stands in a perpendicular direction, and is included within the boiler, except a few inches of its upper end, at which the four-paffaged cock is situated, and the flanch which serves on the lid, with the flutting box for the piston-rod to pass through. The boiler has a projecting neck, into which the cylinder is received, and it is falfed in its place by a flanch round the upper end of the neck of the boiler, which is united by screws to a flanch projecting from the cylinder at about one-third from its top flanch. The upper end of the piston-rod is falfed to the middle of the 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 flays, extending from the other end of the boiler, and falfed to the flanch, which serves 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 prefixed the flanch, 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 flanch which fixes it into the boiler, and beneath the top flanch, which falfes down its lid, is a protrusion of cast iron, to contain the four paffages and the cock, similar to that shown in figs. 6 and 7. One paffage 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 paffage rises from the upper side of the cock, and proceeds to the top of the cylinder, for admitting steam above the piston. The third paffage from the under side of the cock connects with the bottom of the cylinder by a pipe cast close to the side thereof, and connecting to the bottom. The fourth paffage from the cock is on the opposite side to where the steam enters from the boiler, and this paffage is open to the walle-pipe, which carries the steam into the external air, and allows it to escape after it has passed through the engine. Now suppose the paffage leading to the top of the cylinder, and that one which brings steam, are from the boiler to be connected with the cock, and the paffage from the bottom of the cylinder to be connected with the walle-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 walle-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 defending perpendicularly, being guided at bottom by palling through a part of iron falfed on the flanch 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 defending stroke, so that the paffage to the bottom of the cylinder is connected with the boiler, and that from the top with the open air: the steam in confluence enters below the piston, and forces it up, palling 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 walle-pipe, which conveys the steam away from the cylinder after having performed its office, is included 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 dilution in contact with the hot walle-pipe, through which the steam passes, it is heated, and a considerable quantity of heat is faved, which would otherwise be lost.

The velocity of the engine is regulated, or its motion can be entirely stopped, if required, by a cock situated in the fourth paffage from the boiler to the four-paffaged cock, so as to regulate the paffage 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 paffages and cock is exactly similar to what is represented in figs. 6, Plate VII., except that it is placed near the top of the cylinder, because all the lower part of the cylinder is concealed 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 bursting
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burting 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 provisos have been made to guard against these accidents by Mr. Treverhick, who first brought the high-pressure engines into use, at first he proposed inclining the safety-valve in such a manner, that no one might get access to it to increase the head 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 expelling 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 inserted into such a boiler. The plug should be made of such a composition of the fusable metal, that it will melt whenever the contents of the boiler attain that degree of heat which produces steam of a dangerous placticity. 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 these safety-valves are made, the more certainly they will operate.

The mercurial steam-gauge used in many engines is a long curved tube, or inverted fiphoen, 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 burting 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, first by drilling small holes through it at different places, to actually measure the thickness 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 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 44 feet stroke; it worked a pump 18½ inches in diameter, and 44 feet stroke, which raised water 28 feet high. It worked at the rate of 18 strokes per minute, and consumed about 80 lbs. of coals per hour; this, when reduced, is about 17½ million pounds raised one foot high for each bushel. Thus, the weight of the column is 3266.5 lbs. for the area of the pump (18.5 × 18.5 = 342.25 × .7854 = ) 268.8 square inches × .434 lbs. = 116.1 lbs. the weight for every foot of the column × 28 feet = 3266.5 lbs. the total weight of the column. The motion of the piston per minute is (4½ × 18) = 81 feet, or 4860 feet per hour × 3266.5 lbs. = 15,875,160 lbs. raised one foot high per hour. The coals consumed in the hour is 80 lbs.; therefore, as 80 lbs. = 1,575,160 lbs. = 17,450,076 lbs., the number of pounds raised one foot high for each bushel of coals. The area of the piston is (8 × 8 = 64 × .7854 = ) 50½ square inches, and the load 3266.5 × .504 = 65 lbs. pressure 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 fame fystem 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 frill of these manufactories is that of Meffrs. Watt and Boulton, at Soho, near Birmingham, owners of the inventor and his associate, who established the manufactury 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 Woolf, 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 of condensation, they 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. Refecting 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.

Meffrs. Fenton, Murray, and Wood, of Leeds, Yorkshire, are the manufacturers of the most established reputation after Meffrs. Watt and Boulton. The engines they fend out 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 for 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 through, as it is found to make a feasible mark or 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 prelure 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 and other parts always tried, to insure that every part is perfect: they are then taken to pieces, with marks and directions 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. Maudslay has made many very excellent steam-engines upon the plan represented in our Sketch; but his belt 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 for a steam-boat invented by Mr. Brunel, which has two cylinders acting alternately upon different cranks, formed upon the same axis at right angles to each other, so that the motion is continued without a fly-wheel: one boiler is placed between the two cylinders, and one air-pump and condenser exhausts them both. By this means a powerful engine is contained in a small space, and is not heavy to load the boat.

Some engines of Manchester make very good steam-engines, chiefly for the great cotton-mills. At most of the iron furnaces in the country, steam-engines are now made, and some of them produce very capital engines, as at Butterly in Derbyshire, Low Moor in Yorkshire, and others. Their workhops are in general managed by engineers who have been instructed 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 succussion 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 inertiae 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. It 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 feeble, and the expence 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 guess 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 air-tight within another, with cavities so disposed, that there was a constant and great prelure urging it in one direction. But no packing of the common kind could preserve it air-tight with sufficient freedom of motion. He succeeded by immersing it in mercury, or in an amalgam 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 Mr. Barker's mill, inclining the arms in a metal drum, which was immersed in cold water. The steam rushed rapidly along the pipe which was the axis, and it was hoped that a great re-action would have been exerted at the ends of the arms; but it was almost nothing. The reason of the want of success was, that the steam was condensed in the cold arms. It was then tried in a drum kept boiling hot; but the impulse was very small, in comparison with the expence of steam: this must be the cafe.

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 doubled his arms in such 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 1798 for a rotative engine, which is the most ingenious of all the specifications 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 piston of which makes a complete revolution in a channel at a different rate 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 is 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 promise 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
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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 flannel, previously flapped 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 safest to have too much rather than too little white lead, as the durability of the cement is no way injured thereby, only a longer time is required for it to dry and harden. When the fitting will not admit of so thick a substance as flannel being interposed, linen may be substitutted, or even paper or thin plateboard, the only reason for employing any thing of the kind being the convenience of handling. This cement anwers well also for joining broken flanges, however large. Ciliers built of square flanes put together with this cement, will never leak or want any repairs: in this case the flanes 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 fo 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 call-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 blend 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 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, dilute 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 sifted, to get rid of the grogger 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 flone.

Mr. Murray's Rule for the Weight of Fly-Wheels to Steam-Engines. — Mr. Buchanan, in his valuable treatise on propelling vessels, printed at Glasgow in 1816, gives the following rule, as the result of Mr. Murray's long experience in building 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 = 1132 feet circumference × 22 revolutions per minute = 60 = 204. feet motion per second for the motion of the circumference of the fly-wheel. Then 204 feet per minute squared = 4204, and 20 horses' power × 2000 = 40000 ÷ 4204 = 96.4 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 such as Manchellor or Birmingham, where there are many engines together. To avoid this, as well as from an idea of obtaining a greater water 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 founderies, furnaces, &c. has no existence except at the top of the chimney; for while it is ascending the flue, it is only dense, black smoke, consisting of the azote of the atmospheric air which has passed through the fire, of hydrogen gas, coal-tar, and carbonaceous matter; and this smoke is of such a high temperature, that it only requires oxygen to make it inflame instananeously: 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 hasty 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 any person, that it is not an inconsiderable proportion of the fuel that is thus wasted. 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 our producing the spoileine 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 gasser 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 congealed or converted into heat, or into pure flame, free from smoke. This invention is put in practice, first, by slopping 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 that which is burning, and already converted into coke or charcoal; thirdly, by contriving the fire-place in such manner,
manner, that the fresh atmospheric air which animates the fire, and the smoke or flame which rises from the fresh fuel at the first application of the heat, nullifies downwards, or laterally, so as to pass through the whole mass of burning fuel, and issue from the interior 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 cases, after the flame has passed 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 more effectually confined.

This invention of Mr. Watt’s has been very extensively practiced; but another plan, by Mr. Roberton 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 re-ignites on the bottom grate.

The coals in the mouth-piece, or hopper, answer the purpose of a fire-door; and the principal point to be attended to in the management of this furnace is, that the hopper shall be kept full of coal, either wholly or in part with small coal, 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 offers a ready mode of forcing the ignited fuel, which has just flulled 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 nullifies 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 flugged by a rising breath of brick-work; therefore, any smoke which is liberated from the raw coals in the mouth-piece, nullifies over these burning coals before it can reach the flue 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 fill escape in an undecayed flame.

The principal merit of Mr. Roberton’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 inclines 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 left 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 one end on a fluid, 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 halfway 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 known by experiment, the plate is 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 London, where many works have been indited 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. Roberton’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 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 incline the fire in a grating, which will admit sufficient air sideways to supply the combustion. The bottom of the magazine is made moveable up and down in the chamber; and by means of a rack and pinion, a worm, or some other mechanical power, the whole weight of the coal contained in the magazine can be raised up, and a portion will rise up into the grate 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 so close 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
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 stoves 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 draving 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 Dalfinoun, 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 dock; the paddles 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 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 water or rowing wheel, was by placing the cylinder nearly 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 reverse the motion of the wheel, 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 paddles, 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 flammers 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 eighty 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 1812, 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 per 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 so 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 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.

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 seamens call skulling a boat, by an oar at the stern.
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As none of these schemes, except the paddle-wheels at the outsides of the boat, have been brought to any practical utility, we shall not enter into any further particulars, but describe one of the boats 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 underfoot water-mill wheels, 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 belt 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 contrary direction to its motion, and therefore has the greatest force to urge the boat forwards, 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 will 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 even would be more effectual; 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 an extreme 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 water which the paddle removes will not have time to return to its level before the succeeding paddle makes its stroke.

The steam-engine is placed near the middle of the vessel, and the smoke is carried up in a large plate iron tube, which serves the purpose of a mast, to hold a sail when the wind favours. The greatest number of boats at present in use are fitted up for passage-boats, as that is the most profitable employment: they have two cabins, one before the engine, which is smaller, and considered inferior, while the second, or large cabin, abaft the engine, is more elegantly fitted up. Plate VIII. Steam-Engine, fig. 1. is an elevation of the whole vessel, as it appears in the water, and fig. 2. a plan with the deck removed, to shew the arrangement of the apartments, and to explain the steam-engine and machinery by which the vessel is propelled.

That part of the boat which is beneath water, is built like an ordinary boat, which draws but little water, and she is so formed at the stern-ports as to cause her to steer readily. The head must be built more bold or rounding for those boats which are intended for the sea, than those for rivers, which are generally made very sharp at the head, so as to divide and move more freely through the water. The rudder and tiller are constructed the same as other boats. The width of the vessel above water is considerably increased, by the addition of galleries or gangways, X, X, which are fixed projecting from her sides and gunwale: they are composed of a thin planking, and are supported by knees and flanchions, so as to form a gangway to walk round, and at the same time a defence to the paddle-wheels B, B, which are placed close to the sides of the vessel in the width of the gangways. These wheels are put in motion by the steam-engine, and by their action against the water propel the boat forward. The paddle-wheels are constructed nearly in the same manner as underfoot water-wheels, except that the floats or paddles are placed inclined to the axis, instead of being perpendicular before the rim of the wheel. The upper parts of the wheels are inclosed in semi-circular cases of thin boarding Y (fig. 1.), to prevent the action of the wind upon their floats, which, without this precaution, would materially impede their motion, because the floats at the upper part of the wheels move in a contrary direction to those at the lower part, where they dip into the water.

The steam-engine which gives motion to the wheels, is situated in the middle of the boat; but it must be placed low, and, if possible, beneath the water-line, so as to act in part as ballast to the boat, which will otherwise require a greater quantity of ballast than usual to counteract the weight of the engine. It is a great advantage to these boats to be light, and draw little water; these engines must therefore be made as light and compact as is possible, that none of the parts shall break. The principal parts which require strength should be made of good wrought iron, in preference to cast iron, which is used for other engines; for instance, the beam and connecting rods, and also the cranks and shaft for the fly-wheel, as well as those for the paddle-wheels. The wheels themselves are made of thick iron plate or wood; the boiler A (fig. 2.), in which the steam is produced, is made of wrought iron plates, and as large as the space which can be allowed for it will admit, that it may produce a regular supply of steam to the engine: it is placed sometimes across the vessel, and sometimes in the direction of its length, as shown in the figure; and the fire-place is an iron tube contained withinside: / is the fire-door: the smoke, after passing through two or three turns of the tube in the boiler, passes 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 flayed, in the same manner as a malt, by two ropes, or sometimes by iron chains from its top, going fore and aft, with a purchase to each to draw them always tight. There is a safety-valve at d, by which the steam escapes into the chimney when it is produced in too great a quantity, and becomes too strong; or when the engine is not in motion: e is the steam-pipe, which conveys the steam from the boiler to the steam-box f, which contains the four valves for distributing the steam into the cylinder G, alternately above and below the piston, so as to give motion to the engine. These valves are 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 jointed to the middle of a crofs-rod. From the ends of which the two iron rods descend, one on each side of the cylinder, and are jointed to the beam, G P, which is made double, or composed of two levers, joined together in the manner of a frame, so that the cast-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 fixed up to the bottom of this cistern, so that the beams lie close to each side of the cistern: the cylinder is fixed down upon one end of the condensing cistern, and the bearings for the axis of the crank, R, are supported on the other end. The beams, G P, are united together at the extremity most remote from the cylinder by a crofs-rod, on the
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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-axi is supported in bearings close on each side of the crank, which are framed to the condensing cinders; 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 vessel, 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-axi 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 last-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 vessel: the cog-wheels, O, O, are fixed on the extreme ends of the shafts within the vessel, 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 in 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 j, one end of which has a circular hoop, that embraces an excentric wheel p, fixed on the axis of the fly-wheel; so that in turning round, it pushes the rod j p backwards 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-vessel 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 vessel for quick travelling. (See the plan, fig. 2.) The after or grand cabin, marked i in the figure, is generally fitted up and furnished in an elegant style, for the use of the boat company, who also occupy the deck and gangways abaft the chimney. The entry to the grand cabin is at the stern of the vessel. The grand cabin is generally situated in the after-part, on account of there being the mull room in that part, the engine being always placed considerably nearer the head of the vessel than the stern; a small room for the use of the passangers, 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 4, in which the steward keeps his stores. The coals for working the engine are stored beneath the floors of the cabins, and the engine-man 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 chile in the middle, which will contain all the luggage, and serves also as a table for those who fit round it. These passengers have a seat to the crank forwards of the chimney; but the gangways at that part are almost entirely occupied by a large water-calk on each side, the cable, spare sails, or whatever the vessel 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 as these are only intended to be used in fine weather, with a fair and light wind, the masts and cordage may be as light as is convenient. A pair of hajiards should be provided to the chimney, to hoist occasionally a large light lugger-fail; and if the chimney is not sufficiently strong, a pair of extra stays may be set up to strengthen it. The chimney is generally made to lower down, for the convenience of passing bridges, when the vessel 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 69 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, 6, 7, 8, 16, 32.) In other words, to make the same vessel 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 stature than any other vessel of their size, as those hitherto constructed are less easily turned than vessels impelled by sails only. The tendency of the wheels acting so near the centre line of the vessel, is to propel her straight forward; whereas in turning a sailing vessel to the wind, the sails aid her in coming about, and even common oars act so far out from the side of the vessel, that they 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.

Those engines which work with a bell-crank, or a double beam, below the cylinder, and on each side the ciphers, instead of a beam working above, are found to strain the vessels; those having the beam above, work much more readily.
STEAM-ENGINE.

The engines that Messrs. 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 Messrs. 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 33-horse power, requires 3 tons 12 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's El�� on Propelling Vessels, 8vo. 1816.

The Application of Steam-Engines to driving of Carriages.—There are now called locomotive engines, and we may date their introduction with the patent of Messrs. 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; at a distance of nine miles; and it performed all that diligence 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, so as to work constantly, until 1811, when Mr. Blinkinop, 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 cast-iron, of a cylindrical form, five feet long, and four feet three inches diameter, the fire-place being within the cylinder. 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 pinion-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 alternate ascending and descending motions of the pinion-rods act to turn round the crank and wheels, and draw the carriage forwards; in this way no fly-wheel was necessary, because the movement of the carriage to advance itself forwards on the road, continued the motion of the wheels and cranks sufficiently to make the cranks pass the lines 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 relling 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. Blinkinop, 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 cast at the same time with the rail, and are hollow beneath, to be as light as is sufficient with strength and durability. The pitch of the cogs, or distance from centre to centre, is fix inches, so that each rail, of three feet in length, has only fix cogs. A wheel, which is fixed on an axis at one side of the carriage, works in the teeth of the rails; and as it is turned by wheelwork from the axis of the cranks, the whole machine is caused to advance along the railway. When we saw Mr. Blinkinop'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 cylinders 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 fix wheels for the carriage to run upon; and to make the bearing equal upon all fix, the two middle wheels were applied to the pinion 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 steam-engines draw carriages upon public roads, is a refinement not yet attained. In drawing up this article, we have derived considerable affluence from books, as our numerous references will testify; but 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-six volumes of the Philological Magazine, and the Philosophical Journal. The first and second volumes of the quarto series 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, consisting of 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 pollute merit, or to have been successfully put in practice.

The article Steam-Engine in the third edition of the Encyclopædia, 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. Prony, who devotes the second volume of his " Nouvelle Architecture Hydraulique," 1796,
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expressly to that subject. 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 Chalott, 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 the writer of this article visited them in 1814; 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 Messrs. 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 effect, made a kind of secondary claim to the invention of the double engine; for he informs us, that he saw 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 are 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 marked by the distribution of the building, which isolated 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 Messrs. Boulton and Watt's valves, he invented those parts himself; and M. Perrier, from this model, constructed a large machine in 1790, at the Isle of 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 exhaust-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 flying-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 must be regretted, that none of our experienced engineers have undertaken to write a work on steam-engines, as there is not any 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 Breckman's edition of Ferguson's Lectures, which gives a sketch of Mr. Watt's double engine, with the parallel levers and rotatory 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 Encyclopaedia, Svo.

**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 nature 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 into it. A cauldron, 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 cauldron 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 also very closely, and there is a short thick plug put tightly in a hole in it, to give air; or this hole may be covered with a piece of lead, fitted closely upon it, and movable on a leather hinge, that it may of itself give way, to prevent the cauldron 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 cauldron 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 one of the most simple contrivances of a steam-boiler, 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 caulls at the same time; or instead of caulls, there may be fixed boilers with sliding bottoms, for emptying the potatoes into little wagons, or barrows, wheeled in under. The potatoes might also be taken out of a fixed boiler by means of an iron basket, made to fit the inside of the boiler; which basket might be easily taken out with a lever, a small crow, or some other familiar 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 business 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 will be given and further noticed upon, in speaking of the use of steaming of cattle-food. It may be suggested, that if steam-boilers be fixed up in a contiguous manner to the kitchens or sculleries of farm-houses, they may be occasionally converted to the use of the families; as this method
it preferable to the practice of boiling in water for most culinary purposes. See *Steaming of Cattle-Food*.

Some other 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 potato, 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 drawn from 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. Those on the steamed potatoes looked perfectly smooth and sleek, while the others were quite rough. Mr. Eccleston, near Ormskirk, in Lancashire, also found them useful instead of corn for their 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 neat 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 waste of the potato is about 34th 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 washed, 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 boiler has a steam-pipe, which connects with the lead-pots near the place where the tubs stand upon whilst steaming. 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 washer is disengaged from the axle by a jointed notch between the two lead-rocks. The water-back is supplied by a fount from a pump, in order to fill the boiler; also, a shorter fount is applied to fill the tub which the washing-machine runs in. And 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-pipes, which leads from the boiler, and conveys the steam to the lead-pots, is one inch in a quarter in diameter. It is observed 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 leaden pots. The tubs are let 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 size of the washer must be according to the work required to be done.

Another method has, however, been suggested by Mr. Pierpont 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 boiling 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 six 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 fix digellers. 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 60 pounds before they were put into fix digellers. The potatoes from the two first digellers, 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 likewise. That the carpenter measured the wood with which they were baked, and he tells the writer that a well-lacked cord of good fuel-wood will bake 90 fets, or 90 times 6 digellers, each containing half a bushel of potatoes, at the rate of wood it took to bake the above fix, 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 digel- 
ters, and by adding a small fire thus,  

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...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 fove fume. 

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 digelters holds 6 gallons wine meafure, but in potatoe measure each will only hold half a bufheil; fo that 1, 2, or 3 bufheils, 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 5 fix baken in a day; which 6 baken, that is, 6 flacks, or 18 bufheils, at 60 lbs. the bufheil, were done within twelve hours, the wood being in a dry flate. He believes that eight digelters, 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 satiafactory for any perfon willing to use the method on a larger scheme.

Representations of these different apparatus for flameing of cattle-food may be seen in the second volume of the "General Dictionary of Agriculture and Husbandry."

There are some other more fimple and cheap contrivances in use in different districts for flameing of cattle-food, fuch 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 fo quickly flameed in Suffolk, it is faid, that flax tubs are done in the course of the day, which is nearly double the number that could be boiled in the water. It is fuggested, however, that there fhould be an easier way of clearing the copper from dirt, which will, in fpite of washing, gradually collect at the bottom of it, without having the neceffity of breaking the mortared joint which connects it and the half-hoghead. Other modes of a fimilar nature, equally fimple and convenient, exist in many other places, which are found to answer perfectly well, where only small quantities of this fort of food are wanted to be prepared at a time.

The flameing of cattle-food is a practive which is yet probably but in its infancy, conseqently every discovery of a ready and cheap method of efrecting the butterknife is particularlly deferving of the farmer's attention, as well as the ascertaining of the improvements which different forts thereby undergo, for the purpofe of being applied in the different procéfles of feeding and fattening various kinds of animals of the farm fort.

STEAMING-House, a place properly fitted up for the purpofe of preparing roots by flame for the ufe of cattle. See the preceding article.

STEATITE, in Mineralogy, a mineral particularly diftinguifhed for its uctuous feel, refembling that of soap. That variety which is found in Cornwall differs from common flate by the abfence of alumine in its composition, and is commonly called foap-flone. See SOAP-Stone.

Steatite is of various shades of white, grey, yellow, and red. It occurs mafive, and forming fucrations; it is fometimes cryftallized; but mineralogifts are not agreed regarding the cryftals; fome confidering them as true cryftals, others as falfie ones, formed in the cavities made by pre-existing cryftals. The fix-foided prism, the rhomb, and fix-fided pyramid, are confidered by Mr. Jamefon as falfie cryftals; the prism originating from rock-cryftal; the rhomb from brown flate; and the fix-foided pyramid from calcareous flate.

Steatite is soft, yielding to the nail, but does not adhere to the tongue; the fracture is splinterly: it is more or lefs tranquilent on the edges, and bears a great reemblance to perfentine; 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 metalled 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 infufible by the blowpipe, but changes its colour, and becomes black. According to Klaper, the flate of Barenth contains

| Silex | - | 49.50 |
| Magnesia | - | 39. |
| Iron | - | 2.50 |
| Water | - | 5.50 |

According to Vaquelin, the flate of Monte Ramuzo contains

| Silex | - | 44. |
| Magnesia | - | 44. |
| Alunine | - | 2. |
| Iron | - | 7. |
| Manganese | - | 1.50 |
| Chrome | - | 2. |

...with a trace of lime and muriatic acid.

Steatite has been employed in various countries to anfwer the purpofes of soap and fuller's-earth. The white variety is much valued in the manufacture of porceain.

The inhabitants of New Caledonia are faid to eat confiderable quantities of flateite. Humboldt fates also, that the Otosacks, a favage race on the banks of the Oronoce, live for nearly three months in the year principally on flateite, which they fift, bake flightly, and then fotten with water. Mr. Goldbery fays, that the negroes on the banks of the Senegal mix their rice with white flateite, and eat it without inconvenience. Very recently, confiderable alarm was exicted in the county of Cornwall, on the discovery that it had been the practive of a fraudulent miller in that county to mix a confiderable quantity of ground flateite with his flour.

Steatite hardens in the fire, and has been successfully employed in imitating engraved gems, by Mr. Vidalot, an artifl in the vicinity of Liege. The subjécts to be repreffed are engraved on it with great ease; it is then expofed to a frong heat. It is afterwards polished, and may be coloured by metallic solutions. A variety of flateite found at Aragon, in Spain, is used by artifls under the name of Spanifh chalk; when gently burned, it is fometimes used as the basis of rouge.

Steatite occurs in Cornwall, in Angleafe, at Portjoy, Icolm-kil, and various parts of Scotland; and in Norway, Sweden, Germany, Switzerland, &c.; and we believe, in all districts where perpontine abounds. Some mineralogifts fuppofe that flateite is formed from the decomposition of felfpar and mica; others, that it is nothing more than decomposed perpontine. See Serpentifne.

STEATOCELE, from steat, fat, and ko, a tumour, a fwellling of the fcrotum, containing fat.

STEATOMA, a wen, or encyctled tumour, composed of a fhulace like fult.

STECKBORN, in Geography. See STEKKOREN.

STECKEM, a town of Flanders; 5 miles S. of Hulit.

STECKEN, a town of Bohemia, in the circle of Czlow, 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 patrinate of Sandomierz, on the Wieprz, near its union with the Vilula; 20 miles W. of Radom.

STEE, a provincial term applied to a ladder.

STEEBERG, in Geography, a town of the duchy of Carniola; 11 miles E.S.E. of Cirknitz.

STEEGE, 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. 52° 3'; E. long. 15° 26'.

STEEL, in the Arts, a most valuable metal, consisting of iron combined with carbon. It is chiefly used for edge-tools, and other cutting instruments, 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, and suddenly cooled, it becomes the most elatic of all the metals. It is of a darker colour when polished, and retains its polish much longer, than is liable to oxidate.

The specific gravity of steel is greater than that of iron: thus, the specific grav. of cast-iron is .72070; malleable iron, .77880; steel in its solid state, .78404; hardened steel, .78180.

Steel is manufactured by two processes, one in which the steel is made from pig-iron at once in the furnace: this is practised in Germany, and is called natural steel. Cemented steel is formed by stratifying bars of iron with powdered charcoal in a close 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 concræfön. The test of the conversion being complete is its blitfered appearance, from which it has been called blitfered 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 tilting steel, see Tilting of Steel. It is from blitfered steel that all the different kinds of steel are manufactured. These are principally of two varieties, viz., cast-steel and wrought-steel.

Cast-steel is blitfered steel fused 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 blitfered steel: this is what renders cast-steel so much better for polished goods: for when blitfered 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 blitfered or common steel is generally melted into cast-steel; but this is not of the best quality. The best cast-steel is made by melting the bars of blitfered 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 blitfered steel. The bars are broken into small pieces, for the purpose of lowering the greatest quantity in the crucible.

The furnace employed for melting steel is the best 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 calling is performed. These are arranged along the two opposite walls, each containing a stack of high chimney. The ash-pits of these furnaces terminate in a cellar below, which is well supplied with air. The crucibles in which the metal 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 crucible 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 softest pottery. 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 fland about four inches high, which is also placed upon the middle of the grate. The base of this fland is less in diameter than the upper part, in order to intercept the air the least possible. Each crucible is also provided with a 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 cally 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 oxidating the iron. In order, however, to guard more completely against this evil, some make use of what is termed a flux. This consists of some vitrifying substance, such as bottle-glass, in very small quantity. The substance now employed is the blast-furnace cinder.

The fuel used for melting steel is the coke of pit-coal, very highly baked in kilns used for the purpose. The fracture of these coals is white and brilliant. They are so hard as to be porous; and their specific gravity is much greater than ordinary coals. 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 flame. The heat required to melt steel is so intense, that if the furnace were not firm and dense, the fire would not last till the steel 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 large 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 fooria, or refuse arising from the flux, is first removed. This expels 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 their continue all the time the metal is pouring into the mould, causing a grand and interlinge appearance. The mould is
of cast iron, giving an octagonal shape to the ingot. These moulds are of various forms. Those used for fleel-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 fleel known by the name of shear-fleel, has been fo called from its application to the cutting part of sheef or wool fhears. It was formerly manufactured at Newcastle-upon-Tyne, and has been called Newcastle fleel. From being subjected to a similar process to the natural fleel made in Germany, it has also been termed German fleel.

We have before obferved, that the bar-iron of which fleel is made, contains many defects in its mechanical texture. In this fleel, it is faid by the workmen to be baffe, and is more or lefs So, as depending upon the management of the bar-steel-forger. The manufacture of shear-fleel confists in removing these defects, and at the fame time giving it what is called increased fibre by the operation of hammering.

The prefent preparation is to lay a number of bars of blistered fleel together, and bind them with iron rings at one end, fo that the bars which are put in the fire may not be difplaced. A portion of these united bars is now to be heated to a full welding heat, keeping the surface well defended by throwing powdered fand upon it from time to time. This fufes with the oxyd of iron, forming a liquid coating, which defends the surface from the action of the air. If this precaufion is not obferved, the fleel, when heated to the degree of welding, would become what is termed burnt, and its malleability be impaired. In the welding fleel it is placed under a forge-hammer, working by water or a foom-engine; when the bars become firmly united, and all the loose parts previously exifting in the malleable iron are at the fame 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 hammer ed in a fimilar 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 fleel it is fold to the consumer, who afterwards has it reduced to different fixed rods by the tilt-hammer. The fleel is rendered fo compact in texture by the welding and hammering, as to become fufceptible of a much better working than the bar-iron. In this fleel is placed at the fame time that its tenacity and malleability are much improved. The former improvement highly fuits it for table-knives; the latter makes it valuable for Springs of various kinds, particularly thofe of gun-locks.

The process by which this fleel is formed has another advantage besides rendering it found and more malleable. It is found fouter and more kind than the blistered fleel from which it is formed, and is much more uniform in its quality. This may be explained by the fad, that a quantity of the carbon of the blistered fleel is diffipated in the form of carbonic acid during the welding and hammering, by which a fleel is obtained, having a lefs than ordinary proportion of carbon, and is in confquence ftruck liable to break in bending, and at the fame time fouter and more flexible. Indeed, if the process of welding and hammering were repeated feveral times, the fleel would lofe the whole of its carbon, and become pure iron.

Blistered fleel fhou Id not be used but for the commo nfeil purpofes, where great tenacity of polifh is not an obje pt. For all nice purpofes, where great tenacity and foun dnefs are neceffary, shear-fleel fhould be employed; and where a fine polifh or great hardnefs is wanted, cat-fleel is indifpenfable. See Iron and Cutlery.

Steel. Annealing, or Neafeling of, is for the foftening it, in order to make it work eafier; which is ufually 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 fecrets in annealing, by which they could bring down iron or fleel 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 effe ft than what is obtained from the former, when the cooling is very gradual.

Steel may indeed be made a little fouter than in the common way, by covering it with coarse powders of cow-horn, or hoofs: thus inclining 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 itfelf, and the fleel to cool, which it will do foonly from being infecled. See Tempering, and Steel, fuper.

For the expansion of fleel by heat, see Pyrometer.

Steel-glafler, a name given by fome authors to the metaline fpheres used in optics. Thofe, accord ing to Cardan, are made of three parts of brifts, one part of tin, and one of filver, with an eighteenth part of antimony; but fomewhat entirely lefs than this proportion, and many of the other methods, directed by feveral authors, but most rife arsenic and tartar, mixed with the metals. These are afterwards to be polished with emery, rotten-flone, putty, and the like.

Steel-ore, is used to fignify a particular kind of lead-ore.

Steel-powder. See Powder.

Steel, Satl of. See Salt of Steel.

Steel-Waters. See Mineral Waters.

Steel, Damascus. See Damascus.

Steel, Engraving on. See Engraving.

Steel, Faggot of. See Faggot.


Steel-Wine. See Wine.

Steel Plate, in Geography, a cape on the E. coast of Labrador. N. lat. 58° 40'. W. long. 62°.

Steele, 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 Ormond, through whose influence the son was sent, at an early age, to England, and placed at the Charter-Houfe for education. In 1691 he was entered of Merton college, Oxford. Of his academical 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 horfe-guards, but his friends soon after procured for him an ensign's commission. Feeling that he might not be able effectually to refit the temptations incident to his age and situation, he drew up a little treatife 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 fifileers. The seriousnefs of the work exposèd him to fome ridicule among his companions, and the more fo, as it failed in producing the correponding good effect in regulating his own morals; he therefore, "to calvien his character," as he fays of himfelf, brought out a comedy, entitled the " Funeral, or Grief à-la-mode." This piece proved fucciffeful: it had the merit of uniting entertainment with the more direct purpofe of moral improvement, than was usual among dramatics at that time. Either on this or on other accounts he attracted the notice of king William, who meant to have R
betrothed 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 purfued 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 fided with the minister, Steele obtained the reward of a place among the commissioners of the stamp-duities, 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 affiance 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 subordinated 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 majesty, voted to be feditious and scandalous libels. The most noted of these, entitled "The Crifi," was not written by Steele, but by a friend and political coadjutor. The charge brought against him, that the libels, as they were called, contained many expressions highly reflecting upon her majesty, &c. maliciously insinuating 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 fir

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 unwelcomeness 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 expenses. 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 were to be wished that his difficulties had occasioned no other fardicencies than that of money; but there is reason to suppose that they sometimes interfered with the dictates of conscience." Whilton says, that once having met with Steele after a vote in parliament contrary to his former declarations, with which he lightly upbraided him, the knight replied, "Mr. Whilton, 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 South-sea scheme. In 1722 he brought forward his comedy of "The Confeious 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 man of parts rather than of genius; his productions are lively, but they display neither the great, nor the accurate. His style and 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 fearlessly entitled to a place among those which throw peculiar luster upon the period of English literature. Biog. Brit.

Sir Richard Steele, without much taste or science in the art, was a musical critic and poet. His elegies on Nicollini, in the Tatler, No. 115, would have done his taste and judgment honour, if he had not afterwards treated operas in general, when they clashed with his interest in the playhouse, with the utmost contempt. He joined with Clayton, Haym, and Duport, 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 set which he employed Clayton! but the plan failed. And he had the room in York-buildings afterwards fitted up at a considerable expense, and a roof erected for himself to read lectures in, on the drama and other subjects. We have heard, 8
Sir Richard Steele was certainly a man of wit and humour, and in some of his sermons there were good intentions; but he seems to have been (says Dr. Burney) an unprincipled politician, an occasional Christian, and a prentice, self-interested and ignorant musical critic.

STEELING, in Ship-Building, a name given to the foremost or aftermost plank, in a strake which drops short of the flume and flern-poll, and of which the end or butt nearest the rabbot is wrought very narrow, and well forward or aft. Its use is to take out the fusing-edge occasioned by a full bow, or sudden circular buttock.

STEELING, in Cutlery, the laying on a piece of flesh upon a larger mass of iron, to make that part which is to receive the edge harder than the rest. The body of an 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 flesh; but it must have a quantity of flesh at that part where the edge is to be made.

STEELYARD, or STYLLARD, in Mechanics, a kind of balance, called also flattera Romana, or the Roman balance; by means of which the gravities of different bodies are found by the use of one single weight.

STEELYARD, Confinication of the. It consists of an iron beam A B (Plate XXXVIII. Mechanics, fig. 6.) in which a point is assumed at pleasure, as C, and, on this, a perpendicular raised, C D. On the shorter arm, A C, is hung a scale or bason 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 steeleyard, the manner of using it is apparent. But the instrument, 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 brafs 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 succesively hanging on to an hook fastened to the other end, 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 steeleyard, the manner of using it is apparent. But the instrument, being very liable to deceit, is therefore not to be countenanced in commerce.

The beam, or yard, is a small rod of wood or ivory, about a foot in length; upon this are three rules of meafure, made of a fine silver-fuddled 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 meafure, the other two seem to be China meafure. At the other end of the yard hangs a round scale, and at three several distances from this end are fastened so many finer 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 things, 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.


STEELYARD-SWING. In the Philosophical Transactions (No. 452, fept. 5.) we have an account of the steeleyard-swifg, proposed as a mechanical method for affilling children labouring under deformities, owing to the contraction of the muscles on one side of the body. The crooked person is suspended with cords under his arm, and these are placed at equal distances from the centre of the beam. It is supposed that the gravity of the body will affect the contracted 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 ornaments of the Flemifh school of painting, was born at Leyden in 1636. His father was a brewer in that city, who perceiving an inclination in his fon for painting, placed him as a pupil with N. Knuffer, an historical painter at Utrecht.

That he might not be entirely dependent upon his talents as an artist, his father established him in a brewhoufe at Delft; but this kindnefs, which might have secured him comfort, only afforded him the means of fentimental indulgence, to 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 difpaffion, at length abandoned him. He afterwards 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 faid to be a more active consumer of his own fiores than any of his customers.

Amidst the interruptions of indulgence and of bufinefs, he continued conftantly to prattife the art he had acquired; prefenting generally the features and fubjefts in which he paffed his time and were molt congenial to him. The felivity, frolic, and fun of low life in the alchonie or other places of public refort, he treated with the cleareft expreffion and character; and executed them with a pure tone of colour, and a freedom of touch peculiarly his own. Sometimes, however, he feared somewhat higher, and entering the domestic circles of his friends, perpetuated with the greatest felicity the diversities of character and anfufements which prefented themselves to his obfervant and intuitive eye. In no man's pictures is another more amufed with variety than in Jan Steen's; or more entertained by wit and humour, unless it be in thofe of our own Hogarth. His drawing and composition are in general very good, and his colour admirable, particularly in parts; but oftentimes his management of chiaro-feuro is deficient, and his pictures want air. While he lived, his works were not in much effimation; perhaps his vulgar and disorderly habits prevented them from being known: but since his death, and particularly since Sir Joshua Reynolds evinced an affimilation of them, they have rifen in value, and are now fold, when of fuc quality, at very R 2 great
great prices, and fought with avidity. He died in 1669, at the age of fifty-three.

STEN, in Geography, a town of Norway, in the province of Aggerhuss; 15 miles N. of Christiania.

STEENBERGEN, a town of Brabant, formerly a place of confederation, on the sea-side, with a convenient harbour, but now, in consequence of the reefs of the sea, a league from it; and by this circumstance, as well as the calamities of war, reduced to 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.

STEENSEHOUSE, a town of Scotland, in the island of Pomona; 7 miles W. of Kirkwall.

STEENKIRK, or STEENKERQUE, a village of France, in the department of Nord, situated on the river 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, Steenvre, or Steenkerch, a town of Flanders; 8 miles W. of Dixmude.

STEENPLAAT, a town on the W. coast of the island of Giljo. 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 3414, and the canton 23650 inhabitants, on a territory of 132 kilometres, in 9 communes.

STEENWYCK, Henry, in Biography, was born at Steenwyck in 1550. He was a scholar of John de Vries, a painter of perspective and architectural scenes. Steenwyck surpassed his master in the fame subjects, viz., interiors of churches and Gothic buildings, which he painted with great neatness and clearness. His colouring is rich and brilliant, but he injured his effects by painting the lights too much in lines, unblended and too sharp, 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 married to the last he painted on a larger scale than his father. Vandek, 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 emblazoned 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 feeds in, which are designed to be town 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, 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-Fly.

STEEP, in Rural Economy, a term sometimes employed to signify the prepared mash, bag, or吩咐, 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 curdly matter to be present, are the best for the purpose, when well prepared by proper salting and steeping in pickles. See DAIRING and RENNED.

STEEP, Island, in Geography, a small island in the Mergui Archipelago. N. lat. 16° 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 Zoe, 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° 34'. E. long. 109° 3'.

STEEPHOLM, a small island in the Bristol Channel, about midway between the coasts of England and Wales. N. lat. 51° 16'. 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 steep, 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 modes of steeping, brining, and liming feed-wheat, are inapplicable, and all equally intended against the fmut. From his experiments it appeared that steeping from twelve to twenty-four hours in a loy of wood-ashes, in lime-water, and in a solution of arsenic, gave clean crops from extremely smutty seed, 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 flock kinds with lime, and the following are the practices in two of the principal grain districts in the southern part of the kingdom. It is stated in the Agricultural Survey of Norfolk, that Mr. Robinson, of Watton, for many years has had no other fmut on his farm, than what has been caused by accidentally fowing a headland, or finishing a corner of a field with dry feed; but if steeped, the prevention is im-possible. 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 Hookham, had great plenty of pheasants, but loll them all by using arsenic in steeping his wheat-feed. Mr. Salt, of Winborough, however, dresseth with salt and lime without steeping, and never has the fmut; it is only to be concluded, that he has always fown clean feed. And Mr. M. Hill makes 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 thrives his feed well in pump-water, then lays it in a heap to drain, and adds half a pound of salt to every bushel, flits it well together, and dries with lime; this he finds sufficient against the fmut. Whence the writer concludes that he's feed is always free from that dissembler, or assuredly he would find the process to fail, for he does not leave it any time limed.

The falt 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 hottell rate the wheat becomes candied, having previously been moistened for the purpose with pure water.

Also in Hertfordshire, Mr. Bye brines his wheat; he swins it, but takes it out directly and limes it. And about Beachwood they make a brine with salt, which will swin a new-laid egge. They leave the feed from two to four hours long in this brine, and lir and dicem it; they lume it over night, and then row it next morning, but if it be kept a week it will receive no injury; they are however not free from smut, and have occasionally much over the whole country, even from Watford. A steeping of one hour is trusted to at King's Waldon. If chamber-ley be added or thrown on the feed after brining, it kills the wheat. Mr. Leach has bought smutty wheat to sow for curiosity, and even the worst which he could find; he steeped it six hours in a verystrong brine, made to swin a large egg; he dreed it with hot lime and fowed it directly, and had no smut. He has tried this several times, always with success. He steep clean wheat but three hours. But Mr. S. d'Gwick steep his feed in brine above six hours, then dries it, with lime and fows it directly, and he never has any smut; 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 inferred from Mr. Blackie, the bailiff of the earl of Chesterfield, on the farm at Bradley Hall, in Derbyshire. It is there rated that it has been found by experience, and is pretty generally known, that smutty-feed-grain of the wheat kind will produce smutty crops; but it is believed, that it is not generally understood, that the molt smutty feed, by being properly cleaned, will produce clean crops; such, however, is the fact, it is said; and it has been found that the pure feed will, by being exposed to, or inoculated, as it is called, with the diseased, produce smutty wheat-crops. It is for the naturalist, it is supposed, to affign a cause why the disafe 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 smut, after having been at the trouble and expense of changing the feed, and even washing and steeping or bringing that feed, not being aware of the infectious nature of this; which, however, is the fact, it is said; and it has been found that the very means they were taking to clean the feed, were also perhaps the means of inoculating, impregnating, or infecting it with the smutty 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 same floor where smutty wheat had previously been threshed out; or perhaps the feed is put up into sacks in which had been smutty wheat but a short time before. The inoculation or infection is then, it is said, complete; the feed is fown; the produce will inevitably and invariably prove smutted; 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 ferrants, 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 smut 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 employed 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 communicated, 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 preceding year, his lordship bought a peck of very smutty diseased wheat from a neighbouring farmer, who had that year great loss in his crop from smut. A piece of land was then let apart for the trial; one half of the wheat was sown in the latter in which it was bought, and the result proved, it is said, as might be expected, two-thirds of the produce being smut. The other half peck was washed as clean as possible, changing the water three times, and then put into a brine or steep strong enough to carry a new-laid egg, in which it remained two hours, being floured twice in the course of that time; when taken out it was dried over with quick-lime, and sown on the other half piece of land: the result, it is said, proved entirely satisfactory, as it produced a full crop of clean wheat, without a single ear of smut.

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 smut. Six ears of the smutty kind were fowed from the crop of the preceding year's trial; they were put into a small bag, and rubbed therein; the smutty grain was then carefully shook out of the bag, so that there only remained the black dust: a quart of Dunstable wheat was then taken, and although perfectly clean at the time, was washed in three waters, and then put into the smutty bag for the purpose of inoculation, or being impregnated 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 smut; while out of twenty acres sown with the same feed-grain not inoculated or infected by the smutty matter, not one smutty ear was produced, although carefully 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 shewn to any person who might think it worth while to examine it. It is further noticed, 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, frequently not efficacious.

It is thought too, that it would be very advisable, in addition 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.

The above observations and results are strongly enforced, and shewn 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 send for the steep or pickle which was left. He has suffered much
much in former years from the smut, and previous to his
farming for the pickled, had that year sown half of his wheat
feed brined or steeped in his usual way; the remainder of the
feed 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 sown feed
proved full of smut; whereas there was not one smutty ear
to be found among that of the latter sown feed.

On the nature and causes of the disease there are too many
notions and opinions, that, it is said, one farmer fits down
contented with his crop of diseased wheat, under the idea
that it has been caused by something pernicious in the at-
mosphere; 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 affording
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 also maintained by others, which need not
be here noticed.

It is condescendingly concluded, that it has surprised the
writer much, that lenible, practical farmers and agriculturists
should still remain so greatly prejudiced, even against
their own interests, as not to endeavour to eradicate or re-
move this pernicious disease, when it is certainly within their
power so to do. The means by which it is thought possible to
accomplish fo definable an object, arc, it is said, ficians 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 esta-
blished practices of well washing, and brining, 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 feasibly be attempted or
established upon any thing like a satisfactory or scientific
basis; but the result of the whole of what has been flated
from the above experiments and trials would seem to direct
and lead to greater correctness and certainty in the principles
and practices which are to be pursued, as it shews, 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 feed-grain, and probably that the infection lies in the
black powdery matter which adheres to the grain; conse-
quently 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
cautions in every way, and for a proper length of time.
When, in spite of all 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 feen, sometimes originate from
infection and the imperfect execution of the means which
are made use of for the purpose, in the barns or other simi-
lar places, as well as from slight portions of the powdery
substance being inadvertently 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 there are different prepara-
tions and menstrua of the chemical kind which render the
process of sproting or germination much more rapid than
usual, when the feeds have been steeped in them. As in
these cases the feed-leaves are quickly protruded and pro-
duced, and more speedy perform their functions, it was
proposed as a subject of experiment to examine whether
such menstrua and preparations might not be useful in raif-
ing 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 feeds so
reated, though they germinated much quicker, did not pro-
duce healthy plants, and often died soon after sproting.

In the month of September 1807, radish-feeds were
steeped for twelve hours in a solution of chloride, and simi-
lar feeds in very diluted nitric acid, in very diluted sulphuric
acid, in weak solution of oxysulphate of iron, and inome
in common water. The feeds steeped in solutions of chlo-
rine and oxysulphate 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 seven days. But,
if 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
left 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 tri-
als. Too rapid growth and premature decay seem invariably,
it is supposed, connected in organized structures; and that
it is only by following the slow operations of natural causes,
that we are capable of making improvements. See Turnip-
Fry.

However, if the result of these trials should be confirmed
by farther ones, and more full and complete experience,
even though 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 pro-
moting the healthy sproting and early growth of thefe
and many other sorts of small feeds in very dry times and
hot parching feasons, as well as, in common water, for
clearing them of various sorts of extraneous matters and
light imperfect feeds. 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 items
of many different sorts of plants and fruits.

STEERAGE, 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 spire are such as ascend continually, dimin-
ishing either conically or pyramidically.

The latter are mere parallelipiped, and are covered at top,
platform like.

In each kind, there is usually a sort of windows, or aper-
tures, to let out the round; and so contrived, at the same
time, as to drive it down.

Maltese, 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 every moment 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 so at first by the architect; as
is evident from the ceilings, windows, doors, &c. which are
all in the level.

STEER. Hog-fret. See Hoo and Ox.

STEERAGE, in a Ship, that part of the ship abaft where
where the tiller traverses between decks. In merchant-ships, it is the term between the companion-ladder and 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.

STEEVAGE, in Sea Language, is also used to express the effort of the helm; and hence

Steevage-way is that degree of progressive motion communicated to a ship, by which the becomes susceptible of the effect of the helm to govern her course.

STEERING, in Navigation, the art 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 bell steerman, who uses the leaf motion in putting the helm over to and again, and who keeps the ship's bell from making yaws; that is, from running in and out.

For this purpose the helmsman should diligently watch the movements of the head by the land, clouds, moon, or stars; because, although the course is in general regulated by compass, yet the vibrations of the needle are not so quickly perceived, as the failies of the ship's head to the right or left, which, if not immediately refrained, will acquire additional velocity in every instant of their motion, and demand a more powerful impulse of the helm to reduce them; the application of which will operate to turn her head as far on the contrary side of her course.

The phrases used in steering a ship, vary according to the relation of the wind to her course. Thus, if the wind is fair or large, the phrases used by the pilot or officer who superintends the steerage, are port, starboard, and finely; which see respectively. The first is intended to direct the ship's course farther to the right; the second is to guide her farther to the left; and the last is designed to keep her exactly in the line upon which she advances, according to her preferred course. The excess of the first and second movement is called hard-a-port, and hard-a-starboard; the former of which gives the greatest possible inclination to the right, and the latter an equal tendency to the left.

In a ship of war, the exercise of steering a ship is usually divided amongst a number of the most expert sailors, who attend the helm in their turns; and are accordingly called timoners, from the French term timonier, which signifies helmsman.

The steerage is constantly supervised by the quarter-masters, who also attend the helm by rotation. In merchant-ships, every seaman takes his turn in this service, being directed therein by the mate of the watch, or some other officer. Falconer.

For the theory and effect of steering, see Sailing, Course, &c.

STEERING-Wheel, in Ship-Building, the wheel on the quarter-deck, to which the tiller-rope 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 exactness.

STEERISH, 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 Shakspeare, born at Poplar in the year 1735 or 1736, was the son of an East Indie captain, afterwards a director of the company. The subject of this article received the elements of his education at King's-upon-Thames, and he had Gibbon, the celebrated historian, for his school-fellow. From hence he went to Eton, and in a few years was admitted a fellow commoner of 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 Efsex militia he accepted a commision, 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 book-sellers, in the Shakspeare gallery, or in the morning conversations of sir Joseph Banks.

Although not an original writer, he devotes 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 bell specimen which he gave of his great talents is his edition of the works of Shakspeare, in which he is said to have left all competitors far behind him. He had studied the age of Shakspeare, 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 Shakspeare passed 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 kept 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 Shakspeare 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 Shakspeare, in 15 vols. octavo.

Mr. Steevens died in the year 1805, at the age of about 65 years. He bequeathed his valuable copy of Shakspeare, illustrated with 1500 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 Shakspeare, with 200 guineas, he left to Mr. Read, at whose chamber 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 courteous, on many occasions, to persons in distress." He was indefatigable in every thing which he undertook, but subject to caprice in his habits and attachments.

STEEVING, or Stiving, in Sea Language, denotes the
the elevation of a ship's cathedral or bowprit above the item, or the angle which either makes with the horizon.

STEVING, in Merchand Ships, is used for the flowing of cotton or wool, by means of torcers, to force it close 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 Vafari, 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 luminous, he certainly corrected perspective, and gave more varied turns, more character, and greater vivacity to heads. His most accredited works in the church of Alz Colet at Rome, Sta. Spira at Florence, and elsewhere, are no more. No authentic work 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 1352, aged 49. Tuceli.

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 N Giotto, from the great resemblance of his works to those of Giotto. A Pieta, which still remains of him at S. Remigio at Florence, and some frescoes at Affili, bear indistinguishable marks of that style. He died at Florence, at the age of 22.

STEFANI, Agostino, a disciple of the elder Bernabei, was born in 1655. Though Walther and most of the Germans, who wish to rank him among their countrymen, say that Leipsig was the place of his birth; yet Handel and the Italians make him a native of Caffello 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 diisguised 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 et 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 Dei principij della Musica," he has treated of the subject of musical imitation and expression, according to P. Martini, like a philosopher, and agreeable to mathematicall 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 let for the court of Hanover, where he resided many years as maestro di capella: "Alessandro," "Orlando," "Enrico," "Alcide," "Alcibiade," "Atalanta," and "Il Triunfo del Fato," which were afterwards translated into German, and performed to his music, between the years 1695 and 1699, 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 1729 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 indif-
STEIGNACH, a river of Wurttemberg, which rises S. of Neften, and runs into the Neckar, near Nürtingen.—Alfo, a river which runs into the Maine, 1 mile S. of Zeulen, in the bishopric of Bamberg.

STEIGNACH, Markt, a town of the duchy of Wurzburg; 3 miles E.N.E. of Schweinfurt.

STEINNAKIRCHEN, a town of Austria, on the Little Erlapf; 10 miles S. of Ips.

STEINAM AXGER, or Szambath Hely, a town of Hungary, built on the ruins of an ancient Roman town, called "Sabaria;" 48 miles S. of Vienna. N. lat. 45° 30'. E. long. 16° 50'.

STEINAU, a town of Silefia, and capital of a circle, in the principality of Wohlan, on a small river near the well side of the Oder; containing two churches, and forge manufactures of cloth. It has had the misfortune of being fenced and burned in several successive wars; 80 miles W.N.W. of Wohlan. N. lat. 51° 22'. E. long. 16° 25'.

STEINAU, or Strymawa, a town of Silefia, in the principality of Oppeln; 22 miles S.S.W. of Oppeln. N. lat. 50° 18'. E. long. 27° 18'.

STEINACH, a town of Germany, in the county of Hanau; 16 miles S.W. of Palms. —Alfo, a town of Germany, in the duchy of Bremen; 24 miles N.E. of Carlburg.—Alfo, a river of Silefia, which runs into the Neyelle, opposite to Lowin.

STEINACH, 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 Nassau; 16 miles N.W. of Dillenburg.—Alfo, a town of Germany, in the duchy of Bremen; 5 miles W.S.W. of Gerfchach.

STEINACH, Langen, a town of the duchy of Bamberg; 3 miles W.N. of Baden.

STEINBACH, a town of Pruffia, in Natangen; 24 miles S. of Brandenburg.

STEINBERG, a town of Bavaria, in the bishopric of Bamberg; 3 miles N. of Cronach.—Alfo, a town of Welfphalia, in the county of Lippe; 10 miles E.N.E. of Lemgow.—Alfo, a mountain of Welfphalia, in the principality of Calenburg, near Minden.—Alfo, a town of Saxony, in the circle of Ercegeberg; 14 miles S.E. of Freyberg.—Alfo, a town of Germany, in the county of Henneberg; 3 miles E. of Romhild.

STEINBERGEN. See Steenbergen.

STEINBIZA, in Ichtyology, a name given by Hildegard, and some other writers, to that small species of cebites, called by others cebitis acutata, and tenia corona. It is the cebitis with a forked spine under each eye, described by Armed.

STEINEA, in Geography, a town of Switzerland, belonging to the canton of Zurich, in the Thurgau; 4 miles N.E. of St. Gal.

STEINFURT, or Burg Steinfurt, a town of Germany, and capital of a county, to which it gives name, on the Aa; 17 miles N.W. of Munften. N. lat. 52° 15'. E. long. 7° 15'.

STEINFURT, a town of the duchy of Wurzburg; 3 miles W.S.W. of Hafurt.—Alfo, a county and principality of Germany, surrounded by the bishopric of Munfter, about 25 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 Munfter, and part to the count of Bentheim. To a Roman month it contributed 7 florins 32 krueters, and it was taxed to the imperial chamber 40 rixdollars 42 krueters.

STEINFURT, or Dreischenfurt, a town of Germany, in the
the bishopric of Munster; 11 miles S. of Munster. N. lat. 51° 48'. E. long. 8° 32'.

STEINHARD, a town of Germany, in the principality of Anspach; 5 miles S.S.E. of Wafflertudingen.

STEINHAUS, a town of the duchy of Sthiri; 4 miles N.E. of Muensterichberg.

STEINHAUSEN, a town of Switzerland, in the canton of Zug, on 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 Oker Steinheim, a town of Germany, in the circle of the Lower Rhine, on the Main; 2 miles S. of Hanau.

STEINHEIM, a town of Weilhalla, in the bishopric of Paderborn; 14 miles N.N.E. of Paderborn. N. lat. 51° 45'. E. long. 9° 51'.

STEINHEIM am Muhir, a town of Wurttemberg; 10 miles N. of Stuttgart.

STEINHOF, a town of the Helvetic republic, in the canton of Bern; 16 miles N. of Bern.

STEINHÜDE, a town of Germany, in the county of Schauenburg, on the south side of the Steinhuder Meer; 13 miles N.W. of Hanover.

STEINHÜDER MEER, a lake of Germany, in the county of Schauenburg, six miles long and two broad; 14 miles N.W. of Hanover.

STEINHUN, Stone-hen, in Ornithology, a name given by the Germans to a bird of the lagopus kind, more commonly known by the name of otomo, and in some places by that of colomfre.

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 well, shaft, or tunnel pit.

STEINISNAK, in Geography, a town of Croatia; 10 miles E.S.E. of Carltad.

STEINKIRCHEN, a town of the duchy of Bremen; 10 miles S.E. of Stade.

STEINORT, a town of Prufia, in Nantangue; 52 miles S.E. of Königsberg.

STEINPLEISZ, a town of Saxony, in the circle of Frezzeberg; 5 miles W.S.W. of Zwickan.

STEINSDORF, a town of Saxony, in the circle of Neudorf; 3 miles S. of Weyda.

STEINSTADT, a town of the duchy of Baden. In October, 1756, the French were defeated here by the Autrians; 16 miles S. of Fruburg.

STEISBEL, a mountain of Hungary; 4 miles N. of Kemnitz.

STEITZ, a town of Germany, in the principality of Anhalt Zerbit; 6 miles S. of Zerbit.

STEKAN, in Commerce, a liquid measure in Holland. Rhine and Moeil wine, and also spirits distilled from corn, are sold by the aam, which contains 4 ankers, 8 fleksans, 21 viertels, 64 florins, 128 mingels, 256 pints, or 1324 miles; and which holds 8666 Dutch, 7205 French, or 9351 English cubic inches, or about 404 English wine gallons. Linseed and rape-feed oil is sold in aams of 7 1/2 fleksans, or 120 mingels, weighing about 286 lbs. avoirdupois. Train-oil is sold in quartels of 18 or 21 fleksans; also in vats of 12 fleksans, or 192 mingels. The mingel of 2 pints, or 8 mufes of rain-water, weighs about 2 lbs. 43 oz. Amsterdam weight; 19 mingels = 6 English wine-gallons, and 27 mingels = 7 English beer-gallons. A vat of oil of olives contains 717 mingels, and weighs 1730 lbs. avoirdupois: 19.82 fleksans of Amsterdam = 100 English gallons, and each flekan = 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 STEKKEEN.

STEKENZIT. See STEKKEENZIT.

STELE, in Ancient Geography, the name of a town in the island of Crete, near Paros. Steph. Byz.

STELE, Etruscan, in Antiquity, a kind of punishment, being a pillar wherein a criminal was exposed, and on which was engraved an account of his crime.

The perils thus exposed to the laughter and reproaches of the people, were called felpis. Potter, Archzolel. Græc. lib. 1. cap. 25. tom. 1. p. 130.

STELECHEIA, a word used by some authors to express the vena portae.

STELECHITES, in the Materia Medica, a name given by Dioscorides, and some other of the Greek writers, to a peculiar kind of florax. It was the same with the calamite, only that this name was given to the larger, and the name calamite 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 ducts they made by their erosion formed a hillock or heap round the tree, or at its foot, and the extravasated balsam running amongst this duct, made a mias that was called the cynnatus florax at that time, and was the same with the common florax now in use.

STEL娌ES, Sthili 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 elongated 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, passing for the remains of boughs, and the hollow in the middle, for the cavity where the pith of the tree was. The addition of Stili facis was only from the observing that the top and bottom were radiated, or frirated, from the central hole to the circumference, in the manner of antimony. These are truly no vegetable remains, but parts of the arme of that strange fished called fela arboreus. See Sthili-Fish.

STELENCHIS, a fritill, or an instrument used in the baths to rub off the sweat from the skin.

STELENDENIA, in Ancient Geography, a country of Affia, in Syria, near the deferts of Palmyra. Pliny.

STELHOVEN, in Geography, a town of Holland; 3 miles S.W. of Gertrudenburg.


Gen. Ch. reformed. Col. Perianth of three equal, ovalate, keeled, somewhat concave leaves, cohering at the base. Cer. Petals two, distinct, much smaller than the calyx, obtuse, concave, vauled over the column. Nectary a lip without any spur, of the size, and nearly the shape of the petals, somewhat emarginate, inflexed at the edge. Stam. Another a vertical moveable deciduous lid, of two cells; mallets of pollen globular, at length waxy, solitary. Fyl. German inferior,
STELIS.

inferior, ovate; fiolet very short, dilated, hollowed, with three teeth, at the summit; stigma 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. ophioglossa. Adder's-tongue Stelis. Swartz Ind. Occ. 1557. Willd. n. 2. Alt. n. 1. (Epipedium ophioglossa; Lindl. Sp. Pl. 1553. Jacq. Amer. 225. t. 125.)—Stem with a solitary, lanceolate leaf, shorter than the spike. Cloved flowers three-fidged. This grows on the trees and branches of trees, in the mountains of Jamaica, and other islands of the West Indies, flowering in July and August. The perennial root consists of numerous long, simple, zigzag, whitish fibres. Stems several, two or three inches high, simple, clothed with compressed, oblique, tubular, membranous sheaths, and bearing at the top one coriaceous, ribbed, blunted, nearly elliptical leaf, two or three inches long, on a short twisted footstalk. Spike generally solitary, axillary, falked, erect, slender, simple, rather taller than the leaf, bearing numerous, alternate, small, ovate, acute bracteas. Flowers very minute, nearly or quite sessile, 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. Occ. 1553. Willd. n. 2. Alt. n. 2. Sm. Exot. Bot. v. 31. t. 75. (Epipedium micranthum; Swartz Prodr. 125.)—Stem with a solitary, lanceolate leaf, shorter than the spike. Cloved flowers five-fidged. Found on trees, and on the sides of rocks, on the lofty mountains of Jamaica. The marquis of Blundford received it from thence in 1805, and it flowered in his lordship's hothouse in November 1806. This has the habit of the preceding, but is rather larger, with a longer, though narrower, leaf. The flowers are numerous, revered in their position, but we know not whether this character be proper to the whole genus. When closed, they form a roundish five-fidged figure. Calyx green. Petals and lip, as well as the column and anther, of a dark brownish-purple.

3. S. acutiflora. Sharp-flowered Stelis. Willd. n. 3.—"Stem very short, with one lanceolate, abrupt leaf, shorter than the spike; tapering and sheathed at the base."—Native of Peru, on the trunks of trees. Described by Willdenow, from a dried specimen, gathered by Ruiz and Pavon, as are all the following, except our tenth species.

4. S. lanceolata. Lanceolate Stelis. Willd. n. 4.—"Stem elongated, with one oblong-lanceolate, abrupt leaf, equal to the spike. Bracteas membranous, the length of the flowers."—From Peru.

5. S. polyphylla. Many-spiked Stelis. Willd. n. 5.—"Stem elongated, with one lanceolate-elliptical, abrupt leaf. Spikes two or three together, longer than the leaf."—From the same country.

6. S. oblonga. Long-leaved Stelis. Willd. n. 6.—"Stem elongated, with one lanceolate-elliptical, pointed leaf, longer than the twin spikes."—Native of Peru. The back of the leaf is purple.

7. S. parviceps. Purple-leaved Stelis. Willd. n. 7.—"Stem elongated, with one elliptical, slightly pointed leaf; coloured underneath. Spikes two, longer than the leaf."—Native of Peru.

8. S. revoluta. Revolute Stelis. Willd. n. 8.—"Stem elongated, with one ovato-lanceolate, coriaceous leaf, scarcely longer than the spike."—Native of Peru.

9. S. cordata. Heart-shaped Stelis. Willd. n. 9.—"Stem elongated, with one ovate, somewhat heart-shaped, pointed, coriaceous leaf. Flowers aggregate, in the bosom of the leaf."—This, like the six preceding species, grows parasitically on trees in Peru. They constitute the genus Humboldti of the learned authors of the Flora Peruana, notice of which has, as yet, appeared in their Prodrorum only.

Section 2. Inflorescence radical. Leaf from a bulbous base.

10. S. racemosa. Yellow Racemose Stelis. —Leaf lanceolate, emarginate, on a short stalk. Flower radical, nearly sessile, deflexed.—Found by Dr. F. Buchanan, on trees in Upper Nepal. The root is thread-shaped, creeping, fixing itself at intervals by means of tufts of numerous fibres, from whose crown proceeds a green ovate bulb, an inch long, bearing an erect leaf; measuring, with its short stalk, four or five inches. Cloths solitary from the bases of some of the bulbs, each four inches long, pendulous, on a short stalk, enveloped in membranous sheaths. Flowers about ten, rather distant, red, each on a very short partial stalk, accompanied by a lanceolate membranous bracteas, equal to the germen, 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 radical, cylindrical, on a long stalk, drooping. Calyx hairy. —Gathered by Dr. Buchanan, on mossy rocks in Upper Nepal, flowering in January. The inhabitants call it Suni-pang, whence Dr. Buchanan named all the species of this section Sunipia, as composing a new genus. The difference of their habit from the original Stelides counterbalances 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 ovate 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, whitish, highly fragrant, crowded flowers, of the size and shape of the leaf, but remarkable for their calyx being all ever 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 distant oblong bulbs, on each of which stands a fleshy leaf, near two inches in length, and somewhat emarginate. Flower-stalks 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 fleshy globose 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-stalks a little remote from each bulb, hardly to long as the leaf, bearing usually two yellowish flowers, larger than any of the foregoing; their partial filaments an inch long, gradually swelling upwards. Petals pointed, much smaller than the ovate calyx-leaf. Lip ovate, revolute, entire, falked, 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,
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 imbied 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 fulfil his studies; but was detained in his progress at Florence, by Coloma 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 unlimited attention the works of Raphael, in company with Nicola Poussin, with whom he lived in intimacy and friendship.

He had received repeated invitations from the court of Spain, and at last set out from Italy with an intention of going there, but was again interrupted in his journeyings 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 state painter, and an apartment in the Louvre; and, before 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 blest odour to his works. His invention was ready, 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 such eminence. There are many of his pictures in the churches in Paris.

Stella, Giuseppe Maria, an Italian ecclesiastic, author of a tract entitled "Breve Instruzione Alli Giovani, per imparare con ogni facilita il Canto Fermo," 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 tretise on the subject, probably intended for the instruction of young persons intended for holy orders in the Roman 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 tar, by the numerous croffings which it makes. It is employed after arteriotomy in the temple.

Stella. See Pseud-Stella.

Stella Grinita, 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 proceffes, which are covered with a line down or hair.

Stella Lapis, in the Materia Medica, the name of a stone which has been very differently interpreted by different writers. Some have supposed it the asteria of Pliny, and some the common coralloid substitute; but Mulfre explains it to be the lapis lauiul.

Stella Marina, in Natural History. See Star-Fish.

Stella Arterioidea. See Basket-Fish, and Star-Fish.

Stella Occidentalis, a word used by some of the chemical writers to express salt ammoniac.

Stella Scapopendi, a name given by Linkius to a kind of star-fish with an indivited body, and five rays, resembling the bodies of the scapopodiæ, as those of the more usual kind, called Stella lumbricales, do the bodies of the common earth-worms.

Stella Verniformis, 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 Prifenis.—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 Licola.—Alfo, a town of Italy; 12 miles N. of Friuli.—Alfo, a mountain of the Grifoni; 15 miles S.W. of Tullis.

Stella, La, a town of Naples, in Principato Citra; 27 miles S.W. of Cangiano.

Stellarium, See Inter-Stellar.


STELTE
STELLARIA.

decisive mark, under all its numerous varieties, it may be known at once from every plant of its natural order, except *S. camphyloides* but particularly from *Ceratium aquatica*. *Leaves opposite, ovate, entire, smooth, on fringed stalks.* *Flowers white, inconspicuous, on solitary, axillary, or terminal stalks, which are hairy on one side.*

"It is a good vegetable boil-d like Spinach. Small birds eat the whole herb, as do young poultry."

3. *S. dichotoma.* Forked Stitchwort. Linn. Sp. Pl. 603. Sm. Pl. 1c. t. 14.—Leaves ovate, acute, stem forked. *Flowers solitary. Stalks when bearing fruit reflexed.*—Native of Siberia, whence it was sent by Gmelin to Linneaus. It flowers in July. *Root annual. Stem round, downy, much branched, and spreading on all sides, remarkably forked, leafy, manyflowered. Leaves two at each division of the stem, opposite, acute, stem, downy. *Flowers solitary, on round, downy stalks, which are upright at first, but bent back, as if broken, when the flower is ripened.*

4. *S. radians.* Radiated Stitchwort. Linn. Sp. Pl. 603. Willd. n. 3. (Alfina laxatlis, angular et oblongo falciis folio, flore albo, tenuifiae laciniae; Amm. Ruth. 64. t. 192.)—Leaves with small teeth, deeply five-cleft.—Native of Siberia, in swampy ground. *Root yellowish, jointed. Stems at the radical joints, about an span high, slender, upright. *Leaves opposite, pale green, hairy, veined, like those of a willow. *Flowers terminal, solitary, white, on slender stalks, with much divided or jagged petals, in which respect it differs from all the other species.*


"This herb has so much of a grasy appearance, that old botanists have named it the white-flowering grasf."

7. *S. graminia.* Sheifer Stitchwort. Linn. Sp. Pl. 604. Engll. Bot. t. 833.—Leaves linear-lanceolate, entire. *Pedicile 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 observ- able in the early summer months. *Root perennial, creeping. *Stems and flower-stalks perfectly smooth. *Leaves entire, scarcely ever rough at the margin. *Flowers in a dichotomous panicle, extremely elegant, white, baskinggurar 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 grays-green, not glaucous."

8. *S. glauca.* Glaucous Marsh Stitchwort. Sm. Fl. Brit. 475. Engll. Bot. t. 825. (S. palustris; Willd. n. 7.)—Leaves linear-lanceolate, entire, glaucous. *Flower-stalks erect. Calyx three-nerved, shorter than the petals.—Found occasionally in a moist, 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 habit, but perfectly distinct. *It has glaucous colour, perfectly 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-stalks are more univerally lateral and foliary, much less collected into a panicle, 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. holophylla,* but that is beautifully distinguished by the total want of nerves in its calyx, and the rough edges of its leaves and stem."

9. *S. uliginosa.* Bog Stitchwort. Sm. Pl. Brit. 476. Engll. Bot. t. 1074. Curt. Lond. facs. 6. t. 28. (S. uliginosa; Willd. n. 9.)—Leaves elliptic-lanceolate, entire, with a callous tip. *Flowers irregularly panicked, lateral. Petals shorter than the calyx.—Frequent in rivulets, and clear waters, in grass or rushes. *Flowers plentiful in June. *Root annual, fibrous, small. *Stems numerous, feeble, branched, square, smooth, leafy. *Leaves much veined, pale, glaucous, a little undulated at the margin, with a callous tip. *Flowers very small, yellowish, on axillary and terminal stalks, generally three in number, two of which are three-cleft and three-flowered, the remaining one single flowered, all furnished with membranous, lanceolate bracteas.* This species, like *S. camphylodes,* is remarkable for varying in the number of its styles, from three to five.

10. *S. saepigera.* Many-stalked Stitchwort. Willd. n. 17. Engll. Bot. t. 1260.—Stems shorter than the flower-stalks. *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, (Wildonow incorrectly says, none,) tufted, thickly clothed with numerous, opposite, acute leaves, smooth except at the edges, turning red in decay, each having a single rib, very thick at the base, tapering and vanishing towards the point. *Flowers terminal, white, on long, mostly single stalks.*


three or four inches long. Leaves opposite, sessile. Flowers axillary and terminal, two or three together, on capillary, long-ridged stalks.


17. S. gruendlichiana. Greenland Stitchwort. Willd. n. 15. Retz. Prodr. Fl. Scand. 107.—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. Willd. n. 16.—Leaves fruticulose. Stem erect, bifid. Branches alternate. Petals emarginate.—Native of Spain. Root annual, fibrous. Stem erect, round, a span high, downy and rather glutinous, 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 leaf alternately from their axils.

19. S. pubera. Woolly Stitchwort. Michaux Boreal-Amer. v. i. 273. Pursh v. i. 317.—Leaves fruticulose, ovate, fringed. Flower-stalks erect. Petals longer than the calyx.—Native of sandy 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 observe that the whole herb is remarkable for being clothed with a downy wool. The flowers are large and white. Calyx-leaves oval.

STELLARIA is also a name used by some authors for the carduius fellatus, or star-thistle. See CENTAUREA.

STELLARIS LAPIS, a name given by many authors to the various species of alstroemer, or star-lone. 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, apenora or woodruff, gallium, or ladies bed-flower, ajarine or cleavers, and rubia tinctorum or dyers' madder.

STELLENBOSCH, in Geography, a small town of Southern Africa, near the Cape of Good Hope. It consists of three long straight streets, running parallel to each other, and several crofs streets intercepting these at right angles. The houses are most of them, 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 small fire occurred, when the number of houses left standing was about 80. The church was built in 1722, and though not equal in size to the churches of Roodezant 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 seafar of the year, often make parties of pleasure to this fertile spot. Hence houfes are fitted up here for the accommodation and entertainment of strangers.

STELLENBOSCH. See DRAGENSTEIN.

STELLENBOSCH, Draygely ef, one of the divisions of the Stellenbosch district, is a very handsome village, consisting of about twenty 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 streets or open fpaces, planted with oaks, which have here attained a greater growth than in any other part of the colony. This village, which is the residence of the landdroft, is delightfully situated at the feet of lofty mountains, on the banks of the Eerle, or Frift river, at the distance of twenty-six miles from Cape Town. In it is a small neat church, to which is annexed a parsonage-house, with a good garden, and very extensive vineyard. The clergyman has a salary from government of 120l. 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 landdroft has a salary and emoluments that feldom fall short of 1500l. 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 fuch as they call egendoms, 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 droydy, which furround it, and lie between it and Faife bay. They consist chiefly of freehold eflates, 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 Simou’s-bay. They yield also a small quantity of corn. Barrow’s Africa, vol. ii.


Obi. S. Pafflerina has eight ilamens. S. Chamaegaphus ten. Linneus and other authors inaccurately define the calyx as a corolla.


1. S. Pafflerina. Flax-leaved Stellera. Linn. Sp. Pl. 512. Jacq. lœc. Rar. v. t. 68.—Leaves linear. Flowers axillary, selflile, with a four-cleft calyx.—Native of dry, funny fields, in Germany, Switzerland, France, and Italy, flowering in July and August. In general appearance, this herb resembles Thesium alpinum. It is acrid, bitter, and purgative. Root annual, spindle-shaped, nearly smpfe, yellow on the outside, white within. Stem upright, about six inches in height, much branched from the very bottom. Leaves alternate, selflile, acute, entire, smooth, spreading, reflexed, shaped like a sparrow’s tongue, whence Linneus adopted its old generic name as a specific one. The flm and branches are terminated by long, loose, interrupted, leafy spikes. Flowers selflile, three, four, or five together, on the ends of the leaves, imbedded in wood at the base, greenish, with yellow tips.

2. S. Chamaegaphus. Siberian Stellera. Linn. Sp. Pl. 513. Gmel. Sib. v. 3. 27. (Chamaegaphus radice Mandragora; Amman. Ruth. 16. t. 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 talle, and in its mode of growth greatly resembling the Mandrake root, divided generally into two parts, each furnished with numerous radicles. Sems numerous, slender, weak, reddish below, pale green at the summit. Leaves alternate, short, acute at each end, nervcd. Flowers white and purple, five-cleft.

STELLO, in Zoology, the name by which authors call the swift or spotted lizard. The spots which distinguish this kind are not, however, stellated, as might be supposed from the name, but round; some small, and featted 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 Er and Lizard.

The stellio, named by the Greeks cordileos, is the most common species of lizard in all the islands of the Archipelago, in Crete, in the Morca, on the eal coast of Natelia, in Egypt, and in Syria. Olivier describes it as hav-

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 verticelated, 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 palls that seafon in a kind of torpor. STELLIO Adylica, an affected term used by some chemical writers for eimbar.
The term stem is also occasionally, in some district, made use of to signify the handle of any sort of tool of the fork kind.

Stem of a Ship, is a circular piece of timber, into which her two sides are united at the fore-end; the lower end of it is feared to the keel, and the bowprit rests upon its upper end.

The stem is formed of one or two pieces, according to the size 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 rabbleting.

The outside of the stem is usually marked with a scribe, 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 stem, 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.

Stem, false, that fixed before the right one. When a ship's stem is too flat, so that she cannot keep a wind well, they put a false stem above, which makes her ride more way, and bear a better sail.

STEMMATA, in the History of Insects, are three smooth hemispherical dots, placed generally on the top of the head, as in most of the hymenoptera, and other classes. The name was first introduced by Linnæus. See Entomology.

STEMODIA, in Botany, derived from stemodium, a flamen, and his, double; each of the filaments bearing two anthers.


1. S. maritima. Sex Stemodia. Linn. Sp. Pl. 881. Swartz Obs. 242. (Scordium maritimunum ruticoformi, procumbens; Sloane Hiit. Jam. v. 1. t. 110. f. 2.)—Leaves opposite, half clasping the stem. Flowers sessile, solitary.—Native of the southern parts of Jamaica, on the east-shore. Root probably biennial, long, round, fibrous. Stem from one to three feet high, hairy, erect, or occa- sionally scandent, much branched. Leaves small, cellular, ovate-lanceolate, obtuse, ferrated, thickish, hairy, with smaller ones at the axis of the larger. Flowers few, axillary, among the terminal leaves, small, white or blue.

The whole herb has a pleasant aromatic smell, with a bitterish tinge.

2. S. duratifolia. Marth Stemodia. Willd. n. 2. Swartz Obs. 240. (Caparria duratifolia; Linn. Sp. Pl. 876. Veronica caule hexangulari, folia faterete ternis, terratis; Sloane Hiit. Jam. v. 1. t. 124. 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, clambilis. Leaves sessile, toothed or rather ferrated, spreading, nervcd, downy. Flowers on such short stamens as to be all but sessile, small, of a blue colour.

3. S. sijcofia. Vicid Stemodia. Mart. Mill. Dict. n. 4. Roxb. Coromandel. v. 2. 33. t. 163.—Leaves opposites, clasping the stem. Flowers on flsks, fully hariy. Native of Coromandel, in rice-fields after the crop has been cut. The Telingas call it Beda-sarum.—Stem herbaceous, two feet high, generally inclining to one side, branched from the base, square, hairy. Leaves linear, ferrated, clamby like the whole herb. Flowers axillary, small, violet-coloured. The plant has a pleasant aromatic fennel.


Vahl mentions a variety of S. camphorata, with narrower leaves, which, he says, may probably be Dodartia orientalis.

6. S. aquatica. Water Stemodia. Willd. n. 5. —Leaves three together; those imbermed doubly pinnate, capillary; those above water undivided, lanceolate, fertile. Spikes axillary. A native aquatic of the East Indies, found near Tranquebar. —Stem from six inches to two feet in height. Lower leaves doubly pinnate; upper three-nerved, smooth, deeply ferrated from the middle to the tip. Flowers alternate, fertile, in terminal spikes.

7. S. parviflora. Small-flowered Stemodia. Ait. n. 1. ("Erius verticillatus; Mill. Dict. ed. 8.")—Stem procumbent, much branched, downy. Leaves three together, on flsks, 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.

STEMONA, was so denominated by Loureiro, from stemodium, a flamen, because of the remarkable form and connexion of those organs in its flower; which latter circumstance led him to refer the genus to the class Monadophila. His genus, however, proves 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 flackle for the mere right of priority of names, in spite of authority, use, 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 Rox- burgia, for the sake of its author's authority. We cannot but contend for the occasional exercise of some disinterested 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.

STEMPHYLA,
STEMPHYLAL, a word used by the ancients to express the buds of grapes, or the remains of the preflings of wine. The same word is also used by some to express the remaining mats of the olives, after the oil is pressed out.

STEMPHYLITES, a name given by the ancients to a sort of wine pressed hard from the husks.

STIMPLES, in Mining, crofs bars of wood in the shafts, which are fink to mines.

In many places, the way is to sink a perpendicular hole, or shaft, the fides of which they strengthen from top to bottom with wood-work, to prevent the earth from falling in: the tranfverfe pieces of wood, used for this purpofe, they call flemes, and by means of thefe the miners in some places defend, without using any rope, catching hold of thefe with their hands and feet.

STEMSON, in Ship-Building, a piece of capproat timber, wrought on the affide of the apron, the lower end of which fears into the keel. Its upper end is continued high enough to tenon into the under fide of the middle or upper deck hook: its ufe is to fuccour the fears of the apron, as that does thofe of the item.


Gen. Ch. Cal. Perianth inferior, permanent, double; the inner of five broad, oval, equal, convolute leaves; outer of numerous ovate, concave, imbri cate, blinfih, pointless fcalas, not fo long as the former. Cor. of one petal, tubular, deciduous; tube twice the length of the calyx, swelling, smooth, and naked within; limb in five short, spreading, lanceolate, blinfih fegments, bearded underneath at the extremity, as well as half way along the dife from the base. Nectary a cup-shaped undivided gland surrounding the bafe of the germin. Stam. 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. Pjlk. German superior, roundifh, of five fefs; style capillary, the length of the tube; stigma fimple, obfute. Peric. Drupa nearly dry, globofe. Sec. Nut of three or more fells, with a thick, not very hard, fhell, not burfting, with a pendulous kennel in each cell.

Eff. Ch. Outer calyx of many imbri cate leaves. Corolla tubular; its tube swelling, twice as long as the calyx, naked within; limb much fhorter, spreading, bearded half way. Filaments included in the tube, fleshy, broader than their anthers. Drupa almost dry, of from three to five fells.

1. S. pinifolius. Pine-leafed Stenanthera. Br. n. 1. — Native of the neighbourhood of Port Jackson, New South Wales, from whence we have a fpecimen gathered by Dr. White, but this shrub has not yet found its way into the gardens of England. It is the only known fpecies of its genus. The stem is woody, erect, spreading, branched, feared; the younger branches hairy, clothed with innumerable, crowded, awl-shaped, pungent, revolute, roughift, feffile leaves, about an inch long. Flowers axillary, erect, feffile, about the bafe of each branch, very beautiful, with a rich fearlet tube an inch long, and a yellow-green limb, making a fingular, but molt agreeable, contrail. Drupa the size of a small pea, invcled with the brown chaffy calyx.

STENAY, in Geography, a town of France, in the department of the Menf, and chief place of a canton, in the ditref of Montmedy; 21 miles N.N.W. of Verdun. The place contains 3599, and the canton 14,434 inhabitants, Vol. XXXIV.

on a territory of 170 kilometres, in 18 communes. N. lat. 49° 30'. E. long. 5° 36'.

STENBOCK, Magnus, in Biography, a distinguished Swedish general, fon of Guiflauus Otto Stenbock, a general under Charles X. and XI., was born at Stockholm in 1664. He was educated at Upfal, and in 1683 he went to 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 to 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 Wifmar, where he employed his leisure time in com- posing a work on the art of war, entitled "The Swedish Military School," which, however, he did not find kifure or inclination to publish. He accompanied Charles XI. 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 entrusted with the command of detached bodies employed chiefly in levy- ing contributions; a service for which he was exceedingly well qualified: he was also employed in constructing bridges over luch rivers as the Swedish army had to pass, on its in- cursions 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 shameful abuses had been committed; and in order to put an end to them, and deter others from similar practices, he put the laws into mott severe execution; but a war breaking out put a floop to his plans of reform. When in- telligence of the Swedes being defeated at Pulawa reached Frederic IV. of Denmark, he made preparations for the invasion of Scania. Stenbock was appointed to oppose him; he put himfelf at the head of 8000 old troops and 12,000 new levies, and went in pursuit of the Danes, 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 drefled in frocks, and had pitfols tied to their girdles with cords. They at- tacked the enemy; and what was wanting in order and discipline, was amply compensated in zeal; and these raw troops completely defeated the regular army of the king of Denmark. The Danes quitted Sweden with great precipitation, having firit killed their horses, and destroyed by fire their baggage and magazines. They left behind them about 4000 wounded foldiers, 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 ftrengthen the fortifications of Christianfled, 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 enthrall him with the direction of another enterprise, to the successful and speedy execution of which great im- portance 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 Stenbock, to meet his Swedish majesty, on his propofed return from Turkey. In this meafure 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 himfelf to succefsfully, that he collected, in the courefe of a month, T
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 Rodlof; 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 Tommningen, 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 domestics, who obtained leave to wait upon him, and was in other respects subject to great restraint and severity. At length, exhausted by misery, chagrin, 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 consolation to his distressed relatives, and, at the same time, to preserve his name and reputation to posterity. This work was printed in 1773, in Lönomb's "Anecdotes of celebrated and distinguished Swedes," He died in 1719, 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 talents, and always held in high estimation by Charles XII. In his political sentiments he adopted the system of his father-in-law, the celebrated Oxenhierna. 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 risks, but in a war really undertaken on just principles." He had no share in the deposition of Augustus, for whom he had a sincere esteem. He incurred considerable blame for the severity which he exercised at Altona, and the minillers and generals of Poland and Denmark wrote to him complaining of his cruelty on that occasion; but Stenbock, who considered 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 cause the law of nations to be respected." Gen. Biog.

STENBRUGGE, in Geography, a town of Norway, in the province of Vingenhus; 8 miles N. of Tonborg. STENBY, a town of Sweden, in Earl Gotland; 11 miles E. of Nordenkoping. STENCH. See STINK.

STENCILLING. See PAPER-HANGINGS.

STENCKBACH, in Geography, a river of Saxony, which rises 4 miles S. of Landsberg, and runs into the Fuhe, 2 miles N. of Zorbig.

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° 50'. E. long. 12°.

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 Eutin.

STENE, a town of Norway, in the province of Drontheim; 48 miles E. of Drontheim.

STENFORT, a town of Hinder Pomerania; 8 miles S. of New Stettin.

STENHEL, a town of Sweden, in Velt Botnia; 32 miles N.W. of Lulea.

STENO, Nicholas, in Biography, a distinguished physician, and subequently bishop of Titiopolis, and vicar-apostolic of the northern countries, was born at 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 palled several years. He was at Amsterdam in 1669, and resided during the three succeeding years at Leyden, where he purified his studies with the utmost diligence. He arrived at Paris in 1664, and at the end of two years more went to Vienna, travelled 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 physician about the year 1667, with a liberal salary. He was afterwards honoured with the efeete and confidence of Cosmo III., who selected him as preceptor to his son. His attachment to the Protestant religion had been shaken by the eloquence of Boffuet 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 1672, Stenso returned to his native city, 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 resumed the education of the young prince of the house of Colmo, 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 Iauria, 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, Hamburgh, 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 sense, and organs of voice, and to the lymphatic vessels; as 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 Narium Vasa," 1662; this was enlarged and reprinted in 1664, with the new title "De Musculis et Glandulis Observationum Specimen." "Elementorum Myologie Specimen, seu Muculi Deferptio Geometrica," 1667. "De solido intra solidum naturaliter

1. S. Forsteri. Oval-leaved Stenocarps. Br. Tr. of Linn. Soc. n. 1. (Embothrium umbellatum; Linn. Suppl. Linn. Soc. 128.) Lamarck Dict. v. 2. 355. Illutr. n. 1285. t. 55. f. 1. Willd. Sp. Pl. v. 1. 358. E. umbelliferum; Forit. Gen. t. 8. f. a-f.). — Leaves elliptic-oblong, obtuse, with prominent ribs. — Gathered by Forster in New Caledonia. The flom is shrubby, with alternate, round, smooth, leafy, dotted branches. Leaves alternate on short thick flanks, coraceous, smooth, entire, an inch or inch and half long; tapering at the base; obscurely triple-ribbed in a dry state. Flowers about half an inch long, red, about six or seven together, in axillary, flatked, smooth umbels, subtended by three or four small, membranous, ovate bracts. Follicle near two inches long, like a small legume, with hollows for the seeds.


A genus of New Holland shrubs, either nearly smooth, or clothed with very fine greyish down. Leaves alternate, without veins; mostly undivided. Flowers single-lobed, foliary, single-lobed, without bractees. Flowers either purple or yellowish. Nut of the drupa often with only two cells, the others proving abortive.

"Bonitas", though very nearly related to Stenochilus, differs in having the upper lip of its corolla emarginate, the lower three-ribbed; 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. 142.

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 Lechenault.

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 erick." — Found also on the south coast of New Holland, by Mr. Brown. The flowers were pale, but the habit, as well as fruite, answered to the preceding. The flowers are from three to five inches long.

STENOGRAPHY, Short-hand, from ρωμοι and κατα. Palling 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 Buxtord, appears to have unfolded one of the earliest notions mankind had of a method of short-writing. Some of these abbreviations are merely the incipient letters of several words jointed together as one, and marked at the top with points; others are the final or terministical 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 lenography. 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 lenographic 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 he gave to the notarii the power of following 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-
STENOGRAPHY.

mended. In what the subsequent improvements confided
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
terms.

It is evident the Romans held this art in great estima-
tion; for Suetonius, speaking of Caligula, expresses his
surprise, that an emperor, who, notwithstanding his nu-
merous 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 witnessin g which of them
wrote the fastest. He not only amused himself with steno-
graphic, 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 oblige concerning himself, that he should
have made an excellent mimic or counterfeit.

Various were the schemes, as at present, which were for-
erly 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 de-
stroyed. The art was consequently much neglected, as is
evident from two books of short-hand, mentioned by Tri-
themius. The first was a Short-Hand Dictionary, which he
bought of an abbot, a doctor of law, for a few pence, to
the great satisfaction of the community to which he be-
longed, who had defied 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 Dictionar y 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. Germans, at Paris, carefully preserved as a steno-
graphical curiosity. The late Mr. Byrom had a few pages
of this transcript for his inspection and use.

Plutarch, in his Life of Cato, informs us, that the cele-
brated speech of that patriot, relating to the Carthaginian
conspiracy, was taken and preserved in short-hand; and
there are numerous epigrams of Aufonius, Martial, 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 Latini MS., entitled
"Ars Scribendi Characteris," or "The Art of writing in
Characters." The author of this is not known, but it was
printed about the year 1412.

We may jult, however, remark on this head, that the
ancient Irish alphabets, called Bobcob, a specimen of which
may be seen in Lediwick's Antiquities, and also in Dr.
Fry's Pantographia, have much the appearance of some of
our modern short-hands. Two of their alphabets were
called Irish Logums: Celtic words implying letters written
in cypher, and, indirectly, an occult science. They were
first stenographic, then Pegarographie, then magical, and,
lastly, alphabetic.

The Japanele 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 steno-
graphical 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 Theelcus Ambrofrus, in his
"Appendice des differentes Lettres et des diferentes
Langues," and cited by Druet, p. 132, 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 rather 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 com-
posed.

Lambinet, 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 motion, the debates of the tribune, 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 coloured; 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 partakes, perhaps, more
than all others, of short-hand, properly so called; but was
not intended so 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 be-

lieve it is his intention to make an experiment of the prac-
ticality of his scheme.

The art of short-hand was first attempted in this country
by Dr. Timothy Bright, who published his "Characteris"
in the year 1688. 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 "Brachygraphy," and contains rules to write as
fast as a man can speak with propriety and distinctness.
In 1618 appeared Willius's "Stenography, or Short-Hand
Writing by speaking Characters."

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 "Brachygraphy" was an attempt to im-
prove upon Willius's; but all improvements of the art, till the
invention of Byrom, were little better than the original:
--

arbitrary and mysterious.
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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 lay before the reader such a system of stenography, which, if generally known and practiced, 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. Ma-


von'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. Molinex, 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 assigned to the letters which are of most frequent occurrence.

3dly. That those 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. That all the rules of abbreviation should be founded upon the properties of the language, and expressed 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 flated to be the art of expressing all the words and phrases of the English language by a character which is perfectly regular and beau-
tiful, 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 obtaining 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 con-


sequently 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 ob-

ject with the inventor to expunge every thing arbitrary, both from the short-hand characters and the rules of abbrevi-

ation; and in this truly effential point he has succeeded to

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. Molinex, of Macclesfield, explaining the theory of the art in a very clear and perspicuous manner; and to a supplemental 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 familiarizing Mr. Byrom's excellent method for the general use of schools, and for the particular guidance of those who, without the aid of a living instructor, may be devoid of a literary attainment, which is at once useful and ornamental.

The letter C, having always the found either of k or s, is here represented by those letters respectively; s and z, and also f and v, having a near affinity to each other in found, are denoted by one and the same mark. The short-hand alphabet consists of the following consonants: w, b, d, f, or v, (the latter being easily distinguished when necessary, by a thicker stroke,) g, j, k, l, m, n, p, q, r, s, (differing in the latter, when necessary, by a thicker stroke,) t, w, x, y, z, ch, th, and sh.

The vowels, w, a, e, o, and u, though often omitted in short-hand, are easily repre-
sented by a dot or dots in five different positions, either 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.

1st. 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.

2dly. 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.

3dly. 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 arrangement of a threefold power or signification 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 head 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 de-


signified by its leading consonants, placed near, but not joined to the following part of it, secures alike the beauty and...
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 conso-
nant subjoined, but not connected with the end of the other
characters, when, by the mutual help of each other, they
describe long and complex words in a neat and concise man-
er, 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 be, and the second but. The
principal reason, however, for assigning two marks to the
fame consonant, is to secure a more easy combination of the
marks in writing, the first being used, for instance, before a
defending character, as be, or be, and the latter before one
which ascends, as or or . The first character is generally
written upwards, but the second is always made downwards.

Ufed as a preposition, the first denotes be; and the second,
used as a termination, represents , 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 de as a pre-
position, 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 de-
tached from the roots of their respective words. It is diffi-
cult 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.

Misch, however, depends upon the degree of force or im-
portance which the termination may poifea in the correct
pronunciation of the word, in writing the phrase, a learned
man, he is learned in the law, &c.; it is not chaff to say
a learned man, learn'd in the law. On this account it will
admit of a question, whether it would not be more correctly
to detach the termination ed in short-hand, notwithstanding it
will so very conveniently join in this word. And here let
the learner observe, once 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 are always written downwards. In
cases where dispatch is not required, the letter w 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 w,
and the thickness of the line by which it is expressed; the
letter j has, to use such a term, a thinner sound, and may
only be denoted by a thinner character; the sound of f and
w, however, is so nearly the same, that the same shaped
character is very properly used for both characters. These
remarks will apply to the letters s and z; in which is the fame
sound of sound, denoted by the same respective strength
in the pronunciation.

This character, as a word, stands for g or j; prefixed to
other characters, it represents the preposition for; and, as
a termination, -ify.

The letter G 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
eventually used instead of j. Standing by itself, it de-
notes, when written at the top of the line, the word
again, and at the bottom, again. It has no prepositional
or terminational character.

H is denoted by two characters; but the first only is to be
considered as the proper representative of that letter.
It is written downwards from the twirl. The other char-
acter might very well have been dispensed with; but
being retained in the alphabet, may still be used simply
to denote the word but; and notwithstanding the twirl is
at the bottom, it is better to write it downwards. The
first character stands for the word have.

When it is requisite to write the words hat, hit, hat, but,
or any others beginning with h, and ending with t, with
one or more vowels in the middle, the vowels may be indi-
cated by placing the vowel in its appropriate position with
reference to the line, but out of its usual order in other
repetitions, viz., immediately before the consonant, and not
lengthening the last letter, or t, below the line. By writing
the letter r, in the words hitter and bitter, only half its
usual size, the t in the former part of the word denotes th.

The letter J having been accidentally omitted in the
plate, it is supplied here by the following characters
j, standing, when written separately, for the words judge, and just; but the first only is the proper mark
for the words which the other character standing in a similar
situation to the last character for b; being in a manner
unnecessary: when used, however, it must be written down-
wards. There are some instances in which the letter g may be
used for j.

The next letter, K, is a very important one; for it re-
pre sents 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 expre-
sed by the letter s; and sometimes the k and q are
used promiscuously for each other, whenever greater facili-
ity, convenience, and beauty of joining, may be brought
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 can; and at the bottom, for could
or could. As a preposition, it represents, at the top,
middle, or bottom, con-, con- and contra:- in the middle
of the space, it denotes the terminations -ical or -ical.

Cm 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 k or c, and
beginning the next letter, m or n, 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 singly, the first character
denotes the word all, the second always, and the third
al-together.

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 among. As a preposi-
tion, at top it is magni-, in the middle mix-, and at the bottom
omn-. Used as a termination, it is ment; and it is cus-
tomary, in this case, to write it at the top of the line.

N, the letter m reversed, is also of frequent use. As a dif-
ficult word, it stands for an at the top, in the middle,
and under at the bottom. Prepositionally, it is
ante- or anti-, inter- or in-; and at the bottom, under- or un-
. As a termination, it stands for ent at the top, and -m at
the bottom; but when used in the latter case, it is cus-
tomary
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Stomary 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 revered. As a word, it stands for open; and as a preposition, for per-, pre-, or pre-. It may also occasionally be used for "ge.

Q is the k revered. In the middle, and at the end of words, it is frequently used instead of that letter. Ufed fingly, it is the word question.

R is the oblique character used for s, 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 or; as a preposition, for re-; and as a termination, for ropy and sing; the plural of which may be denoted by a small 3 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, the z 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 c 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 fat-is, circums-, super- and jub-. And, again, as a termination, according to the order of the vowels, for atom, a-otion; atom, a-ition; atom, a-reon; atom, a-cion; et cetera. Indeed, for the common terminations -aion, -aion; but whenever this termination is preceded by a single consonant only, the word must be written at length; as motion (mofin), nation (natin). When placed close after any of the pronouns, it no longer represents a-ition, or any other termination of that kind; but stands for self and selves, or sever, or severer; the first in the c's, and the last in the s's place.

T is a perpendicular line or stroke. As a word, it stands for the; as a preposition, for tran-; and as a termination, for -ty. It should uniformly be written downwards.

When two t'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 commenced. 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, nth, &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, prayer, &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 l. 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 -wards. With respect to the use of the letter y, in union with w, see the observations on k 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 r and g will often express the sound of this letter.

T 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 i, made thicker, when needful.

Ch are denoted by a character resembling the short-hand g revered, and stands for the word which. When founded hard, like k, as in words from the Greek, it is not used, but this latter letter used instead of it.

Sh have two characters, but the first is the only 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.

Th, a very frequent combination of consonants, are denoted by two characters, either of which may be considered as the legitimate representative of these 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 i, and a small t or c left, 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 withing 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 definable object to be attained by the practice of this art, eis. 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 copious 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 instruction 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 no unpleasant exercise of the learner's capacity; and if the few be properly given, the sense of the passage, and a due attention to the ideam 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 embarras himself with short-hand abbreviations, till, by a competent
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Competent practice of writing according to the rules already laid down, he becomes 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, must 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 this, 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 perpendicular to the last consonant mark; one placed before the substantive point, signifying the adjective, one after it, the adverb; as, forgetful, forgetfulness, forgetfully; reasonably, reasonableness, reasonably; 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 conceivably written, may be denoted by the first letter, if they begin with a consonant, if not, by the first vowel and consonant, with the adjective, substantive, or adverb point annexed; as, “life and immortality 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 lordship.”

Most writers of short-hand accustom themselves to mark such words as most frequently occur in their own particular prolixities, by the initial letters only, with the substantive, adjective, or adverb points, which, through custom, easily suggest the words to them at first sight. But it must not be understood, that those marks imply those words exclusively, and no other. They may fland 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 proposition, 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 manifest 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 proposition; 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, forming us to do our neighbors 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, signification, 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, when necessary, the substantive, adjective, or adverb point; as, deliberate, transmutation, recommendation, confidentiality, &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, confounding, confedered.

Words beginning with double or treble prepositions, may be written after the same manner, joining the prepositions together; as, representation, misrepresentation, incomprehensibility. If two consonants begin the next syllable, the writing of them both will help to discover the remainder of the word; as, misunderstanding, transconfabulation.

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, lowfulness.

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 -to, 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 good observations upon it.”

Rule 12.—Prepositions generally require after them either a noun or pronoun. The pronouns being few in number, and used as substitutes 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 some, any, none, which, each, both, &c. followed
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lowed by a preposition and pronoun, may be denoted by their first connotants, and may be joined to the preposition and pronoun; as, some of them, any of us.

Rule 19.-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 connotants, or at most by their first connotants and vowels; as, "you may safely de-

pend upon my word."

Rule 15.-Many common phrases, formed by a sub-

stantive preceded by the prepositions with, without, in, &c., and followed by to, of, &c., may be very conveniently abbrevi-

ated; as, with regard, reefs, or reference to, in order to, in con-

sequence, comparison, or consideration of.

Rule 16.—Common adverbial phrases are, in like manner, often denoted by their initial connotants joined together; as, at the same time, 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, so much as, as well as, as soon as.

Rule 17.—The contractions which may be made, when it is or it was, are followed by an adjectival, and to or that, are very numerous; as, it is impossible to, it was unnecessary to, 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 agerinum, and has been given by the later writers, and terra, or ereta Selenenata, by Dionysius and Galen.

STENOSA, in Geography, an island in the Grecian Archipelago, 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. side of the gulf of Bothnia. N. lat. 65° 12'. E. long. 21° 30'.

STENSSITZA, a town of Poland, in the patinate of Sandomirz; 28 miles E. of Radom.

STENTATO, in Geography, an island of the Grecian Archipelago, 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. side of the gulf of Bothnia. N. lat. 65° 12'. E. long. 21° 30'.

STENSSITZA, a town of Poland, in the patinate of Sandomirz; 28 miles E. of Radom.

STENTATO, an Italian musical term, given by Brof-

ard, 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 Stenter, the vociferous Stenter, celebrated by Homer (Iliad, lib. v.) as the most illustrious throat-per-

former, or herald of antiquity: "Stenter the strong, endowed with brazen lungs, whole throat surpafs'd the noise 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 "Musurgia;" however, the Stenterophon horn or tube of Alexander the Great claims primogeniture, as well as im-

mortal magnificence; 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.

STENVICK, in Geography, a town of Norway, in the province of Drammen; 24 miles S.W. of Drammen.

STENYCLARUS, in Ancient Geography, a town of La-

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conia, upon the river Parnius, N. of the gulf of Melas; where Cretphonte, one of the chiefs of the Heracles, established his residence, and which he made his capital, so that it was called a royal city, or βασιλικά. —Also, a plain of Melosia, W. of the river of Paunosias, known on account of a battle very disastrous to the Lacedemonians, in the year 684 B.C. Paunosias places this plain on the road from Megalopolis of Arcadia to Ithome.

STENZYLY, in Geography, a town of Poland, in Vol-

ymia; 15 miles N.E. of Luckow.

STEPS. See Place, Throne, &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 keelson, and that for the mizen-mast upon the lower-deck beams. The holes or mor-
tises into which the heel of the mast steps, should have suffi-
cient wood on each side, to accord in strength with the tenon left at the head of the mast, and the whole cut rather less than the tenon, as an allowance for shrinking. The step for the capitan is a solid lump of oak, let down between the beams, in which the spindle at the head of the capitan trav-
eres in an iron cup. Steps for the ship's side are pieces of oak quartering, with mouldings, nailed on the sides at the gangway, about nine inches asunder from the wales upwards, for the convenience of getting up the sides.

STEP, or Tongue, in Rope-Making, for the tar-kettle, is made of three-inch oak-pank, 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 yarn to pass through. The step is suspended and regulated by a tackle.

STEP and LEAP, in the Mange, one of the seven airs or artificial motions of a horse, consisting, as it were, of three airs: 1st, the pace or step, which is terra-a-terra; the rising before, which is a curve; and the whole finished with a fault or leap, which is a capriole.

This manage is infinitely less painful to a horse than the capriole; for when you dree 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 dree to the caprioles, will execute only baloteades and croupades, unless particular care is taken to make them jump our.

It is this, likewise, which, next to running a brisk course, enlivens and animates a horse most; to reduce a horse to the juftness of this air, you must begin by embolming and making him lose all fear of correction, teaching him to keep his head steady, and in a proper place, lightening his fore-paws by putting him to make pefades, and teaching him to know the aid of the switch, the same as in the lefion of the capriole, and by giving him a firm and good appui, and full in the hand; though it is certain that the step contributes to give him this appui, inasmuch as it puts him in the hand; besides, that it gives him strength and agility to leap, just as we ourselves leap with a quick step while running, than 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 rise, and hold him in the air; then let him make three or four pafades, and afterwards let him walk four or five steps slow and equal. If he forces the hand, or retains himself too much, he should be made to trot these four or five steps rather than walk; after this, make him rise again, and continue this lefion for some days.

When he is so far advanced as to comprehend and un-
derstand this sufficiently, begin by putting him to make a
pèfades; demand then a leap, and finish by letting him make two pèfades together.

There are two things to be observed, which are very essential in this lefson: one, that when he is to make the leap, he should not rise f0 high before as when he makes pèfades only, fo that he may yerk out with greater cafe and liberty; the other caution is always to make your latt pèfades longer and higher than the other, in order to prevent your horse from making any irregular motions, by fluffing 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 flps, that he may make again the fame number of pèfades, and in the fame order. In proportion as the horfe begins to under-

fand, and is able to execute these lefsons, you fhould aug-

ment likewise the leaps one by one, without hurrying or

changing their order, making always between two leaps a

fingle pèfade, but lower than thofe in the firft lefson, and

then two more again after the laft leap, and fufficiently

high.

By degrees the horfe will grow active and light in his hinder parts: you muft raife him then higher before, and

support him longer in the air, in order to make him form

the leaps perfect, by means of prudent andjudicious rules,

often practiced and repeated.

If a horfe forces the hand, or prefles forward more than

you would have him, either from heavines of make, or from

too much fire in his temper; in this cafe, you fhould oblige him to make the pèfades in the fame place, without

flurring from it; and instead of letting him advance four or

five flps, you fhould make him go backward as many.

This correction will cure him of the habit of prefing for-

ward, and forcing the hand. Upon this occafion, likewise,
you fhould use a hand-flpur to prick his croupe, instead of a

flwitch.

To make this air juft and perfect, it is neceffary that the

action of the leap be finifhed as in the caprifes, except that

it ought to be more extended; and that the pèfade, which

is the two leaps, fhould be changed into a

time of a quick and fhort gallop; that is, the two hinder

feet ought to follow together in a quick time, and briefly;

the fore-feet, as in curvets in the mezzair; but in this the

horfe fhould advance more, not be fo much together, nor

rife fo high.

The perfection of this time of the gallop depends upon

the juftnefs of the horfeman's motions. They ought to be

infinitely more exact in this lefson than in the caprifes, or

any other airs which are performed in a ftraight forward.

In reality, if the horfeman is too low, and does not catch

the exact time which parte the two leaps, the leap which

follows will be without any fpring or vigour, becaufe the

animal fo refrained and held back can never extend himfelf;
or put forth all his force. If he does not support and

raife his flhoulders fufficiently high, the croupe will then be

lower than it ought to be, and this difproportion will force

the horfe to tofs up his nofe, or make fome other bad mo-

tion with his head, as he is coming to the ground in his

leap; or elfe it will happen from this, that the fucceding

time will be fo precipitate, that the next leap will be falle

and imperfect, as the horfe will not be fufficiently united,

but will be too heavy, and lean upon the hand. If he is not

together, the leaps will be too much extended, and con-

fquently weak and loofe; becaufe the horfe will not be able
to collect his strength, in order to make it equal to the

first.

Learn then, in a few words, what fhould be the horfes-

man's feat, and what actions he fhould ufe in this lefson.

He fhould never force, alter, or loose the true appui,

either in raifing, supporting, holding in, or driving forward

his horfe.

His hand fhould be not only firm and feady, but it is

indispensably neceffary that his feat be exactly ftraight and

juft; for since the arm is an appendix of the body, it is cer-

tain that the motions of the horfe make or diforder the body

of the rider: the bridge-hand muft inevitably be fhook, and

confequently the true appui deftroyed.

In this attitude then approach the calves of your legs,
support and hold your horfe up with your hand; and when

the fore-pate is at its due height, aid with the fwitch upon

the croupe.

If your horfe rifes before, keep your body ftraight and

firm; if he lifts or tofles up his croupe, or yers out, fling

your flhoilders back, without turning your head to one fide

or the other, continuing the action of the hand that holds

the fwitch.

Remember that all the motions of your body be fo neat

and fine, as to be imperceptible: as to what action is the

most graceful for the fwitch-hand, that over the fhoulder is

thought the belt; but then this fhoulder muft not be more

back than the other; and care muft be taken that the motion

be quick and neat, and that the horfe do not fee it fo plainly

as to be alarmed at it.

It is faid, that when the horfe makes his leaps too long

and extended, you fhould then aid with the hand-flpurs,

and for this reafon, because the hand-flpurs will make the

horfe raife his croupe without advancing, as the effect of

the fwitch will be to raife the croupe, and drive the horfe for-

ward at the fame time; it fhould, therefore, be ufed to fuch

horfes as retain fhemselves.

Remember that you fhould never be extreme with your

horfe, and work him beyond his strength and ability: indeed

one fhould never alak of a horfe above half of what he can

do; for if you work him till he grows 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,

whether the rider nor the horfe can appear with brilliancy

and grace.


STEPAN, in Geography, a town of Poland, in Vol-

hynia; 15 miles N.E. of Luckow.

STEPENITZ, a river of Mecklenburg, which joins the

Trave, at its entrance into the Baltic.—Alfo, a river of

Saxony, which runs into the Ellie, near Wittenberg.—

Alfo, 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 Euxin sea, with a

port, where vessels were secure, between Cimilis and Po-

tani, according to Arrian.

STEPHANIOUSKO, in Geography, a town of Bo-

hemia, in the circle of Chrudim; 16 miles N.E. of

Chrudim.

STEPHANIA, in Botany, fo named by Lorencio,

from sèphos, any thing encircling the summit of some-

thing else; whence comes sèphos, a crown; and hence the above

appellation alludes to the anther, "which surrounds the head of

the filament, like a crown of gold."—Loureir. Cochin.

608.—Clafs and order, Dioccia Monandria. Nat. Ord.

Sarmentae, Linn. Alpargi, Jull.

Gen. Ch. Male, Cal. Perianth of five rather acute,

spreading leaves; the three alternate ones smaller. Cor.

Petale
Petals three, small, obtuse. Stem. Filament one, as long as the calyx, thick and abrupt at the summit; anther circular, crowning the filament.


1. S. rotunda. Round-rooted Stephania.—Leaves petate, roundish. Umbels compound.—Native of the woods of Cochinchina. Stem shrubby, twining, scarcely branched, very long, round, smooth, without thorns. Leaves alternate, falcate, petolate, roundish, obliquely triangular, acute, wavy, smooth. Flowers in lateral compound umbels. Petals of the male blossoms, which Lourier terms a three-leaved petalary, yellow. The root is a large, roundish, rough, brown knob, rifting above the ground, of a very bitter flavour, and agreeing with the Aristolochia rotunda in shape as well as qualities. It tends down into the earth a very long, central, perpendicular, thread-shaped radicle.


Stephania is also the name of a genus in Wildenow, Sp. Pl. v. 2. 193, dedicated by that author to the honour of professor F. Stephan, of Moscow; but this cannot aftide the long-published Stephania of Lourier, if the latter should prove, as appears by the above description, a good genus. There seems indeed more doubt respecting Wildenow's Stephania, which is thus defined.—Clas and order, Hessandria Monografia. Nat. Ord. Capparidaceae. Jaffé.


1. S. colominosa. Willd. n. 1. (Capparis paradoxus; Jacq. Hort. Schen cob. v. 1. 58. t. 111.)—Native of the Caraceas, from whence it was brought to Vienna by Dr. Joseph Marter, to whom we are obliged for a native specimen. The stem is fleshy, crept, with round leafy branches, clothed when young with rusty down. Leaves alternate, deflexed, lanceolate, pointed, entire, slightly wavy, from four to six inches long, with one rib and many transverse veins, marked with scattered glandular dots, each of which, in an early state, is furnished, on both sides of the leaf, with a hairy tuft of deciduous hairs. Footstalks half as long as the leaves, or more, straight, clothed with rusty down. Stipulae none. Clavicles terminal, solitary, simple, slightly leafy; their partial stalks clothed, like the calyx, with orange or tawny hairy down. Petals yellow, acute, downy, a little longer than the calyx. Stamens, and fork of the genus, four times as long. The genus of Capparis is so ill defined, that we know not how far this plant accords or not with some of the species, nor whether they require separation from the rest. If this should be the case, a new name must be sought for.

Stephanitae, in Antiquity, an epithet given to games and exercises, where the prize was only a garland.

Stephanium, in Botany, Schreb. Gen. 124, a name given by this author to Aublet's Palicourae. (See that article.) The genus itself is, however, abolished, Dr. Swartz having reduced it to Physutria. Fl. Ind. Occ. v. 1. 433, in which he is followed by Willdenow, Sp. Pl. v. 1. 971. These authors call Aublet's plant Physutria Paltuera. It is a native of Guinea and the West Indies. Stephania would be too near Stephania, if the genus of Schreber and Aublet were a good one.

Stephanakowice, in Geography, a town of Poland, in the patrinate of Belz; 34 miles N. of Belz.

Stephanophorus, i.e. Crown-Bearer, in Mythology, one of the priests in the festival of Ceres, called Thafmophoria; which see. Priests of the same denomination, called also Flamines, from a kind of bonnet and fire-coloured veil with which they covered their heads, officiated at the sacrifices appointed by Numi, and offered in the temple consecrated to Romulus.

Stephanowze, or Stephanestein, in Geography, a town of European Turkey, in Moldavia, at the confluence of the Pruth and the Bafzen; 40 miles N. of Jaffa. N. lat. 47° 58'. E. long. 27° 30'.

Stephanusberg, a town of Germany, in the principality of Anspach; 4 miles N. of Maybernheim.

Stephanus Dord, a town of Silefia, in the principality of Neill; 4 miles N.W. of Neill.

Stephanus, a town of Asiac Turkey, in Natolia, on the coast of the BlackIce; 18 miles N. of Sinob.

Stephanus, Byzantium, 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 Hermodaus, and dedicated to the emperor Justinian. This work is known by the title Praep. nabus, de Urbibus; but that of the original was Ladox; 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 Cahnorn, Scliger, and Salmasius. It was first printed in Greek at Venice, in 1522, under the superintendence 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 Berkheius, who added a very copious commentary. This edition was not completed when the learned editor died, and it was finished by James Grunovius. A fragment of the original, relative to Do- donna, is extant; and an edition of it was given by Gro- novius.

Stephen I., Pope, succeeded Lucius about the year 244. 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 temerity, by pronouncing the restoration of Balsides 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;
STEPHEN.

an opinion which was confirmed by a council of seventy-one bishops, held at Carthage. Their determination was lent 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-
flections against Cyprian. The latter instantly summoned another and still more numerous council, which unani-
mously confirmed the determination of the former af-
semble. The pope, in his turn, proceeded to anathema-
tize all the bishops who had affixed at the council, and all who adopted the same opinion, which comprised the pre-
lates of Africa, Egypt, and Leiffer Afa. Stephen's au-
thority was not much regarded, and his death, in 257, put an end to the dispute. The church of Rome, which has
pronounced in favour of his opinion, enrolled him in the
list of its saints, as it has done his antagonist.

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-
ceded by

Stephen III., who was elected in the same year. He
was a native of Rome, the son of a perfom named Con-
flantine, and had acquired the dignity of deacon of the Roman
church, when he was chosen to fill the pontifical chair. At
this time Afothphus, king of Lombardy, who had made
himself master of all the exarchate of Ravenna, threatened
Rome, requiring its submission, and the payment of a
tribute. The pope attempted to divert him from his de-
signs, but without effect; the haughty monarch invested
the city, nor could he be deterred from his purpose by the soli-
citation and threats of the emperor Constantin. The pon-
tiff 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 Afothphus in Pavia,
who was obliged to submit to the terms of restoring
to the church all the territories which he had feigned from it,
and also of relinquishing the exarchate of Ravenna. No
former, however, had Pepin repaired the mountains, than
Afothphus refused his arms, and marched to Rome, to which
he laid siege. Stephen had again recourse to his protector,
imploiring him, in the most urgent and pathetic manner, to
come to the relief of the holy see in its imminent danger.
He also employed all 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 person, and that
of the Blefséd Virgin, to halten and rescue his favourite
people. Pepin did not wait for the second invitation, but
immediately on hearing of the danger of the pontiff, marched
without delay, and laid siege to Pavia. Afothphus 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 see all the places thus yielded up by the Lombard
king, including the exarchate, which he had taken from the
emperor of Conflantinople. He afterwards caused the in-
frrument 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 fist polleffor, 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 preceding popes. He was titular priff of St.
Cecilia at the time of the death of Paul II. in the year
767. On that event, Toto, duke of Nepi, coming to
Rome with an armed band of friends and vassals, caufed
his own brother, Conflantine, then a layman, to be proclaimed
pope; and taking him to the Lateran palace, oblid the
bishop of Paleftrina to ordain him, and afterwards to confe-
crate him bishop. This ufurpation produced great discon-
tent at Rome, and various parties were formed, who elected
two popes, of whom one was instantly thrown into prifon,
and the other as quickly depofed; after which there was a
regular election, and the unanimous choice fell upon Ste-
phen, who was consecrated in August 768.

The firft act of the new pope was to fend a letter to
Pepin, and his sons Charles and Carломan, requesting
their protection, and also desiring that some learned bishops
might be fent from their dominions, to affift at a council
which he proposed to assemble at Rome, for the purpose of
reforming the ecclesiastical discipline, which had gone to
decay during the ufurpation. Pepin was dead before the
arrival of Sergius; nevertheless, he was received with great
repeft by Charles and Carломan, who complied with the re-
quell of sending bishops to the council. This was assem-
bled in the Lateran; and Conflantine, who had usurped
the popedom, and who had been deprived of his eyes, was
brought before it, and condemned to confinement for life in
a monastery; and all those who had received the eucharift at
his hands, among whom was Stephen himself, were obliged
to perform penance. The pope was now in peaceful pe-
feflion of his fee, but some differences arose between him and
Defiderius, king of the Lombards, who had not delivered
up all the places to which the church was entitled by the
treaty of Pavia, and had nominated a fucceffer to the vacant
archbishopric of Ravenna. Defiderius, having a party in
Rome, marched towards that city at the head of a body of
troops, and he obliged the pope to dismiss his minifters Chri-
topher and Sergius, whom he treated with great cruelty,
under the pretence that they were the partifans of Caralom.
He also urged Stephen to enter into an alliance with the
Lombards, till a solemn embassy from Charles and Car-
ломan, offering to maintain him in the possession of all
that their father had bestowed on the holy fee, relieved him
from his difficulties. A marriage being afterwards proposed be-
tween the daughter of Defiderius, and Charles, the pope
opposed it, in a letter which he wrote to the two French
princes, filled with declaration, not only against the Lom-
bards, but against the female sex. The match was, how-
ever, determined upon; and Bertrade, the mother of the
princes, visiting Rome, was received by the pope with great
honour, and was probably instrumental in procuring the de-
ivery, by Defiderius, of some places which he had still
withheld from the Roman fee. Stephen died in the beginning
of 772, after having governed the church nearly three years
and a half. Three of his letters are extant.

Stephen V. (IV.), pope, succeede Leo III. in 816. He
was of an illuftrious Roman family, and had been made
deacon by Leo, who, as well as the clergy in general,
etertained a high opinion of his learning and virtue.
Imme-
diately after the consecration, he obliged all the Roman
people to take an oath of allegiance to the emperor Lewis,
fan of Charlemagne, and he sent legates into France, to pro-
pose 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 passing 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 Basili,
was of a noble Roman family, a prebendary 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-
cceeded 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 Gros, who immediately sent a delegate to
depose the pope, as having been appointed without his con-
sent, or even knowledge; he was, however, pacified by a
solemn embassoy bringing the decree of election, signed by
thirty bishops, and all the leading laity; and Stephen was
confirmed in his seat. The eastern emperor, Basili 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 predeces-
sors, and strongly expressing his own disapproval of Photius.
This patriarch being afterwards deposed by the emperor 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 di-
penation 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 sati-
faction in the expulsion of Photius, but refused the dispas-
ification till he could be more fully informed of the case, for
which purpose he defined that bishops might be sent to him
from both parties. On the death of Charles the Gros
without male heirs, in 888, there was a competition for the
succession to the crown of Italy, between Berenger, duke
of Friuli, and Wido, duke of Spoleto; the pope and the
emperor declared for the latter, who was eventually chosen 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 beheld on
the dead body of pope Formosus, who had preceded
Boniface. Having assembled a council for the purpose, he
caused 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 apostolic 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 conferring orders, all persons who had
received them at his hands must be re-ordained. Stephen
re-
verted the decree of Adrian III., which determined, that on
a vacancy, the pope elect should be consecrated without
waiting for the presence of the imperial envoys. 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 929;
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 reformed 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'Ou-
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 sovereign, and then threatened them with excommu-
nication in case of disobedience. He also attempted to me-
diate between Hugh, king of Italy, and Alberic; and for
that purpose sent for Odo, abbot of Cluny, to Rome;
but both the abbot and he died very soon after, in the
year 942. 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 Liege,
he was one of the delegates sent by that pontiff to the em-
peror Constatine X., in order to conclude 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 Vi-
tor 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
faint. 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
effected the submision of the church of Milan to that of
Rome, after it had for some years withdrawn itself from
that jurisdiction; and he sent an embassy into the East, for
the object of uniting once more the two churches. His brother
Godfrey, who had married Beatriz, widow of Boniface,
duke of Tuscany, projecting to be chosen emperor, the
pope was very anxious to bring the design to effect, and for
that purpose he sent a perfon to secure all the t財re in the
monastery of Monte Cassino, which however he restored in
consequence of the tears and intreaties of the monks. His
regia was short: he took a journey into France, in order to
conferr with Godfrey, in which city he died, in the year
958, having fat in the pontifical chair only a few months.
Two letters of this pope are preserved, one to the archbishop
of Rheims, the other to the bishop of Marli.

STEPHEN, king of England, the son of Stephen, count
of Blois, by Adele, fourth daughter of William the Con-
queroor, 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
preferences. Henry entered into the ecclesiastical profe-
sion, and was created abbot of Glafonbury, and bishop of
Winchelter. But Stephen received higher marks of favour,
and more substantial endowments. He cau-
him to be married to Matilda, the daughter and heiress of
Eulace, count of Bolognus, gave him the earldom of Mor-
tagnie
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 subsequent Stephen, who, on his return, professed the most tender affection for his uncle; and displayed a marked eagerness in taking the oath for securing the succession of the empress Matilda, daughter of Henry I., 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 possess, 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 he now entertained the most languid 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 judiciary 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 death-bed, had declared an intention of disinheriting his daughter Matilda, and leaving the crown to Stephen, although several of the nobility had declared, and Stephen, in return, professed his most grateful declaration. Such was the reminiscence 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 abolish certain exactions and arbitrary measures of the reigns 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 incident to an usurpation, entered the north of England with an army, and took possession of Carlisle and Newcastle. Stephen outnumbered him, and made wide exactions as the price of peace. Robert, earl of Gloucester, natural son of Henry II., who was in Normandy when Stephen feized 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 sucesses of Stephen were, at first, equally flattering in Normandy. He was invited over to allume the sovereignty of that duchy, and in 1137 he accepted the invitation, and formed an alliance with the king of France. The kingdom 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 successes of the Scottih 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 combined in a conspiracy, which they held in defiance of the royal authority. Stephen having called, in 1139, a council of the nobility at Oxford, feized 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 seditions and undermining their character. Difcontents were, however, aggravaled, and Matilda, who had fled from England, was received into Arundel castle by Adelais, the queen-dowager. Stephen instantly marched thither, and invested the place, but Matilda escaped to Gloucester, where she remained under the protection of the earl. A number of barons declared for her cause; and in the following year, 1140, the flames of civil war spread throughout the kingdom; and from the cruelty, bloodshed, devastation, and famine which every where prevailed, this year proved one of the most calamitous in the English annals. Stephen performed his part with vigour and courage, but being taken prisoner in a battle which was fought under the walls of Lincoln in 1141, his party was broken, and Matilda, generally acknowledged as his heir. Before, however, she was well seated on her throne, her haughty and impolitic conduct excited an insurrection against her government. The legate, bishop of Winchester, joined the party of his brother Stephen, who was always popular with the Londoners. Matilda was invested in Winchester castle, whence, with the utmost difficulty, she made her escape; but her protector and friend, the earl of Gloucester, was taken prisoner in the flight. Stephen was exchanged for the earl, and the civil wars renewed. The events of the following years were disastrous to the country, which was plunged into a state of continual wretchedness. The emperors, after various changes of fortune, retired to Normandy, and Stephen, who was with them, was invested with the most extensive powers, and finally declared his will as the will of God. He married the earl of Gloucester's sister, and having thus gained a foot, was at length invested with the earl's estates, and obtained the earl's hand. He was received with the utmost honours, and the mark of respect paid to him was increased by a public declaration of the rights of the crown, laid all his party under an interdict.

The young prince Henry, son of Matilda and the count of Aipur, now advanced to majority, and displayed those qualities which afterwards rendered his reign in England glorious. By various fortunate circumstances, he became a powerful sovereign on the continent, and in 1153 he resolved upon an attempt to enforce his claims upon the English crown. He landed in England with a small army, which was soon augmented by the barons in his interest, and the contestants met at Wallingford. A decisive action was every day expected, for nearly a week, when the principal nobles, deñrous of putting an end to the miseries of a civil war, proposed an accommodation, and a treaty was set on foot, the difficulties of which were much alleviated by the death of Eustace, Stephen's eldest son. It was at length agreed that Stephen should pollese the crown during his life, that justice should be administered in his name, even in the provinces which had submitted to Henry, and that this latter
fter prince should, on the demise of Stephen, succeed to the kingdom, and 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 these quarrels and jealousies which were likely to have ensued in to dedicate 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 exception; 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 prevented the neighbouring states from taking any durable advantage of her confusion, her intestine 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 Csep : their leader was slain, and themselves completely routed. The body of Csep was divided into four parts, and exposed in four of the principal cities of Hungary. After this great victory, he established tea bibliography, 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, Gúla, 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, pursued them to their own country, and obtaining a signal victory, returned laden with booty. Beside the glory derived from his successes in war, he had that of being the legislator of his country. He published a code composed of fifty-five chapters, in 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 by the church of 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 school of Herleufsholm, and after having twice travelled into foreign countries, was made professor of eloquence at Soroe, in 1630. In 1639 he became professor of history in the same seminary, and was afterwards appointed to be historiographer by Christian IV. He died in 1650. Among his works are enumerated the following: "Breves Emendationes et Notae in Saxonem Grammaticum," 1627. "Florestium Sententiarum ex Saxone," 1627. "De regno Danie et Norvegia, Infulis adjacentibus Tractatus variis," 1629. "Suenonis Agononis Filii Opuscula, Notis illustrata, accedunt Leges Calabrense Canuti magi, et incerti Autoris Genealogia Regum Danie," 1642. "Historia Daniae Libri duo, qui componitur res memoratuis dignas, in Dania gellas, Regnante Christiano III. ab Anno 1550, ad Annum 1559." STEPHENS, in Geography, a river of Vermont, which runs into the Connecticut.

Stephens, Cape, a point of the American continent, opposite to Stuart's island, situated in N. lat. 65° 33', and E. long. 197° 41'.

Stephens's Passage, a strait between Admiralty Island, and the continent of America; the fourth entrance is between Point Hugh and Point Windham, from whence it extends about 70 miles north, a little inclining to the west. N. lat. 57° 20'. E. long. 226° 35'.

Stephens's Island, an island in the North Pacific ocean, about 14 miles in circumference, situated to the north of Pitt's Archipelago. N. lat. 54° 11'. E. long. 229° 32'.

Stephens's Island, a small island in the N.W. part of Cook's Straits, in New Zealand. N. lat. 40° 30'. W. long. 185° 6'.

Stephens's Islands, two small islands in the Eastern Indian sea, discovered by captain Carteret in 1767. They had a green pleanant 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 fix. The passage between them appeared to be about two miles broad. S. lat. 0° 22'. E. long. 138° 39'. Hawkeworth's Voyages, vol. ii. p. 387.

Stephens's Point, 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. 207° 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.

Stephens's Medicine for the Stone. Mrs. Stephens having folded medicines for the stone in the bladder, or kidneys, Dr. Hartley published several cafes of their success; and so much was said 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 500£ contoured pledge her, in 1739, for publishing the receipt.

Her medicines are a powder, a decoction, and pills. The powder is fix parts of fine powder of hen-egg shells, calcined till they become of a greyish-white colour, and of an acid salt taste, then left two months in an open vessel, till what is sufficiently calcined falls into a fine powder, to be separated from the grocer parts by passing it through a hair-sieve. To this egg-shell lime add one-fifth part of the powder of nails, with their shells burnt in a crucible, till they have done smokings. A dracon of this powder is to be taken thrice a day, in a large tea-cupful of white wine, cider, or small punch, and half a pint of the decoction is to be drank after each dose. If the patient feels pain, it
is to be made milder by opiates; if he is colicive, gentle laxatives are to be taken, and purging is to be restrained: if the powder is too strong in the above proportion of six parts of the powder of egg-shells 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 belt Alnicant foap, a large spoonful of the powder of swine's-creffies, burnt to blackness, and as much honey as was necessary. She boiled one of these balls fried 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, the takes the tame quantity of their roots, cut and fried. Those whose stomachs cannot bear this decoction, may take one-sixth 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-feeds, burdock-feeds, ashken-keys, hips and haws, all burnt to blackness, and reduced to a fine powder: with a large spoonful of this powder, four ounces of foap, and as much honey as is necessary, bring them to the constancy of pills of about sixty, which 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 ufe of these medicines, the patient ought to abstain from salt 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 LITHONTRIPPTICS.

Dr. Halles, after several trials on the different ingredients, found that the disolving power of them lay in the lime, which Dr. Rutty confirmed; and Dr. Jurin having taken foap-lees, the ingredients of which are pot-athes 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 pallied several small stones; after which he had no uneasines.


For other forms of administering foap and lime, and remarks on Mrs. Stephens's medicine, see LITHONTRIPPTICS. See also LIME-WATER.

STEPHEN, in Geography, a large and populous parish in the hundred of Oldkton, 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, 6146 houses and 35,199 inhabitants.

The origin of the name of Stepany is very doubtful, but is supposed to have been derived from the Saxon steb-hyche, a timber-hall 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 Stepany. In the year 1794 it contained, as Mr. Lysons remarks, "about 1530 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 marshy land." But since that year, the increase of buildings has produced a considerable diminution in the ground appropriated to agricultural and horticultural purposes.

In 1599, 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 poached by the bishops of London; and Roger Niger is thought to have died at the manorial residence in 1241. It palled, however, from that fee to king Edward VI. by gift from the ill-fated Ridley; and after being granted to lord Wentworth, defended 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-Crofts, and an annual fair on Michaelmas day. Stepney manor is now vested in the family of Colebrook. Exclusive of this the principal manor, the Dome-
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. Huikarls, Pomfret, Lord Wake's, Helles, Popham, Coebam, Mile-End, Ewell, and Runbadls. 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 streams to his mansion-house in London.

Almost opposite the present rectory-house, Henry, first marquis of Worcester, possessed a large manorion in 1665, of which the gateway only remains. It afterwards devolved 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 1497, the father of Dr. John Colet, who founded St. Paul's school; and Sir John Berry, a distinguished officer in the reign of Charles 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 adoreation before the Virgin and the infant Saviour. The wall of a porch towards the north-east contains a house, on which some veres, dated 1665, Rate to have been brought from Carthage. The church-yard contains, with many other celebrated names, those of Dr. Richard Mead, and his father. A short distance to the west of this edifice is an ancient wooden mansion, built, it is supposfed, in 1524, by Sir Henry Colet, and leased to Thomas, earl of Effex. 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. 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 Methodistical meeting-houses: these are Sion-chapel, a chapel belonging to the society of Friends in Brook-street, Ratcliffe, one of Mr. Whitefield's at Mile-End, which formerly occupied by Mr. Brewer, and some others of recent erection.

Popular hamlet, including Blackwall, is on the south-east side of Stepney, and is about seven miles in circumference. The revision of this manor was granted by William of Wykeham, bishop of Winchester, to the abbey of St. Mary de-Graces, near the Tower of London. At the dissolution of religious houses, it remained for some time vellied in the crown, and afterwards was given to Charles I., when prince of Wales; and, since that period, has been possesséd by different persons. The manor-house was formerly occupied by the family of Dethick. The chapel is a brick building, with a wooden turret at the west end; commenced in 1650, and finished in 1654, by a subscription, to which the East India company mortally contributed; and by them, in 1776, it was nearly rebuilt. The right of presentation, after several disputes, remains vested in them, on the condition of their keeping it in future repair. Its interior is divided into a nave, chancel, and two aisles: the windows contain escutcheons of some of the contributors, among which are those of Dethick. Within it are monuments to the memory of Robert Ainworth, the lexicographer; and the Shakspearean commentator, George Steevens, to whom one is erected after a design by Flaxman. Attached to this building are several alm-houses, for the support of decayed officers belonging to the East India company; and in various parts of the hamlet are other institutions of a like nature. In 1769, an ancient town-hall belonging to Poplar was taken down, and the present built in the following year.

Sir Richard Steele made his residence here for some time, and, in a vain pursuit after alchemicall treasures, considerably decreased his fortune. Adjoining to Poplar is Stepney Marsh, a tract of land lying between the former place and Blackwall. It appears, from an inquisition in the time of Edward II., that a considerable portion of land had been recovered from the river by a former lord of the manor, and had been by him granted to his vassals and retainers. This marish is peculiarly celebrated for the richness of its purltere, and once contained an ancient building, called the chapel of St. Mary.

The hamlet of Ratclifl lies in the western division of the parish. It is about two miles and a half in circumference; and in 1794 contained nearly 1150 houses, of which 456, with 36 warehouses, in the month of July in the same year, were destroyed by an alarming conflagration. The charity-school of Ratcliffe was instituted in 1716, and the schoolhouse in White-Horse-street built by subscription in 1719, to which great additional benefactions have since been made.

There are situated in this hamlet the church, the Friends' meeting, the mercers' alm-houses, a cemetery belonging to the Protestant dissenters, with dwellings for seven poor persons, and a school instituted by them in 1783, and the school-house built in 1785. The fire already mentioned left in ruins some buildings belonging to a dock, several manufacturies, and a free-school, founded by Nicholas Gibbon, sheriff of London.

Mile-End, Old-town, occupies the greater part of the northern division of the parish; its extent is about five miles, and in 1794 it contained about 1300 houses. In the time of Henry VI. the mutinous people of Effex, under the direction of Jack Cade, encamped at Mile-End.

In this hamlet is Brewer's meeting-house, (now Ford's,) and a Methodistical chapel. On the north side of the road are two Judicai 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 an hospital built in 1793, and an adjoining almshouse near the same spot.

Several other charitable erections, belonging to public bodies, are also situated on this road, viz., the Trinity almshouses, founded by that corporation in 1697; Bankcroft's hospital, founded in 1757; the skinners' almshouses, built in 1698; the vintners'; and three others, for the benefit of the whole parish collectively. A lazar-house existed here in the 16th century.

Lands in the manors of Stepney, Poplar, and Bromley, deeded by the custom of gavel-kind. Lyons' Environ of London, vol. iii. 470. 1794.

STEPPE, a name given in Russia to its plains and flats, which are very extensive, and interposed among its mountainous tracts. Some of the chief of these are the following; viz., the steppe of Pethora, bounded on the north by the Frozen ocean and the White sea, to the west by the Dwina, to the east by the Pethora, and to the south by the Floetz mountains, which extend from the Uralian chain westward across the government of Vologda. It therefore properly lies between and on both sides of these rivers. The ground is for the most part sandy, very marshy, thick grown with forets, and almost entirely uninhabited; the districts about Archangel, Meffen, &c. excepted. The trees, in the western
southern part, consist chiefly of the pinus sylvestris, firs, and birch; and on the elevation beautiful larches. On this level are several lakes and rivers.

The flesse of the Don river comprehends a large plain, which lies in the government of Ekaterinoslaw, between the Don and the Donetz, as far as the Terek and the sea of Azof and the Euxine. This extensive plain, comprehending the greater part of the governments of Ekaterinoslaw, Taurida, and a part of Voronech, Korkhof, and Kief, is, in general, a very dry and sandy quality, and contains many salt-lakes and salt-plots, but is little inhabited.

The flesse of the Don and Volga comprises the whole space between the Don, the Volga, and the Kuban; and is a large, very arid flesse, altogether destitute 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 Ekaterinoslaw and Saratof, where, in its sandy and calcareous flesse mountains, it contains coals, sulphur, pyrites, and warm baths. Within the confines of this flesse lies what is called the Kuman flesse, comprehending the whole space from this flesse to the spot where the Kuma flows out of the mountains, and reaches southward to the banks of the Terek and the Caufian sea, northward to the other side of the Sarpa, and eastward as far as the Volga. In this flesse lie the salt-lakes of Altrakhan, some bitter lakes, warm springs, &c. This flesse, it is said, has all the appearance of a dried-up sea: it is a sandy, part clayey and salt plain, without trees. Many circunmstances render it probable that it might really have been sea-bottom, as the flat shores of the Caufian and Azof seas, and the salt-lakes of their coasts, the low situation of the flesse, the saline lakes, and the sea-plants, &c.

The flesse 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 Kalmik flesse, and between the Ural and the Yenika, a part of the Kirghizs flesse lying within the Russian borders. The above-mentioned flesse is called the Kalmik flesse, 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 ells in breadth, extending from the Ural mountains, through the middle of the flesse, quite to the Caufian sea. The soil consists of sand, marl, and clay, often mixed with sea-plants, which indicate this to have been, like the Kuman flesse already mentioned, the bottom of the sea. To return to the flesse of the Volga and Ural. This to the south makes the margin of the Caufian sea, and to the north it skirts the flesse of amphibious animals that run out from the Ural chain. This plain, for the most part sandy, is very deficient in fresh water and wood; but is so much the richer in rock-fall, 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 flesse of the Irtysh denotes that large plain which extends between the Tobol and the Irtysh, and between the latter and the Alby and Oby, as far as the confines of the Irtysh into the Oby, including an enormous territory. This plain, with lakes of several kinds of flesse, among numerous wood firs, firs, 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 includes all that fine well-watered level called the Barabian flesse, on which is found many considerable lakes; extending in length from north to south above 600 ells, and in breadth 400 from west to east. Its plain has generally a good black soil, enlivened on its surface by many pleasant flesse of birch; hence it has been concluded, that the Baraba must have been one general bed of waters, and far more moray and abounding with lakes than it is at present. Another part of the large plain consisting the flesse of the Irtysh, between the Ichieh and the Irtysh, is called the Ichieh flesse, and is found to abound in bitter lakes, but in other respects resembling the Barabian flesse, in both which many ancient tombs occur. The greatest part of the whole flesse of the Irtysh lies in the government of Tobols, but the other part in that of Koliyvan.

The flesse of the Oby and Yenilfie includes the whole of that large tract beyond the Tihulim, (which falls into the Oby,) between the Oby and the Yenilfie, and extends to the shores of the Frozen ocean. The belt forests are found towards the south; on the northernmost margin of the Frozen ocean the wood is low and stunted. The whole of this flesse lies in the government of Tobols.

The flesse of the Yenilfie and Lena is a large tract of defert, bounded by the Yenilfie, the Tungulka, and the Lena; reaching northward, like the former, to the Frozen ocean, and resembling in its nature and quality. One part lies in the government of Tobols, and the rest in that of Irkutsk.

The flesse of the Lena and Indighirka is a vall extended plain along the shores of the Frozen ocean, between the Lena and the Kovyma, to the two sides of the Indighirka, and is wholly in the government of Irkutsk. Tooke's Ruff. Emp. vol. i.

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 hydros.

STERANG, in Geography, a town of Norway, in the province of Aggrebun; 16 miles N.N.W. of Christiansia.


Gen. Ch. Cal. Peranth inferior, of three or five, roundish, concave, acute leaves. Cor. Petals three or five, roundish, notched, unicellular, longer than the calyx. Stam. Filaments numerous, capillary, inserted into the receptacle; anthers roundish. Fil. German superior, ovate; style long, incurved at the tip; stigma capitate, concave. Peric. Legume cylindrical, long, corticose, fleshy, one-celled, not barbating. Seeds numerous, large, angulated, incumbent on each other, imbedded in the pulp.

Eif. Ch. Calyx of three or five leaves. Petals three or five. Legume corticose, not barbating. Seeds numerous, imbricated, imbedded in pulp.

I. S. Interifera. Wild. n. 1. (Singana guianensis; Aubl. Guian. t. 257.) A mass of woods in Guiana, where it flowers, and bears fruit in September.—This shrub is remarkable for throwing out numerous, knotted, creeping roots or stems, which run in a scattered manner over other trees, and are much branched. Leaves nearly opposite, falked, ovate, acute, smooth, entire. Flowers corymbose, scattered,
scattered, axillary, white, on short stalks. Legume a few-coloured.

STERCORARIANS, or STERCORANISTE, formed from stercus, dung, a name which thofe of the Roman church anciently gave to such as held that the hoft was liable to digestion, and all its consequences, like the food. STERCORARIUS Fiscer, the dung-fish, in Ichtyology, the name of an Ealt Indian fish; so called from its frequenting necessary-houses which are over the water, and other places where the like natfines is to be found. It is, for this reafon, supposed unwelcome by some, but is really a very well-tafted fish, and eaten by most people where it is to be had. It is a broad and thin fish, of about fix or seven inches long, and nearly as much in bread. Its back is variegated with spots of deep brown; its belly is bluefin.

STERCORARY, in Agriculture, a place properly fecured from the weather for containing dung. In collecting manures from time to time, as they come to hand, farmers generally keep them together in what they call dung-hills, where they remain exposed to the heat of the fun, the washing of rain, and the drying winds; by which means a great deal of their virtue is diffipated and loft. The making of fer- coraries has, therefore, been advised, which may be done by digging a square or oblong pit, of the fize fufficient to the quantity of the compofit 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 floping, fo as to receive a cart to load or unload eafily. The bottom fhould 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 cafern; and 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 flables and other offices about the house, they will be of great service. Some think that they should be covered, fo as at leat to hinder rains from falling upon them: but if care be taken to make the pit in a place where no running water or fprings 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 exhaling, or the rains washing away its richness, the quantity of water which falls in rain may not be more than requisite to moiften the mixture, and bring on that putrid fermentation which is neceffary for the due incorporating and perfecting of the compofit. It will, however, be right to have a shed to put it over occasionally, in cafe the feafon fhould prove extremely wet. It has been observed by Columella, that the Romans covered their ferocaries with hurdles; but he does not fpeak of covering them with mould, in the manner mentioned above. See Compoft, Fart-Tard, and Manure.


Gen. Ch. Calr. Perianth inferior, of one large, coloured, rather coriaceus leaf, deciduous; somewhat turbinate at the bafe; its lima in five deep, segment-like, in the dried state, none. Organs of impregnation elevated on a cylindrical curved column, various in length, but always much shorter than the calyx. Stem. Filaments scarcely any; anthers from ten to fifteen, cluftered, inserted into the notched margin of the top of the column, roundish, of two definite lobes. Pfl. German foliage above the anthers, roundish, of five lobes; fyle vertical, deflexed, cylindrical, not half the length of the column; fligma cleft, notched. Peric. Follicles five, spreading, ovate, oblong, large, coriaceus, or woody, furdling along the upper fide. Seeds feveral, oval, attached to each margin of the follicle.

Eif. Ch. Calyx in five deep segments. Corolla none. German and anthers elevated on a column. Follicles five, with many seeds.

Obf. Many of the flowers, on the fame or a different plant, have no pitif. In thofe with a pitif, 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 leaft in gardens. The margin of the column is scarcely defcribible in fome fpecies, nor is it, in any, confpicious enough to be taken for the filament of the flamen. We would therefore rather concur with Schreber and Wilfdenow in the defcription of this genus. The fyle is fometimes divided down to the bafe into five parts.

1. S. lanceolata. Lanceolate Chinefe Sterculia. Cavan. Diff. n. 416. f. 142. Willd. n. 1. Lamarrac n. 2. — No leaves lanceolate. Follicles oblong. — Native of China. A very certain fpecies, adopted by Cavannilles from a Chinefe drawing, in which the leaves were reprefented about one inch and a half long, and half an inch broad; the follicles about the fame length, narrow, crimfon, with three or four black feed in each. If fuch be the natural fize of the parts, the plant is different from any other known Sterculia. A fimilar reprefentation, however, of various dimensions, is common on Chinefe papers, and we fuppref it may, in every instance, be meant for a fpecies hereafter defcribed by the name of nobilis.

2. S. Balangas. Balangas Sterculia. Linn. Sp. Pl. 1340. Willd. n. 2. (S. folius ovalibus integerimis alterni petiolatis, florebus paniculatis; Linn. Zeyl. 166. Cydonia arbor, Balangas dicta; Burn. Zeyl. 84. Nux juglanis zeylanica minor bifida, flore puncceo; Rh. 170. Nawaghzas; Hern. Zeyl. 27, Colaba Syen in Rhedos. Hort. Malab. v. 1. 93, note ?) — Leaves exactly elliptical, with a fmall point; very flightly downy beneath. Panicles much fhorter than the leaves. Calyx hairy on both fides; denfely fringed at the margin. — Native of Ceylon. The flem is arborea, with round, fMOOTH, pale branches, leafy at the end. Leaves alternate, flalked, fiv or fix inches long, and two or half three broad, very excially oval, rather coriaceus, entire, in the whole genus, tipped with a fmall blunt point, scarcely half an inch in length; fur- nihed with one longitudinal, and many tranfverfe, ribs, all pale and fMOOTH, connected by innumerable minute reticulations; their upper surface bright green, shining, and smooth; under very little paler, foftcil to the touch, from scarcely discernible itary down. Footstalks fMOOTH, an inch or more in length, with a fhort of joint at the fummit. Panicles axillary, about the ends of the branches, manyflowered, twice as long as the footstalks; their branches alternate, thread-shaped, green, hairy. Flowers foltary at the end of each partial flalk, fmal, foid to be very fett. Bafe of the calyx cup-shaped, smooth within; fegmentS of its limb converging, and connected by their points, hairy on both fides, and particularly lipfided at the edges, relenitly divided, purple, yellow, or velvet or plufh. A fpecimen of this, communicated by Thunberg to Lin- neus, and marked Sterculia Balanghas, seems to be the
the real plant described with "ovate leaves" in the Flora Zeylaniae, from Hermann'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 specimem 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 Balanghas, because no recent author seems acquainted with this plant; though its name, in every body's mouth, is misapplied to several very distinct from it and from each other.

3. S. rubiginosa. Rusty Sterculia. Venten. Malmaif. sub fol. 91. Lamarck n. 4. (S. Balanghas; Wild. n. 2?) Cavan. Dill. n. 415. t. 144. bad. Cavalam; Rheed Hort. Malab. v. 1. 89. t. 49. Nux malabarica fulca mutulaginofa fabacea; Pluk. Almag. 256. —Leaves elliptic-oblong, taper-pointed, plant; downy and rusty beneath. Panicles much longer than the leaves. Calyx hairy on both sides, fringed at the margin.—Native of Malabar, Chittagong, Java, and Ceylon. A tall tree, with copious spreading branches. Rheed. The young branches, clothed with rusty down, are leafy and copiously flowery at their extremities. Leaves from three to six inches long, (on downy rusty flalks 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 rusty furry 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 flender, downy rusty flalks, and scattered, lanceolate, downy, deciduous bracteas. Tube of the calyx short, shallow, nearly hemispherical, very hairy externally, roughish within; limb three to five long, converging as in the leaf, most hairy at the edges, well compared by Rheed to red velvet, which holds good even of the dried flowers, though the colour is brown, or more faded, than in our S. Balanghas. Follicles resembling those of a Penny, two inches half long, containing brown seeds, hairy, downy at the outside; smooth, reddish, and wrinkled, internally. Such is the plant sent by Mr. Buchanan from Chittagong, exactly agreeing with Commeron's Java specimem, in fruit, and not less accurately with the plant of Rheed; whose figure, we must observe, is copied, or rather perverted, by Cavanilles. What was raised from Sierra Leone feeds, in lady Amelia Hume's Jive, appears by the leaves to be our rubiginosa, though their pubicence is less copious and less rusty than in dried specimem. Their texture is plant, not coriaceous. This may however be a distinct species. The seeds of the present, as well as the foregoing, are much eaten, like our chefunas, in India. They seem, by Plukenet's synonym, to be the real Malabar Nut; a name which, by some accident, has been vulgarly applied to Abylicia Adhatoda. Perhaps a similarity between the leaves of the two plants, raised from feed, may have led gardeners into this error.

5. S. urceolata. Pitcher-flowered Sterculia, or Wild Chocolate. (Complanus minor; Rumph. Amboin. v. 3. 169. t. 107.) —Leaves elliptic-oblong, acute, plant; pale and finely down beneath. Panicles close, hardly longer than the foot-flalks. Calyx pitched-shaped, hairy all-over. — Sent in 1797, by Mr. Christopher Smith, from the island of Honima, 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 being roasted and used as such, we know not. We conceive Rumphius's synonym, hitherto misapplied to the Balanghas, must belong to this species. Our specimena are distinguished by the longer proportion of their foot-flalks, which sometimes measure more than two inches. The leaves, though shaped like the leaf, are pale at the back, being very minutely down with whitish, not rusty, furry hairs. The flowers are much fewer in each panicle, and more crowded, the hairs of the flalks, calyx, and especially the margin of the latter, being hoary or white, not red or rusty. Bracteas ovato-lanceolate, with long points. Tube of the calyx pitched-shaped, contracted at the mouth, and nearly as long as the limb. We have seen no fruit. Rumphius describes his plant with whitish flowers, whose fect is opprobrious, but not lathing; the fruit of a fine crimson.

4. S. nobilis. Great Chinese Sterculia. (S. Balanghas; Art. n. 1. S. monosperma; Venten. Malmaif. t. 91.) Lamarck n. 3. Southwellia nobilis; Salif. Parad. t. 69, excluding all the synonyms, except Ventenata. —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 Jove 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 feeds, which are ripened in the Jove or conservatory. The Jem 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 fully grown very smooth, and copiously reticulated, of a rigid or coriaceous texture. Foottalks smooth, flout, above an inch long. Panicles drooping, very large, and copious, repeatedly subdivided; their Jalks pale, flender, downy and rather vilcet, very tender. Flowers drooping, of the fame pale buff hue as their Jalks. Tube of the calyx bell-shaped, nearly smooth; its limb downy, and sparingly hairy, with converging combined points. Anthers yellow. Gynaeceum of two Jalks two inches long, though shorter, and two united; fill Jes inwards. Seeds bluish black. When ripe, the calyx and Jollid, it having been merely from partial abortion that Ventenata's plant bore foliary feed. 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-houfe, whether in April, when covered with flowers, or in the latter part of summer, when laden with its large black feeds, standing on the edges of the red and brown feed-veffels. It is cultivated in the botanical garden at Calcutta, by the name of S. Balanghas.

STERCULIA.

lumn very short. Styles five, reflexed."—Native of the Mauritius. Commen. A. Cr. 21. 6. The leaves are fleshy, leathery, at the summit. Leaves six or eight inches, or more, in length, four at least in breadth, coriaceous, with a long point, smooth and shining, finely veined. Footstalk thick, two inches long. Panicle large and spreading, somewhat cymose, with thick, compressed, very smooth branches. Calyx large, with five, widely spreading, smooth, lanceolate, coloured segments. German near the cell, surmounted with five reflexed styles or stigmas, which cause a doubt concerning the genus of this species. —Poir.


Lamarck n. 15. (Cola; Bauh. Pfl. 507, Bauh. Hist. v. t. 210.)—Leaves elliptic-oblong, pointed, coriaceous, smooth on both sides. Panicles lateral, forked, hardly longer than the footstalks. Segments of the calyx ovate, spreading. Column very short. Native of the coast of Africa, from whence we have a specimen in flower, gathered by Dr. Asfels. 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; rufly, though quite smooth, beneath. Footstalks an inch or inch and half long, smooth. Panicles lateral, below the leaves, solitary, forked, dense, of about ten to twelve large flowers, their stalks, as well as the outside of the calyx, rough with dense hairy hairs, or rather a fort of deciduous m. quilts. Calyx spreading, an inch broad, in five, sometimes six, broad, ovate, obtuse segments; smooth and colored within. Column scarcely any. German rough, five-lobed. Stigmas five, reflexed. We do not find the calyx has more than five divisions; Poiret describes six. The follicles are said to be five, with solitary reddish seeds. The five stigmas, or styles, agree with the last. Probably this character, and the nearly feline germen, 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 Guiana coast, who are reported to take a portion of them to enhance the flavour of any thing they may subsequently eat or drink. Dr. Asfels 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 not, he brought it alive to this country, but it has not lately been heard of.

8. S. nitida. Shining Sterculia. Venten. Milm. fl. fol. 91. Lamarck n. 17. —"Leaves lanceolate-oblong, pointed. Segments of the calyx spreading. Column scarcely any."—Native of Africa; cultivated in the island of Mauritius. Venten inspected the flowers to be dubious. This may possibly not be distinct from the last species, but we have not sufficient information to form an opinion on the subject.

9. S. crinita. Hairy-fruited Sterculia. Cavan. Diff. n. 413. t. 142. Willd. n. 3. Lamarck n. 5. Ait. n. 2. (S. IViri; Swartz Ind. Occ. 1160. IVira pruriens; Aubl. Guan. 655. t. 279.)—Leaves ovate, acute, entire. Panicles as long as the leaves. Segments of the calyx lanceolate, pointed, spreading. Follicles hairy at the base; whitish within. —Native of the woods of Guiana, flowering in October and bearing fruit in May. Trees of this country, or the larger trees of that country, its trunk being fifty or sixty feet high, and four or five in diameter. The bark is red, thick. Wood white, not compact. Leaves from six to twelve inches long, firm, flaked; 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. Column 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 hairs; their cavities filled with fine, rigid, pungent, red bristles, enveloping the black seeds, and causing an intolerable itching, when incautiously handled.

10. S. frondosa. Wavy-leaved Sterculia. Richard Aft. Soc. Hist. Nat. Paris. v. 111. Lamarck n. 6. —"Leaves crowded, oblong-obovate, very blunt, somewhat wavy, smooth and shining, Panicles axillary, on long stalks."—Native of Cayenne. Richard: We inspect this plant may have been confounded with the last, even by Dr. Swartz. A specimen gathered by M. De Ponthieu, in the West Indies, and given us by f'r J. Banks, having very large and wavy leaves, answers in far to Richard's description. Some of its leaves seem moreover to be slightly three-lobed; and as Dr. Swartz cites De Ponthieu, it should seem that corresponding specimens to ours has been his only authority. Thus Willdenow has been led to alter the specific character of S. crinita for the worse.

11. S. cordifolia. Heart-leaved Sterculia. Cavan. Diff. n. 414. t. 143. 1. 2. Willd. n. 4. Lamarck n. 7. —"Leaves roundish heart-shaped, obliquely three-lobed, five-ribbed, smooth. Follicles downy at the outside, bristly within."—Brought from Senna 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.


Lamarck n. 16. —"Leaves undivided or three-lobed, irregularly toothed, on long stalks. Panicles terminal."—Native of the inland parts of the kingdom of Oware, Africa. A taller tree than S. acuminata, with large, broad, handsome leaves, either entire, fringed, or finely toothed. Calyx five-cleft. Column scarcely any. —Poir.

13. S. macrophylla. Large-leaved Sterculia. Venten. Milm. fl. fol. 91. Lamarck n. 10. —"Leaves roundish heart-shaped, somewhat wavy, rather coriaceous; downy beneath. Follicles very smooth within, with two seeds."—Native of Java. Là Hayes. The leaves are about eight inches broad, rounded, or slightly oval; heart-shaped at the base; thickest 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 thick. Panicles terminal, moderately branching. Follicles strong, reddish, wrinkled, obtuse. Flowers not observed. —Poir.

14. S. colorata. Coral-flowered Sterculia. Roxb. Coromand. v. 1 t. 26. t. 25. Willd. n. 5. Lamarck n. 12. —Leaves palmate, five-lobed, pointed; somewhat downy beneath. Calyx downy, club-shaped, with shallow upward lobes. Follicles italked, membranous, oblong, reticulated, expanded, smooth.—Native of mountains in the East Indies, calling its leaves during the cold season, and flowering in April, soon after which fresh leaves appear. The Gentoo, or Telinga, name is Karaka. This is a very large tree, with smooth greyish branches, leafy at the end. Leaves long stalks, more or less; leaves five-lobed, heart-shaped at the base, five-ribbed, minutely reticulated; smooth above; very finely downy, especially at the bases of the ribs, beneath. Panicles appearing before the leaves, about the ends of the branches, from four to six inches long, compound,
STERCULIA—Stinging Sterculia. Stinging Sterculia. Roxb. Coromandel. v. 1. 25. t. 24. Wild. 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 fleshy, coriaceous, rough with pungent bristles. — Native of mountainous parts of the coast of Coromandel, flowering during the cold feason, 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 fearcely serves but to make Hindoo gutters. The branches are leafy at the ends. Leaves measuring from nine to twelve inches each way, much left deeply lobed than the leaf, on long stalks. Panicles repeatedly compound, shorter than the leaves, with a linear brown bracteæ under each subdivision. Such bractæas however are not, as Willdenow supposes, peculiar to this species, though they are usually so 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 simple, short and thick, with a five-lobed stigma. Follicles five, greenish-brown, an inch and a half long, oval, coriaceous, concave, clothed with copious flingling bristles, so as not to be touched with impunity. Seeds four or five, oval, the size of a pea, roasted and eaten by the Hindoos.

16. S. villosa. Villous Sterculia. Roxb. M.S.S. — Leaves five-lobed, pointed, toothed, very downy, feeven-ribbed; heart-shaped at the base. Calyx deeply five-crested, spreading. Column cylindrical. Follicles coriaceous, rough with flary hairs. — Native of the coast of Coromandel. Our specimen was given by Dr. Roxburgh to lord vifcount Valentia, with the above name. The leaves are the size of the leaf, but with coarsely toothed lobes; the under side hoary, soft and downy. Flowers much taller than those of S. uren, with a longer and more slender column, as well as style; the latter, like the uren, very hairy. Calyx widely spreading, downy, with deep ovate segments. Follicles covered with rigid flarly pubescence, but no flingling hairs.

17. S. plataniifolia. Plane-leafed Sterculia. Linn. Suppl. 423. Wild. n. 7. Lamarck n. 9. Ait. n. 4. Cavan. Diff. n. 417. t. 145. Vahl. Symb. v. 1. 80. (Sterculia; Jacq. fil. in Ait. Nov. Helvet. v. 1. 40. t. 34. S. tomentosa; Thumb. Jc. Pl. Jap. dec. 4. " Firmiana; Maril. in Ait. Acad. Patav. v. 1. 106. t. 1, 2." Culhamia; Forl. Ægypt.-Arab. 96. Hibiscus simplicifolius; Linn. Sp. Pl. 977.) — Leaves palmate, smooth, five-lobed; heart-shaped at the base. Segments of the calyx linear, very deep. Follicles flaking, membranous, ovate, reticulated, concave, roughish. — Native of China and Japan, whence it has been differeered over many parts of the East Indies, and introduced into the gardens of Europe. At Padua it feeds in the open air. In England it is a hardly 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, and in length two feet, with acute entire lobes, and rounded finules; smooth above; rather paler, 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. Germin pyramidal, hairy, as well as the simple cylindrical style. Follicles more like those of S. colorata, n. 14, but green, much broader, and more concave. Seeds two or three, globose. Jacquin says the flowers are fragrant, molt of them perfect, a few males only being intercifted.

18. S. fistula. Petal Sterculia. Linn. Sp. Pl. 141. Wild. n. 8. Lamarck n. 8. Ait. n. 5. Cavan. Diff. n. 412. t. 141. Sonnerat Ind. Occ. v. 2. 234. t. 132. (Clompanus major; Rumph. 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 chestnuts, and are eaten by the Indians. The tree is straight and tall. Leghias from feven to nine, lanceolate, a finger's length, entire, smooth, on a long common footstalk. Clusters terminal, compound, drooping with smoothe italaks. Flowers smelling like human excrement, larger than the leaf, widened expanded; molt 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. Germin roundish, five-lobed, very hairy, as well as the simple⌠fly. Follicles oval, obtuse, woody, nearly as big as the fil. Seeds numerous along each margin. Cardi, Rheede Malab. v. 4. t. 36, cited by Linnaeus, seems rather of the order of Fitts. A superficial confusion 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 fructification may be in some species, such differences do not support each other. Thus the follicles of S. colorata and plataniifolia are so unlike all the rest, and agree together so remarkably in their partial flanks, and membranous veiny texture, that they at once indicate a distinct genus. But when we consider their ca-lyxes and stylæ, all particular relationship seems dissolved; for they accord better, in those parts, with many other Sterculia than with each other. Whether the simple or mani-fold stylæ, 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 filipulas of this genus have hardly been noticed, being very fugacious, but we believe they are always originally present, in pairs, at the base of the footstalks, and uniall of a lanceolate or awl-shaped figure. The bractæas frequent under the branches of the panicles, are larger, but nearly as quickly deciduous as the filipulas, at leaf in most of the species.

STERCULIUS, in Mythology, one of the firmans given to Saturn, because he was the first that laid dung upon lands to make them fertile.

STERCUTIUS, the god of ordure.

STERE, in Commerce, the unit for solid measures in the new French systém. See Measure and Standard.
STEREOBATA, or Stereobates, formed from εἰκοσιοσκελός, solid prop, in the Ancient Architecture, the bafis, or foundation, wherein a column, wall, or other piece of building is raised.

This answers pretty well to the continued fole or base-meat of the moderns. See Socle.

Some confound it with the ancient στρεφεῖον, or pedestal, (which see); but, in effect, the Stereobata is that to the stylobate, which the stylobate is to the spire or base of the column.


As it stands at present, in the newly-published Synopis of Acharius, where nine species are enumerated, this has every character of a natural genus. Its firm, branching froid, attached by a slender but very tenacious root, is formed to occupy the interstices of crumbling granite, and especially the cells of volcanic sferic. Hence it is the first of its tribe that clothes the loyly decaying lava of Veluvus and other burning mountains.

Of the nine species of Stereocalon above-mentioned, we feel least confident. The original one may serve to exemplify the genus.


Such is our only certain British species. What occurs on the lava of Veluvus, and which we did not, in gathering it, disfigure to be at all different, is called by Perfoon S. vesuvianum, and made a variety by Acharius of his own S. brotysum, n. 3, a Swijs species, unknown to us, whose characters indeed do not found very distinct.

STEREORAPHIC 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 properties of this kind of projection, see Projection, Stereographic.

The method and practice of this projection in all the principal cases, viz. on the planes of the meridian, equinocial, and horizon, are as follow.

STEREORAPHIC Projection on the Plane 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 equinocial and horizon; Z N the equinocial colure, and prime vertical circle: Z 15 N, Z 30 N, Z 4$5$, N, N 15 $9^2$, N 30 $9^2$, N 45 $9^2$, &c. are hour-circles, or meridians, and also azimuths, because the pole is in the zenith. To describe these circles, find the points 15, 30, 45, 60, &c. in the equinocial, by setting the half-tangent of their distance from $\gamma$; and then their centres are found by setting their co-feccants both ways, from their points of intersection with the equator: $\varphi$, $\varphi$, and $\psi$, $\psi$, are the northern and southern tropics, which are described by setting the half-tangent of 23° 30' from $\gamma$; then the tangent of its complement, viz. 66° 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-feccant of the parallel from the centre of the primitive, which would also have found the fame 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; $\varphi$, $\psi$, 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 30° to each sign.

STEREORAPHIC Projection on the Plane of the Equinocial. Let S C (fig. 11.) be the meridian, and folliollial colure; E N the equinocial colure, and hour-circle of 6; P the north pole; $\varphi$, $\varphi$, the northern tropic; E $\equiv$ N the northern half of the ecliptic (whole centre is found by letting off the feccant of 23° 30' from $\varphi$), and its pole is at a, the interfection 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 co-litude from P to Z; then the tangent of the fame, from P to O, or its feccant from Z to O, gives its centre; and its pole will be at $\beta$, 38° 30' (in the half-tangents) diiland from P, where $\beta$ is at the zenith.

To draw any other circles in this projection. 1. For cir-}

icles of longitude, which must all pass through $\alpha$, and the several degrees of the ecliptic; set the tangent of 66° 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 from the pole P $\alpha$, shall be the tangents of the degrees of their distances from the meridian S P C (which is that belonging to 180°.) 2. All parallels of declination are drawn off by setting the half-tangents of their distances from P. 3. All azimuths, or vertical circles, must pass through $\beta$ at the zenith: hence, therefore, the zenith is 38° 30' distant from P, set the co-feccant of that (or the feccant of 51° 30') from $\beta$ on the meridian extended below, and that will find the point $\kappa$, the centre of the azimuth of east and west; viz. E $\equiv$ N; and the centres of all the rest are in a line that is perpendicular to the meridian, and drawn through $\kappa$. 4. Circles of altitude, or alimacants, are feller circles, whose poles are not in the plane of the projection, thus the circle O P is a parallel of altitude 50° above the horizon. 5. All hour-circles are ftraight lines from the centre to the limb.

STEREORAPHIC Projection on the Plane of the Horizon. First draw a circle representing the horizon, and quarter it with two diameters; then will $\varepsilon$ be the zenith of the place; 12 z 12 the meridian; $\varepsilon$ z 6 the prime vertical, or azimuth of east and west (fig. 12.) Make $\varepsilon P =$ half-tangent of 38° 30' (or tangent of 19° 15'); and $P \equiv$ shall be the pole of the world. Make $\varepsilon = \varepsilon =$ half-tangent of 51° 30' (or tangent of 25° 45'); and $\varepsilon$ $\varepsilon$ = $\varepsilon$ = tangent of 51° 30'.

In this projection all alimacants are all parallel to the primitive circle; and azimuths are all right lines passing through $\varepsilon$, the centre of the primitive, to the equal divisions in the limb. Parallels of declination are all feller circles, and parallel
tereoigrapat, and their intersections with the meridian are found, by letting the half-tangent of their distance from the zenith, southward or northward, or both ways from it. Their centres are found by biseecting the distance between those two points; for the middle will be the centre of the parallel. Thus, \[ \pi = \text{half-tangent of } 28^\circ \text{ to } \text{from the zenith,} \]
and \[ \pi = \text{half-tangent of } 75^\circ \text{ to the southward, or} \]
= distance of the tropic of \( \pi \) from the zenith;
from the zenith.

And the intersection again with the north of the meridian, is at \( \{105^\circ 30'\} \) for \( \{\pi \} \) to the northward, or upward from \( \pi \).

For the hour-circles, make \( \pi = \text{tangent of } 51^\circ 30' \), or
\( P \cdot \pi = \text{tangent of } 51^\circ 30' \); draw \( G \cdot T \) perpendicular to the produced meridian; then, if from \( \pi \), with the radius \( \pi \), you let off the tangents of \( 15^\circ 30', 45^\circ 45' \), &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.

STEREOGRAPHY, 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 stereography. The sections of solids are also a branch of stereography; 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 stereography; 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 of them. 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 surface.

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 plane.

6. The inclination of a plane to a plane is the acute angle contained by two straight lines, drawn from any of the 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 fide 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 paralleleograms.

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 planes 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 spheroid.

16. The straight line extended between the centres of the two bales is called the axis.

17. A solid having any plane figure for its base, and its sides plane triangles terminating in the same point, 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 standing on 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 point; 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 cone; 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.


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 also 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 stand at right angles to each of them in that point, these three 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 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.

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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 the first 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 demarcated an hyperbola; if a cone be cut by a plane parallel to another plane which touches the curved surface, the section formed by this portion 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 rotate 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 solids 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 trihedrals.

In the construction of trihedrals, 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 trihedrals, not only as being the most useful, but as being necessary to the construction of oblique trihedrals.

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 $E B H$ (Plate I. Stereography, fig. 1.) equal to one of the given sides, and the angle $E F$ equal to the other; draw $E H$ perpendicular to $E B$, and $E I$ perpendicular to $B F$, cutting $B F$ at $F$; from $B$, with the radius $B H$, describe an arc, cutting $E I$ at $I$, and join $B I$; then $B I$ is the hypotenuse, from $E$, with the radius $E F$, describe an arc, cutting $E B$ in $G$, and join $G H$; then $E G H$ is the angle contained by the hypotenuse and the side $E F$, or the angle opposite the side $E B H$; or make $F I$ equal to $G H$, and join $B I$.

In the same manner the angle opposite the side $E F B$ may be found.

The reason will appear thus: raise the plane of the triangle $B E F$ upon $B E$, so as to be perpendicular to the plane $B E H$; raise the triangle $E G H$ upon $E H$, until $E G$ fall upon $E F$; then the plane $E G H$ will become perpendicular to $B F$; revolve the plane $B I F$ upon $B F$, and $F I$ will describe a circle, whose plane is also perpendicular to $B F$, from the point $F$; therefore, the plane of the circle and the plane $E G H$ will be both in the same plane; therefore, since the plane $F I$ coincides with $G H$, the straight line $F I$ may be made to coincide with $G H$: let this coincidence take place; and because $F I$ is equal to $G H$, and the point $G$ falls upon $F$, the point $I$ will fall upon $H$; therefore, the straight line $B I$ will fall upon $B H$; and the angle $F B I$, joining $F B$ and $B H$, is the hypotenuse.

Again, it is evident from the planes thus raised, that the angle $E G H$, contained by the planes $E B F$ and $B F I$, and perpendicular to $B F$, their common intersection, is the measure of the angle contained by the planes $F B E$ and $F B I$.

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 $H B E$ (fig. 2.); in $B E$ take any point $F$, and make $E F H$ equal to the angle required; draw $H E$ perpendicular to $E B$; from $E$, with the radius $E F$, describe an arc $E G$; draw $E G$ perpendicular to $B D$, cutting it in $G$, and $E H$ perpendicular to $A B$; make $E F$ equal to $E G$, and $E F H$ equal to the given angle; draw $B H C$, and $A B C$ will be the measure of the plane angle opposite.

The following propositions show 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 folio angle.

PROBLEM IV.

Given two sides and the contained angle, to find the other parts.

Make the angle $A B C$ (fig. 3.) equal to the contained angle; draw $B D$ perpendicular to $A B$, and $B E$ to $B C$; make $B D$ and $B E$ equal to each other, the angle $B D A$ equal to one of the containing sides, and $B E C$ equal to the other. Upon $C$ as a centre, with the distance $C E$, describe an arc $F I$; and upon $A$ as a centre, with the distance $A D$, describe another arc, cutting the former at $F$. Join $F A$ and $F C$, and then the angle $A F C$ will be the measure of the third side.

Now if the triangle $A B D$ be turned round the line $A B$, the triangle $C B E$ round $C B$, and the triangle $A C F$ round $A C$, until the points $D, E, F$, coincide, each of the two planes, $A B D$ and $C B E$, will be perpendicular to the plane $A B C$; therefore, 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 hypotenutal. Proceed, therefore, as in the last problem, and find the angle $G H K$, which will be the inclination of the two planes $C B E$ and $C A F$. In the same manner may the inclination of the planes $A B D$ and $A C F$ be found.

Note. The triangle $A B C$ represents the spherical triangle, of which $A B$ and $B C$ are the tangents of two arcs; and the angle $A B C$ is the spherical angle contained by the arcs, of which $A B$ and $B C$ are tangents.

PROBLEM V.

The three sides of a spherical triangle being given, to find the angles.

Make the three angles, $A B C$, $C B E$, and $E B F$ (fig. 4. N° 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 $A B$, describe an arc $A F$; draw $A C$ and $F E$ tangent at $A$ and $F$; join $C E$; draw the straight line $G H$ equal to $C E$. On the centre $G$, with the tangent $A C$, describe an arc at $I$; and on the centre $H$, with the tangent $F E$, describe another arc, cutting the former at $I$. Join $G I$ and $H I$; draw $I K$ and $I L$ perpendicular to $I G$ and $I H$, making them equal to $A B$ or $B F$; join $K G$ and $L H$. Now if the triangles $G K I$ and $H I L$ be raised on the lines $G I$ and $H I$, until the points $K$ and $L$ coincide; then each of the triangles $G K I$ and $H I L$ will be perpendicular to the triangule $G I H$. Proceed, therefore, as in the fifth proposition, to find the angles, which in the representation of the spherical triangle $G I H$ are represented by $G$ and $H$.

Scholium.—Since each of the extreme angles may be made the middle angle in N° 1, the triangle $G H I$, N° 2, may be
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 H.Olry, at page 215 of his Elementary Treatises. The substanke of it is as follows: Draw a right angle; make one of the legs equal to the difference of the coines of the fides containing the required angle, the hypotenuse equal to the chord of the third side. Upon the remaining perpendicular fide, as a base, confruct a triangle, whose two other sides are equal to the lines of the fides containing the required angle; then the angle contained by the lines 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 fide opposite to one of them being given, to find the other two fides and the remaining angle. Make the angle $ABC$ ($\text{fig. 5.}$) equal to the spheric angle next to the given fide; 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 fide. Draw $AF$ perpendicular to $BC$, cutting it in $F$; make the angle $FAG$ equal to the complement of the other given angle. On the centre $F$, with the distance $FG$, describe an arc $GH$; draw $CHE$ a tangent to the arc at $H$, the fame as in the second proposition. Join $AC$, and the angle $CEB$ will be the measure of the included fide. 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 fide of the spheric triangle.

**PROB. VII.**

Given two angles, and the contained fide, to find the other three parts. Make $ABC$ ($\text{fig. 5.}$) one of the given angles. Draw $BE$ perpendicular to $BC$. Make $BEC$ equal to the number of degrees contained in the given fide. 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 $GH$ equal to $GI$, and the angle $GKH$ equal to the other given angle. Draw $CBA$ (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 fide, 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 fide.

**PROB. VIII.**

Two fides, and an angle oppofite to one of them, being given, to find the three remaining parts. Draw $AC$ ($\text{fig. 6.}$), representing the fide adjoining the given angle, and $AB$ perpendicular to it. Make the angle $ABC$ equal to the given angle. In $AC$ take any point $E$. Draw $ED$ perpendicular to $BC$, cutting it in $D$, and $EC$ 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 fide, 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 $CI$, describe another arc, cutting the former at $M$. Join $HM$, $K$, $CM$; then the angle $CAK$, or $CAH$, is the measure of the spheric angle included by the tangents. The measure of the angle $AHC$, or $AKC$, representing the spheric angle oppofite the given fide, fhewn by the tangent $AC$, is found by Prop. 1. The angle $CMH$, or $CMK$, is the measure of the remaining fide; viz. that oppofite the angle included by the tangents.

N.B. This cafe 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 cafe also there is only one triangle.

**PROB. IX.**

The three angles of a spheric triangle being given, to find the three fides. Take the supplements of each of the angles, and describe a triangle by Prop. V., whose fides are equal to thefe supplements; then the measure of the angles of this triangle will be: the supplements of the fides of the fides 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 laid to enable any one, who has a clear conception of the parts of a spheric triangle, to derive 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 fecttons, 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 fides are bounded by the interferences of the planes of the three great circles of the fides of the spheric triangle; consequently two of the fides of the representative triangle are always two tangents from the same spheric angle. The included angle by thefe tangents in the representative triangle is the measure of the spheric angle contained by the fides which the tangents represent.

And the third fide 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 fides are planes from the centre of the sphere, falling 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 fides. The vertical angles of the fides of this pyramid are the measures of the fides 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 plane.

The triangle belonging to the preceding propositions is such, that when all the parts are completed, the fides may be turned.
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, familiar, and similarly situated to that above. The Rev. George Walker, in his ingenious doctrine of the sphere, Prop. I. p. 258, states, that "if there be a spherical triangle, and a plane quadrilateral figure be formed, two of the whole sides are the facets, the other two the tangents of two of the sides of the spherical triangle, and the angle comprehended by the facets be measured by the spherical base, the angle comprehended by the tangents shall be the measure of the spherical 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 facets, and the angle of the tangents, shall be the tangent and tangent of the spherical perpendicular, drawn from the vertical angle to the base; the angle which this diagonal makes with the facets, shall be measured by the spherical segments of the base; and the angles which this diagonal makes with the tangents, shall be the measures of the spherical angles which the perpendicular makes with the sides." This theorem is very analogous to Prob. V.; but the properties shown 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 triangles, as has been here shown, 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 the polygon; apply the base of the perpendicular section to this straight line, which now calls 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 A B C. Draw the diagonal D C. In B C take any number of points, e, through which draw the lines e f parallel to B D, cutting the diagonal line in the points f. From the points e draw the lines e g perpendicular to B C, cutting the curve A B in the points g; and from the points f draw the lines f b perpendicular to D C. Make all the lines f b equal to the lines e g; and through points D, b, h, ** I, draw a curve, and C D 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 D E, of the rectangle C D E F, is made equal to the circumference of G, and the breadth C D is the height of the cylinder.

If C D E F be wrap 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 B C E F G, (fig. 5) be half the circumference of the base. Divide it into the equal parts A, c, e, g, & c.; and let D E 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 c 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, m, &c. and n L, equal to B c, c e, e g, &c. Draw the lines n k parallel to D E, as also I L; and the lines b k, as also I E, 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 E F G to represent the ungula, and the covering F G I L wrap round F G D E; then, because that all the distances G n, n n, m, &c. are equal to B c, c e, e g, &c., the points n will fall upon those of e, which are represented by o 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 b, and the part F G I L 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
the elevation, which also represents a section of the cone through the axis.

On E is a centre, with the slant side D C, describe an arc C E. Make the arc C E equal in length to the circumference of A. Join D E and D C, and the sector E D C is the covering required.

For C being equal to the circumference of the base, when D E C is bent round the cone D B C, the straight line E D will meet C D, and all the points on the arc C E will coincide in the same plane with the base B C, since the superficies of the cone may be conceived to be divided into an indefinite number of isosceles triangles, whose vertex is the point D, and whose bases are in the base of the cone. The sector D E C may be conceived to be divided into as many isosceles triangles, which, when bent round, will respectively coincide with those of the cone.

**PROB. XIV.**

To cover a conical unguia, 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 A B C D (fig. 7) be the section given. Produce A D and B C to meet it in E. Bifect the vertical angle A E B by E I, cutting A B at K. On the centre I, with a radius A K or K B, describe a circle F M G N. Draw the diameter F G parallel to A B. Divide the semi-circumference F M G N into any number of equal parts, F o, o o, o &c. Draw the lines o p parallel to E I, cutting A B in the points p; the lines E p, cutting D C in the points q; and the lines D r, q r, q &c. parallel to A B, cutting B E in the points r.

Make all the distances B t, t t, t t, &c. on the arc A B, equal to F o, o o, o &c. Draw E B, E r, E t, E r, &c. on the centre E, with the radius E r, describe arcs, cutting the lines E t in the points t. Draw the curve line C F E, &c. and B C L H will be the covering required: for the sector E B H will be the covering of the whole cone; B t t t, &c. will coincide with the base; the lines E r will coincide with the lines E p, and all the lines r t will fall upon r p.

**PROB. XV.**

To cover a solid generated by the revolution of a semi-polygon, the section through the axis being given.

Produce any side A B (fig. 8) to meet the axis produced in C. On C as a centre, with the radius C A and C B, describe arcs A E and B D. Draw the radius E D C, and A E D B will cover a part of the frustum of a cone, represented by A B G F, 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 A B C D E (Plate III. figs. 1, 2, and 3) be the base, F G H the perpendicular section, G F its base, drawn from the centre F, perpendicular to the side A E. Draw the curve G H into any number of equal parts G I, II, II, &c. Draw the lines i f parallel to A E, cutting F G in the points k, and F E in the points l. Produce F G to P, making G P equal to the arc G H, and divide G P into the same number of parts in the points m, as G H is divided into the points l. Draw the lines m m n at right angles to G P, and the lines l n parallel to it; or make the lines m n equal to k l, and through the points n draw a curve; then A P E will be the covering of one of the curved superficies required.

If G H F be a quadrant, each edge of the covering will be the same as that of a cylindrical angle of the same diameter, cut at the same inclination as the angle F E G.

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 H F be raised upon the base G F until it becomes perpendicular to the plane A B C D E, and the covering A P E bent round; the points m will coincide with those of i, and the lines m n will fall upon the lines k l.

There is another geometrical method of finding the superficies of a solid in plano, 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 let 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 side or term of the base of the polygon, those of the similar section to cut the perpendicular side. Take all the respective lengths of the lines, 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. A B C is the similar section to the perpendicular one; A B representing its base, B C its perpendicular, B D the length of the curve of the perpendicular rib, A E the side of the base of the solid. The manner of describing these coverings is plain to inspection. A B C (fig. 4) is for a curve of contrary flexure; A B C (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 A B C; if the outer edge of the perpendicular rib be a curve of contrary flexure, as in fig. 6, described from the summits of equilateral triangles, the similar rib A B C (fig. 4) may be described in the same manner. To find the height B C, 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 F G H (fig. 7) to be the perpendicular rib, G H its base, G F its height. Make A B to B C, (fig. 4) as H G to G F, 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 i p (fig. 1) are drawn parallel to G F, intercepted by the line H F, all the lines k l, as they recede from G E, are proportional to the lines i p, as they recede from G F.

Draw H K (fig. 7) perpendicular and equal to H G. Join K G. Make H I equal to A B (fig. 4), that is, equal to half the breadth of a side of the base of the solid, and join I G. Draw L m, M n, N s, O y, P e, from the points L, M, N, O, P, in the curve F H, parallel to G H, cutting G F in the points v, w, x, y, z, and L M N B C D E P E, parallel to H K, cutting I G in the points V, W, X, Y, Z, G K in the points A, B, C, D, E, and G H in Q, R, S, T, U. Then, because of the parallelograms G L Q, G W M R, G X N S, G y O T, and G e P U; G Q.
G Q, G R, G S, G T, G U, are respectively equal to v L, w M, x N, y O, z P; and because of the similar triangles KHG, EUO, U T D, S C G, B R G, and A Q G, and because HK is equal to H G; U E, T D, S C, R B, and Q A, are respectively equal to U G, T G, S G, R G, and Q G; therefore U E, T D, S C, R B, and Q A, are respectively equal to z P, y O, x N, w M, and v L. Now H I, U Z, T Y, S X, R W, and Q V, are to one another as H K, U E, T D, S C, R B, and Q A; therefore H I, U Z, T Y, S X, R W, and Q V, are as P z, O y, x N, w M, and v L; but A B, c d, e f, g h, i k, l m, (fig. 4.) are to one another as P z, O y, x N, w M, and v L; therefore H I, U Z, T Y, S X, R W, and Q V, (fig. 7.) are also as A B, c d, e f, g h, i k, l m, (fig. 4.); but H I is equal to A B, (fig. 4.); therefore A B, c d, e f, g h, i k, l m, are equal to H I, U Z, T Y, S X, R W, and Q V.

From what has been said, the geometricalian will soon perceive that the coverings A D E (figs. 5 and 6.) are what is called the figure of the frustum.

Example.—Let A B C (fig. 8. N° 1, and fig. 9. N° 2) be the generating plane, A C its axis, B C its base, B E D half the base of the fold, B f j j f . . . . . D the curve line of the section; take the equidistances B f, j j, f f, &c. and on the centre of the base B, describe arcs cutting C B, the base of the frustum, in the points g; draw the lines g b perpendicular to B C, cutting the curve in the points b. Make I K, (N° 2. fig. 9.) equal to B f, j j, &c. and let the points I, in I K, be thence which correspond to f, j j, &c. (fig. 9. N° 1.) Draw perpendiculars I m to I K, equal in length to g b, N° 1, and the curve K m m . . . . . I, being drawn, will give the superficies of the frustum.

STEREOMETRY, \(\Sigma v r e f r o m G \), formed of \(\varepsilon f f o n s f o i d d\), and \(\varepsilon f f o n s m e f f o r e\), that part of geometry which teaches how to measure solid bodies, i.e. to find the solidity or solid content of bodies; as globes, cylinders, cones, vases, vases, &c.

The methods hereof see under the respective bodies; as GLOBE, SPHERE, CYLINDER, &c. See also GAUGING.

STEREOTOMY, formed from \(\varepsilon f f o n s f o i d d\), and \(\varepsilon f f o n s f e t t i o n\), 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 solids 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 figure of a pyramid or cone of rays. But as it has not been the object of the writers on perspective to state the rules for finding the sections of solids in general, under certain specified conditions of 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 solid 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 more acceptable, particularly as 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 feet, A, B, of the intersection in space of two planes, having a given inclination, and the inclination, 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 feet 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 C E 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 E C; make the angle C B F equal to the inclination of the planes, which have A B for the feet 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 A D E to be turned upon A E, until it becomes perpendicular to the plane Y; let the plane Z be turned upon C E, until E B fall upon E D; that E B will fall upon E D is evident, since E B, in revolving upon E C, will always be in a plane parallel to E C; and E D is also in a plane parallel to E C; E B must fall upon E D, and the point B upon D; and the plane A E D will be perpendicular to the two planes C E A and C E B; therefore A D will be perpendicular to the plane C E B; whence it is manifest, that C B F is in a plane perpendicular to the common intersection, and is the measure of the inclination of the planes.

PROB. II. Fig. 2.

Given I N, the intersection of a plane, W, with another plane, X, and their inclination, the feet, A, B, in the plane, X, of a line in space infilling 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 B S perpendicular to I N, cutting I N at E; make the angle B E F equal to the inclination of the plane; draw B G perpendicular to B S; make B G the tangent of inclination to the radius A B; draw G F parallel to B S; through A, draw any two lines A J and A K, cutting I N at J and K; make E S equal to E F; through S, draw V L parallel to I N; produce B S to P; make S P equal to F G; draw V P parallel to A K, and P L parallel to A J; and join K V and J L, cutting each other at a; and a is the section of the line in the plane W, as required.

For the imagine the triangles B E C and C G F in the same plane to be turned upon B E, so that their plane may be perpendicular to the plane X; then B G 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 I N, until E S fall upon E F, as is evident for the same reason as given in the first problem, and the point S will fall upon F; then the line V L will become parallel to the plane. In revolving the plane W upon I N, imagine the plane Y to revolve upon V L, at the same time, so that the plane Y may always continue parallel to the plane X; then V L will continue parallel to the plane W, and B S will continue parallel to A J; then, as in perspective, X is the original plane, W the plane of the picture, Y the vanishing plane, G or P the plane of the eye coinciding therewith, I N the intersecting line, V L the vanishing line, J, K, the intersecting points.
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 \( A \).

**Prop. 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 seat of the line in the plane \( W \), and its inclination to the said plane.

Draw \( G O \) (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 seat 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 seat is \( A B \), and the point \( a \) is another point in the line whose seat is \( A B \); therefore, \( R \) and \( a \) are two points in the line whose seat is \( A B \): then join \( R a \), which will be the part of the line in space on the other side of the plane \( W \), and \( aT \) its seat.

*Scholium.*—This amounts to the same thing as the seat 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 seat and inclination of the visual ray.

**Prop. 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 same inaccessible point.

From any point \( A \), in \( A B \), draw a direct 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 \( D \); find \( D F \), 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 concurrency.

*Scholium.*—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 these 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 \( BC \); and let \( a \) be a given point, from which it is required to radiate other straight lines to meet or tend to the same points in \( BC \), with those drawn from \( A \). Join \( A a \), cutting \( B C \) in \( G \); and through any convenient point \( C \), in \( B C \), draw \( EF \) parallel to \( A a \); make \( C P \) equal to \( G A \), and \( C Q \) 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 \( Cn \), \( C f \) equal to \( Co \); draw \( da, ea, f a \), which are the lines required. This might also be neatly effected by the proportional compasses; but the centred, invented by the author of this article (Mr. P. Nichollson), is much preferable. It is described under the article SCENORAPHY, 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, \( A_{1} \), for the foot of the fyle; then \( A_{1} B \) will be the fyle of the fyle, or of the line tending to the pole of the world: the fyle of the fyle is its inclination. Find \( a \) the representation of \( A_{1} \), that is, the fyle of the fyle of the dial in the plane \( W \), by the second problem: produce \( A_{1} B \) to meet \( I N \) in \( D \); draw \( D a \) in the dial-plane \( W \); then, by the third problem, find \( aT \), the fyle of the fyle 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 lines passing through the fyle, making angles respectively of \( 15^\circ, 30^\circ, 45^\circ, 60^\circ, \&c. \) 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. \( aT \) is the fyle of the fyle, whose intersection is \( T a \); \( T a R \) its inclination; \( aD \) is the 12 o'clock line; and \( U a, Y a, Z a, \&c. \) are the hour-lines. Another method of finding the sub-fyle is thus: produce \( G Q \) to meet \( P E \) in \( H \); join \( H A \), which produce to \( N \); draw \( N a \) the sub-fylter line.

Thus, upon one common principle, the sections of lines, planes, and solids may be found. The sections of folds are found by means of the sections of planes: the construction of a dial is but 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 foot, \( A B \), 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 \( a n q r \) will be the section of the pyramid inscribed upon \( A N Q R \).

**Example 3.**—To find the section of a prism (fig. 7.), the same thing 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 \( M n \) parallel to \( K V \), and \( q u a r \) will be the section of the prism required.

**Plate II. Fig. 3.** To find the section of a cuneiform or cono-cuneous, the same things as before being given, the base of the solid being \( a b c d e f g h \).

Let \( G a \) be the fyle of the plane, passing through the apex, and the centre of the base in the original plane, cutting the base of the solid in \( a \) and \( c \): divide each half on each face of the diameter, \( a e \), into any number of equal parts, as four: through the points of divisions 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, 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 \( G \), 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. 2.** Shews the method of finding the section of a cylinder upon the same general principle, only with this difference,
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ference, 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 parallel to HL; and by this means the figure abedfgb is the section of an oblique cylinder, whose base is FB.

Fig. 1 shews the section of a cone upon 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 said points to 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 palling through its apex, and forming the section into a hyperbola.

Figs. 4, 5, 6, 7, are other methods, not differing in principle, but in the manner of laying them down, which is more convenient in the practice of Stereotomy.

IN is the intersecting line, IP the base of a plane perpendicular to the intersection IN, and PIE the inclination of the cutting plane; the point E is found as in the former cases; draw IN perpendicular to IE.

In fig. 4, IB is the line 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 same 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 in; make IN equal to IN, np equal NQ, or draw n E, p E, q E; let the same distances on the other side of n in 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.

In the same manner, the section of a cylinder may be found by drawing lines parallel to the middle line GI, 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 n will fall upon IN, the point D will be the apex of the cone; then, if a set of planes be supposed to pass through the apex parallel to the intersecting line, and another set of planes to pass through the apex 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 n 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 IN, cutting n E; from the points p, p, p, q, q, &c. of section in n E, and upon the lines parallel to IN, make pb, pm, equal to pb or pm; make pe, pf, each equal to pe or pf; make pd, p, each equal to pd or p; make pe, pf, each equal to pe or pf; make pg, pb, each equal to pg or pb; then the points a and g, the extremities of the diameter, are the points of the extremities of the plane passing through ag, and consequently abedfgb is the section of the whole figure.

Fig. 7 shews the section by the same 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 intersection of the plane Y with the plane X.

Draw the three parallel lines AD, BF, CE, through the points A, B, C; make AD equal to the height of the point whose foot is A; BF equal to the height of the point whose foot is B; and CE equal to the height of the point whose foot is C; join A, B, and produce it to H; join D, E, and produce DE to H; draw FG parallel to AH, and FH parallel to AB, and then FH be the intersection of the plane Y upon the plane X.

Demonstration.—Suppose AD perpendicular to AH, and consequently BF perpendicular to BG; then let the plane ADH be raised upon AH, until it becomes perpendicular to the plane X; and at the same time let the plane BFG be raised upon BG, until it becomes also perpendicular to the plane X; then, because the triangle ABD is similar to the triangle ADH, and since both the planes ADH and BFG are perpendicular to the plane X, and their intersections A and B, with the plane X, are parallel, FG will be parallel to D H; and because AD and CE are perpendicular to AH, AD and CE will be perpendicular to the plane X, and for the same reason BF is perpendicular to the plane X; therefore the points A, B, C, in the plane X, are the feet of the three points D, E, F, raised to the plane Y; and because FG and DH are parallel, the points in FG and DH 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 GH is common to the planes X and Y; whence the straight line GH is the intersection of the planes X and Y.

PROB. VI.

Given the plane 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 intersection GH, as in the fifth problem; let AC be the base of the plane of the segment, which is perpendicular to the plane X: draw AI and CK parallel to GH; and draw CL perpendicular to AI, cutting AI in L; make LI equal to the height upon the point A, and CK equal to the height upon the point C; and join IK. In the base ABC take any intermediate points a, b, c, d, &c.; and draw the lines af, bg, ch, di, ek, meeting IK at f, g, h, i, k; through the points f, g, h, i, k, draw fa, gb, ch, di, ek, perpendicular to IK; make JA, JB, JC, &c., respectively equal to LA, FA, GB, HC, &c., and join A K, and draw the curve AB, &c.; KA 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 GH, and perpendicular to the plane X of the base; also a plane to pass through LC perpendicular to the said plane X; then all these planes will be parallel to the axis of the cylinder, and the plane standing upon LC will be perpendicular to the planes passing through the points A, B, C, D, E, C, as well as to the intersection GH. Suppose, therefore,
fore, L C and I K to meet each other in P, P will be in the straight line G H; and if the triangle I P L be raised upon L P, until its plane becomes perpendicular to the plane of the base, and supposing the sectional plane, Y, to be turned round I K, until its plane becomes perpendicular to the plane of the triangle I P L, and upon the same side of the triangle I P L as the base L A B C; then, if the plane A I K be produced, it will meet the plane of the base in G H; for the plane L P I will then be perpendicular to the two planes L A B C and L A K, and will therefore be perpendicular to their common intersection G H. Therefore, A I K B is the section of a segment of the cylinder, as cut by a plane passing through three given points in the surface, as was to be shown.

STEREOTYPE PRINTING. This art having of late years come very much into use, we shall give a short sketch of its history, practice, and advantages.

The method of printing linen and paper-hangings has been known in the East from time immemorial. Printing on wooden blocks, which is the mode now used by paper-hangers, has been practised fifteen or sixteen hundred years in China. According to this plan, when an author means to print his work, he has it fairly transferred upon a thin and semi-transparent paper. Each leaf is then revolved upon a smooth block of hard wood, upon which the engraver cuts the characters in relief. There must, therefore, be a separate block for every page. About the close of the 14th century, the Italians, Germans, Flemings, and Dutch, began about the same time to engrave on wood and copper, but the previous advances had been gradual. The impressions in relief, upon monuments and altars, in the cloisters, and over church, porches, served as models for block-printing. The letters upon painted windows resemble those in the books of images. The invention of cards was probably an intermediate step; and it has been inferred, as well from edits civil and ecclesiastical, as from the figures on the cards, that these were first brought into use about the year 1376, to amuse, Charles V. of France. By the shape of the crowns, and the sceptres with the fleur-de-lis, it has been thought they were invented by the French; but the names of the suits rather imply, that they are of Spanish or Italian origin. At first cards were painted, but about the year 1400, they were printed from wooden blocks. To this we may directly trace the art of printing. The books of images, which form the next step, were printed on wooden blocks: one side of the leaf only is impressed, and the corresponding text is placed below, or on the side, or proceeding from the month of the figure. Of these scarce books, Lambins gives the following enumeration: 1. "Figura typica veteris atque antitypicae Novi Testamenti," which in Germany is called the Bible of the poor, because it was originally intended as an abridgment of the scriptures, for those who could not purchase, or who had not leisure to read the whole. There is a copy of this work in the Bodleian library, and another at Christ's college, Cambridge. 2. "Historia S. Joannis Evangelista, ejusque viarones evangelistae, ejusque viarones apocalyp- ticae." 3. "Historia fen Providentia Virginis Marie, &c." 4. "Ars moriendi." 5. "Ars memorandi notabilis per figuram Evangelicialium." 6. "Donatus, feu grammaticae in usum scholaram concripta." 7. "Speculum humanitatis.

It is almost certain, therefore, that from the cotton and silk-printing of the Indians, the Chinese block-printing, and the books of images just alluded to, and perhaps from the mode of writing among the bards, who cut their poems upon bars of wood, and which they call carving a book, 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 Catholic, which was printed with wooden tablets, in a series, and composed in forms. This mode of printing, except in China, where it is still practised, was had aside soon after the invention of the common letter-press printing.

The history of the modern stereotype is involved in some obscurity. In the Philological Magazine is the following account: "Above a hundred years ago, the Dutch were in possession of the art of printing with fold 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. Leuchtermans, booksellers at Leyden, have fill 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 call 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 lands of Elwe, a bookseller at Amsterdiam, also an English New Testament, and Schaaff'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 fold 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. Nichols 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 1775, 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 1779 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 aware of 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 entrutted with the secret, avowed, that all the books printed in stereotype had been purposely made incorrect, in consequence of which they were suppressed at the university, and the plates sent to the king's printing-office, and from thence to Caflon's foundry. "After much ill usage," says the writer
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writer in the Philosophical Magazine, "God, 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 let up the forms in the night-time, when the other compositors were gone home, for his father to call the plates from, by which means Saltill was furnished 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 God'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 impressions of which were as perfect and handier as those of the types from which they were cut. Though they had reason to fear, says Mr. Tilloch, from what we afterwards found Ged had met with, 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. God's knowledge of the art may be said 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 Meffrs. 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 purely without even the appearance of justice. About the year 1800, Mr. Wilton, a printer in London, engaged with earl Stanhope, for the purpose of 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 feast, at Chevening, in Kent, where the noble earl was probably initiated into the practical part of the operation, and for which, we have heard, he paid 700l. as a remuneration.

After some years application, Mr. Wilton, 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 procresses of the stereotype art had been so admirably contrived, combining the most beautiful simplicity, with the most defirable economy, the ne plus ultra of perfection, with industry, fidelity, and promptitude, done for the public, that 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. Wilton 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, titel- and prayer-books. Some differences between the syndics and the printer caused the contract to be dissolved. In 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. issue annually from their presses, printed on that plan.

The practice of stereotype printing is readily described: a page of any work is let up in the usual mode of printing, (see the article PVENTORY,) from which a mould of platter, similar to plate 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 let 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 plate is a fac simile of the page from which it was taken, and consequently cannot exceed in beauty the original stamp. Stereotype, therefore, can give no additional beauty to printing; this depends on the taste of the letterfounder, and the care of the prelaid. 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 regula of antimony and hard lead, or tea-ches't 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 slow fire, and when melted, and the fume 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 a delicate 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 platter of Paris. Gypsum in the rock, as it is called, which is the belt, 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 proces 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 polisle on the plate to be cast. The following processes have been recommended: dissolve a quantity of common whiting in a quantity of water, and make it into a paste, and of the confid of some substance which 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
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 must be 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, is to be placed down to an even 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 adhesion 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 painter'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 straight 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 moveable ferew 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 such the accuracy of the process, that plates may be cast from the finest engravings as perfect 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 not removed, it cannot 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 expences 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; 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 its place a

**Price of Common Printing.**

<table>
<thead>
<tr>
<th>Description</th>
<th>£</th>
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<th>d</th>
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<td>0</td>
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<td>Reading</td>
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<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Press-work</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other expences and profits</td>
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<td>10</td>
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<td>0</td>
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<td>12</td>
<td>1</td>
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<td>Ditto for the third half year</td>
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<td>3</td>
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<tr>
<td>Ditto for the fourth half year</td>
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<td>7</td>
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<td>Ditto for the seventh half year</td>
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<td>17</td>
<td>9</td>
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<tr>
<td>Ditto for the eighth half year</td>
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**Price of Stereotype.**

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<td>16</td>
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<td>Reading</td>
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<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Press-work for five hundred copies, fourth extra</td>
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<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Other expences and profits</td>
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<td>24</td>
<td>10</td>
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<tr>
<td>Cafling plates</td>
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<td>Twenty reams of paper</td>
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<tr>
<td>Interest for six months</td>
<td></td>
<td>116</td>
<td>2</td>
</tr>
</tbody>
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**Z 2**

| Carry over                                      | 119 | 1  | 0  |
S T E

Brought forward                        £  s. d.
Coll of the first five hundred, second, and of each subsequent five hundred, will be
38l. 5s. 3d.                            119 1 0

Common printing                        386 17 9
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 6
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 30l. 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 may render the process still more economical than it is at present: thus, if the pages could be cut to the true size, that might go to press, and be worked with the same ease and expense as movable type; 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.

II. On books published in parts or numbers. Purchasers frequently take in the early parts and leave off, by which the fets become broken and uneven, and a great loss is incurred by the wafte 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 fixspence for an octavo page, besides the metal, which will still retain its value. So that a hundred, or a large number of copies, might be struck off to ascertain the opinion of the public. If it did not sell, the fets 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 sold, the loss would be from 30l. to 40l.

3dly. The principal advantage is unquestionably on stock books, whether bibles, prayer-books, or school-books, particularly works of arithmetic, and other branches of mathematics. There, by means of the stereotype, may be brought to perfect accuracy; and having once attained to that standard, may be kept on without the possibility of deviation: for this excellence, the public would not grudge even an extra price.

STEREOXYLON, in Botany, from $x_{2}$, hard and fold, and $x_{2}$, wood, a name given by Ruiz and Pavon in their Flora Peruviana, to the genus which has long before been called Linnaeus 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, 424, 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.

STERILE LAND, in Agriculture, those sorts which are unproductive in consequence of their particular nature and qualities; or which contain only small portions of nutrient soluble matters 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 fort of component material, which is known as a cause of barrenness or unproductiveness, 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 instances, point out the most proper and ready methods of improving them.

Where lands of this sort become so in consequence of their stiff clayey nature, they may be improved and brought into a productive situation by the use and application 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 sandy 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 marle, and earthy vegetable materials to them. The application of peaty or turfy matters over the surfaces of light burning sandy lands, has been found to be attended with immediate and permanent good effects in many instances. Where lands are sterile in their nature, from containing too great quantities of ferruginous, ochry, or saline, irony, and acid matters in their compositions, they may be greatly benefited in their productiveness by the use of quicklime in suitable proportions.

In lands of otherwise good qualities and textures, which were infertile from containing too large proportions of the sulphate 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 sort of sulphate or vitriolated 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 excesses 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 earthly materials of different kinds.

Where boggy, peaty, moory, or marshy lands are to be improved in their fertility and productiveness, the first steps to be taken for the purpose are mostly those of properly inclining and drawing off the superabundant moisture or wetness, both of which greatly contribute to these ends; 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 beneficial action, are not unfrequently produced into 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 fer-
roginous, ochry, and saline matters, the use of lime, or other
calcareous materials in sufficient quantities, is indispensably
necessary for bringing them into a proper state of culture, and
for rendering them productive, either in the arable or
grafs state. When they abound with ligneous matters, and
different coarser 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 cautiously fol-
low, as much as he possibly can, the lessons 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 in-
creased fertility; by their requiring less expense in dressings
afterwards; and by the value of the lands being for ever after
greatly augmented.

The particular nature and caufes 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
fertility.

Sterility was held a grievous affliction by the wives of the
ancient patriarchs. Nature has annexed sterility to all mon-
frous productions, that the creation might not degenerate.
Hence the sterility of males, &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.

STERIPHA, in Botany, so named by Dr. Solander
from eiperiph, 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.
—Gartn. v. 2. 81. t. 94. —Clafs and order, Pentandria
Dignia.

This is no other than DICHONDIA of Forster. (See that
article.)

Gartn. speaks of it as a very distinct and singular
genus, having the habit of Silphoria europea, but in the
number of its parts of fructification, nearly agreeing with
Scherbera. Now it happens that the Scherbera alluded to is,
as we have said in its proper place, merely a Cucurbita,
growing on a Myrtis. Whether Solander or Gartn. made
this allusion to it, they could only have in view its artificial
characters and place in the Linnean system, for the plant
itself was, at that time, unknown to them.

STERIS, a Linnean name, of whose meaning or application
we have no information; nor is it a matter of any con-
sequence, the plant which bears this name, S. javana,
Linn. Mant. 8. and 54, being the fame with Naana zeylanica,
Linn. Sp. Pl. 327, and in fact a species of Hydrangea.
See that article; p. 4.

STERKE, J. F. X. Abate, in Biography, first chapell-
master to the elector of Mentz, was born at Wurzburg in
1743, went into Italy at the expense of his patron in 1781,
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 harpichord and piano
forte, which he produced in Italy, he composed at Naples
the opera of "Farnace."

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 Harpichord, accom-
panied by a Violin and Violonecello obligati, dedicated to his
XVII." These sonatas, when well accompanied, are ex-
tremely interesting and amusing. The abbe Sterkel there, as
in all his compositions for keyed instruments, has manifested
that he did not visit Italy improbably; his productions,
though not very laboured or learned, are full of spirit, taste,
and pleasing pallages; 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 consist of pallages of effect,
and such as give importance to the player. Indeed his pieces,
though not very original, are left tinturied with Bachifm,
or Haydnism, than those of his countrymen who have not
visited Italy; and though left solid, and left his own propri-
erty than those of many modern composers, yet they are more
easy to execute, and more intelligible to unlearned readers.
We have been assured by some of his scholars, that he played
on the clavechord and piano forte, with such taste, expression,
and chiaro-fofo, as few performers, except Emanuel Bach,
ever arrived at.

STERLING, a term frequent in the English commerce.
A pound, shilling, or penny flearing, signifies as much as a
pound, shilling, or penny, of lawful money of England, as
fettled by public authority.

Antiquaries and critics are greatly divided as to the origin
of the word flearing. Buchanan fetches it from the castle of
Striveling, or Strirling, in Scotland, where a small coin was
anciently struck; that in time, according to him, came to
give name to all the reit. Camden derives the word from
caterling, or ceterling; observing, that in the reign of King
Richard I. money coined in the exult parts of Germany
began to be of especial request in England by reason of its
purity, and was called ceterling money, as all the inhabitants
of those parts were called ceterlings; some of whom, skilled
in coinage, were soon after, vis. in the reign of King John,
sent for to perfect the English money, or reduce it to its
due fineness, which was thence forwards denominated from
them, flearing, or caterling, or ceterling: not, says Camden,
from Striveling in Scotland, nor from fiella, a flat, which some
dream to have been coined upon it; for in old deeds, the
English species are always called nummi catularum, which im-
plied as much as good and lawful money, &c. Clarke, in his
connexion of the Roman, Saxon, &c. Coins, p. 80, obser-
vies, that the Saxon or English pound was called the pound flear-
ing, because their ancestors brought it from the most eafier
parts of Europe, the flores of the Exuame; and that they
called it libra feterlingorum, the pound caterling or flearing,
to distinguish it from the Roman pound, which, to preserve
the same distinction, was called libra occidentis, or the weftern
pound. Sommer, again, derives the name from the Saxon
fleere, 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, flearing,
or caterling, is also used for a certain coin, in value amount-
ing nearly to our silver penny; and on some occasions we
find the fame word flearing 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 flearings or
eaterlings were become synonymous: much as, among the
ancients, the words denarius and nummus were used.

STERLING, in Geography, a plantation in Kennebec county,
and
STE

and state of Maine, N.W. of Hallowell.—Alfo, a township
of Connecticut, in Windham county, 44 miles E. of Hartford;
containing 1,101 inhabitants.—Alfo, a township of
Franklin county, Vermont, containing 1,223 inhabitants.—
Alfo, a town of Worcester county, in Massachusetts, in-
corporated in 1781, and containing 1,472 inhabitants; 62
miles N.E. from Worcester.

STERLINGVILLE, a post-town in Granville county,
North Carolina; 267 miles from Washington.

STERLITAMATZK, a town of Ruffia, in the go-
vernment of Upha. N. lat. 54° 40'. E. long. 53° 54'.

STERN, a Ship, denominates 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 inter-
mediate space comprehends the galleries and windows of
the different cabins.

STERN, among Hunters, is the tail of a wolf, or a grey-
hound.

STERN-CHAPEL, See CHASE.

STERN-PIFF, 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 whale,
&c.

STERN-FRAME, in Ship-Building, the strong frame of
timber, composed of the stern-post, transoms, and faftion-
pieces, which forms the back of the whole stern.

STERN-LADDERS, are made of rope and tree-nails, and hang
over the stern of ships, to come on board by in very rough
weather.

STERN-MOFT, in Sea Language, usually denotes that part
of a fleet of ships which is in the rear, or farther aft-tern,
as opposed to head-moft.

STERN-PIT, in a Ship, a great timber let into the keel at
the stern of a ship, somewhat fiberglass, into which are fasten-
the after-planks; and on this poft, by its pintle and gud-
geons, 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 dif-
ficulty 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
barges, which support the rudder, are accordingly
fixed to this latter, which is also tenoned into the keel, and
denominated the back of the poft. It is half the breadth
of the stern-post at the keel, but diminishes gradually to-
wards 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 cor-
responds with the inside or fore-part of the stern-post, to
which it is also bolted in the same manner. Falconer.

STERN-SHEDS, that part of a boat which is contained
between the stern and the aftmoff, or hindmost part of the
rowers. It is generally furnished with benches to accom-
modate the passengers. Falconer.

STERN-WAY, in Sea Language, the movement by which a
ship retreats, or falls backward, with her stern foremost.

STERN-WAY, To make. See Make.

STERNA, the Term, in Ornithology, a genus of birds of the
order Anseres, of which the generic character is: Bill
fulminate, straightish, pointed, a little compressed, without
teeth; nostrils linear; tongue pointed; wings very long; tail
mossily forked. Twenty-four species of this genus are enu-
merated by Gmelin: they are mossily 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,
fotted with black. The birds belonging to this genus are
at all times clamorous and gregarious, but more particu-
larly in the spring of the year, during the time of nesting.
At this period they assemble in large flocks, and their ac-
ivity seems greatly increased, for they repeat with eag-
rel their sharp piercing notes so frequently, 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
plumbeous-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-animals, hovering over the water, and
frequently darting into it for its prey. The bill is red;
rids dusty; tail short, forked; tail-feathers tip with
black; the legs are brownish. 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;
head-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 cinereous; quill and
tail-feathers tip with black.

CAYANENSI S; Cayenne Tern. Cinereous; the feathers
edged with reddish; beneath they are white; the hind-head
is black. It inhabits Cayenne, and is sixteen inches long.

SURINAMENSI S; Surinam Tern. Bill, head, neck, and
breast, black; back, wings, and tail, cinereous; belly
whitish; legs red. It inhabits Surinam, and is about
fifteen inches long.

FULIGINO S A; Sooty Tern. Black; beneath, checks,
front, and shafts of the quill and tail-feathers, white. It
inhabits the Atlantic and Antarctic seas, and is sixteen
inches long. The bill and legs are white; the eggs yellowish,
with brown and violet spots; outer tail-feathers white,
except at the tip.

AFRICA NA; 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 S. fuligino-
sa. 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; eye-
brows black; bill and legs black; the hind-head is cin-
ereous. It is fifteen inches long; found chiefly within the
tropics; is clamorous; seldom goes far from shore, and
always reste at night. It builds on rocks; and its eggs
are excellent food.

PHILIPPINA; 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 fwalow.

SIMPLEX; Simple Tern. Above plumbeous; beneath,
crown,
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.

**NITELICA;** 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.

*CASTALCA;* 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, with purplish and crowded spots; it is full eighteen inches long, and is found on the Kentish 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.

**HIRUNDIO;** 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 but elegant form, which is increased by the beautiful plumage with which it is adorned. The back is covered with a grey mantle; the breast is of pure white, elegantly contrasted 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 in 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 fithers of all the aquatic tribes; insatiabley darting upon the prey which they observe from a great height in the air. After having dived and caught the booty, they as suddenly ride again to their former elevation.

The action of the stomach which this tribe exhibits is amazingly powerful; the fish being so completely digested in their stomach, they swallow them whole, as is proved by the number of bones which they vomit after feeding. Those parts of the food that are nearest the bottom of the stomach are dissolved, and make way for the rest, which soon undergoes the same process.

Immediately after the arrival of this species of the tern, the pairing feaston commences; during which each female chooses a warm bed of fand, 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, some 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 are no sooner protruded from the shell, than they leave the nest, and follow the parent bird, who supplies them with small morsels 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 person 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 parental care from cafe; the young soon 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 below 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 very 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 inatiable 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 moulting.

**PAVAYENSIS;** Panayan Tern. Beneath white; crown spotted with black; wings and tail brown; beneath pale. This species inhabits Panay, and is the size of the last. The bill and legs black.

**CINERA;** Cinerous 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.

**OSCELA;** 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;** Chinefe 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.

**Metopoleucus;** Hooded Tern. Head and neck black; back blackish, hoary; wings cinereous; front, body beneath, 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.

**Sterna;** Steriata; 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.
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always so far difficult, that Albinus describes them as two muscles. They are continued together above, and attached to the apex and outer surface of the manubird process, to the manubird portion of the temporal bone, and to the superior curved line of the occiput. The internal 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; thicker in front than behind. All the muscular fibres go obliquely between the aponeuroses.

The sternocleido-mastoideus, by drawing the manubrid 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 oblongus 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 sternocleido-mastoideus 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 sternocleido-mastoideus more effectual. In the erect attitude, the weight of the head naturally inclines it forwards.

STERNO-CLEIDO-MASTOIDEUS, in Surgery. For an account of the operation of dividing this muscle in cases of wryneck, see Torticolis and Wryneck.

STERNO-COSTALIS, in Anatomy, a muscle passing between the sternum and ribs. See INTERCOSTAL Muscles.

STERNO-HYOIDEUS, a muscle of the larynx. See DEGLUTITION.

STERNOMANTIS, in Antiquity, a designation given to the Delphian priests, more usually called Pythia.

STERNOMANTIS is also used for any one that had a prophesy- ing demon within him.

STERNO-MASTOIDEUS, in Anatomy. See STERNO- CLEIDO-MASTOIDEUS.

STERNOPTYX, in Ichthyology, a genus of fishes of the order Apodes, of which the generic character is as follows: Head oblong, teeth very minute; no gill-membrane; the body is compressed, without apparent scales; breast carinate, folded; belly pellicul. A single species only is mentioned by Gmelin, v. 2.

DIANA. 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 perpendiculat; 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 breast form a pellucid ridge; the back is of a greenish-brown colour, gibbous behind the fin, with a double ridge diverging towards the notials; it has no lateral line; the dorsal fin with an oblique, strong, spinous, immovable ray, joined to which is a membranous very finely toothed at the edge: pectoral fins of a fine amber colour; tail bifid.

STERNESTEIN, in Geography, a town of Bavaria, with a ruined citadel, which gives name to a county. The county lies dispersed 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, Fractures of, in Surgery. See Fracture.

STERNUM of Birds. See Anatomy of Birds.

STERNUTATIVE, or STERNUTATORY, such substan-ces as palfes the quality of exciting sneezing.

It is not by the sneezing which they excite, however, that these substances are useful medicinally; but by producing a discharge of fluids from the orifices of the membranes lining the nostrils, by which some kinds of diseases of the head are relieved. In this quality they are more com- monly denominated erubes, which fea. See also Sneezing.

STERTOR. See SNEEZING.

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 person of some consequence in his native city; 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 Urbinus, Ant. 1568. The general character of his writings is represented as consisting in force and dignity. Horace speaks of "Stesichorus grave suum;" and Dionysius says that he possessed all the excellencies and graces of Pindar and Siko- monides, and that he surpassed them both in the grandeur of his subjects, in which he has well preserved the characteristics of manners and persons; and Quintilian represents him as having displayed the fulness of his genius by the election 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 ranked him among those who were the proper subjects 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 "place of the chorus," which was before "Tifias." Suidas. Moreni.

STETTEN, in Geography, a town of Germany, in the margraviate of Anspach; 8 miles N.N.W. of Anspach.

STETTIN, in Geography, a town of Hither Pomerania, situated in the midst of lakes, built in the 14th century by Duke Ratibalis IV., as a defence of the frontiers against Prussia; but it has never flourished; 45 miles S.E. of Col- berg. N. lat. 53° 42'. E. long. 16° 38'.

STETTIN, or Old Stetin, 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 manufactories, together with a dock for the building of ships. Its trade with England, Holland, France, Spain, Denmark, Germany, Prussia, Danzig, Mecklenburg, Lubeck, and Hamburg, is very con- siderable. It contains five parishes-churches, a college of phy- sicians, a board of health, a chamber of commerce, a court of admiralty, &c. and about 20,000 inhabitants. It fur- rendered to the French in 1806; 12 miles W.N.W. of Starzard. N. lat. 53° 29'. E. long. 14° 44'.

STEUART, Sir James, in Biography, the only son of Sir James Stuart, 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
STEVEN'S, a short navigable river of America, which rises 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 Colneyhe. Having formed an acquaintance with the Pretender at Rome, he renewed his connection with him at Edinburgh in the year 1745, 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-Maine, 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 Doctrine 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 competency 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 fortress of Charlemont. A remonstrance having been presented to the British cabinet, and peace being established, sir James regained his liberty. Under assurances of protection in his native country, he settled at Colneyhe in 1763; and in this retirement he probably finished 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 Beattie's Essay on Truth," "Critical Remarks on the Atheistical Fallacies of Miraband'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 five vols., 8vo.

STEUBEN, in Geography, a county of New York, esteemed 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 16,141 square miles, or 1,050,240 acres; and it is situated between 42° 40' and 42° 36' N. lat., and 7° 51' and 3° 50' W. long. from New York. Its towns are Addison, containing 369; Bath, with 1,616; Canisteo, with 656; Danville, with 666; Painted-Post, with 954; Pultney, with 1,038; Reading, with 1,210; Trumbrburgh, with 2,021; and Wayne, with 1,025 inhabitants; amounting in the whole to 7,746. 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 household industry, from which the clothing is chiefly produced. The capital is Bath. This county has 443 electors, and sends one member to the house of assembly.

STEUBEN, formerly Naugatuck, a town of the district of Maine, in the county of Washington, at the S.W. corner of the county. Naragutag river runs through its N.E. corner. It contains 552 inhabitants.—Alto, a small fort in the Indiana territory, situated at the rapids of the Ohio, a little above Clarksville.—Alto, a township of New York, in Oneida county, taken from White-town, and incorporated in 1792. In 1795, 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 12 miles N.E. of Fort Schuyler, and 32 N.W. of the mouth of Canada creek.

STEVENSON, E.L.E., 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 1,617 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 Gamlan Carleby.

STEVEN'S Klint, a mountain of Denmark, in the island of Zealand, near Heding.

STEVENAGE, a village in the hundred of Broadwater, and county of Hertford, England, was anciently a market-town, and named Steigne, or Sienne, and Siennebraugh. The manor was given by Edward the Confessor to Welfinh, 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 fee of London, to which they have ever since belonged, with the exception of a short period in the consuime reign 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 continuity of the towns of Baldock and Hitchin has greatly tended to the decay of this. Stevenage contains 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 1,302, and the number of houses to 308. The petty feoffees 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 county, to be of Danish origin. Stevenage is pleasantly situated on the high North road, 12½ miles N.W. by N. from Hertford, and 31¼ miles N.N.W. from London. Beautes of England and Wales, vol. vii. by J. Britton and E. W. Brayley.

STEVEN'S, a short navigable river of America, which
ripcs 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 Culpeper 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.

STEVENSIA, in Botany, is said to have been so named by M. Poiteau, a French botanist, in compliment to Dr. Edward Stevens, American consul at Hfipaniola, or St. Domingo, who had rendered many important services to the French in that island; but whether he possessed 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'Hilft. Nat. v. 4. 235." Poiret in Lamarck Dict. v. 7. 439.—Claf and order, Hexandria Monogyna. Nat. Ord. Rubiaceae, Juili.

Gen. Ch. Cal. Perianth superior, of one leaf, in two deep, lanceolate, deciduous segments. Cor. of one petal, tubular, slightly silky externally; tube cylindrical, the length of the calyx; limb in five, sometimes seven, oblong, ciliate, spreading, somewhat reflexed segments. Stam. Filaments none; anthers inverted 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 cells. Pet. German globose, inferior; filly 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 inflexed margins of the valves, which at length split longitudinally into two parts. Seeds numerous, minute, oval, a little compressed; encompassed 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 superior, in two deciduous segments. Corolla tubular, with five or seven segments. Anthers filiform in the mouth of the tube. Capsule of two cells, with many winged seeds.

1. S. biaulifolia. Box-leaved Stevensia. Poiteau Ann. du Mus. d'Hilft. Nat. v. 4. 235. t. 60.—Native of the northern part of Hfipaniola. An upright branching shrub, ten or twelve feet high; the wood very hard; bark ash-coloured, full of cracks. Young shoots covered with a wifed rein. Leaves opposite, stalked, oblong, acute at each end, about an inch and half in length, rigid, smooth, shining above, pale and reticulated beneath. Footstalks short, connected by an undivided sheathing stipula. Flowers axillary, solitary, white, fragrant, on stalks the length of the footstalks. Bracteae at the base of the calyx, in four divisions, two of which are short and obtuse, the two 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 Meuf, built in the year 1635: besieged and taken by the allies in 1702; 30 miles N. of Liege.

STEVENTOWN, a township of New York, in Weftchester county, bounded W. by York town, and N. by Dutchess county, containing 1,573 inhabitants.

STEVER, a river of the principality of Munster, which runs into the Liptpe at Hattern.

STEVIA, in Botany, was named by Cavanilles in memory of Peter James Steve, or E Reeve, an eminent physiologist 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. Ie. v. 4. 32. Wild. Sp. Pl. v. 3. 1774. Ait. Hort. Kew. v. 4. 510.—Clafs and order, Syngenesia Polygama-epiitalis. Nat. Ord. Composite disfoides, Linn. Corymbifera, Julii.

Gen. Ch. Common Calyx simple, oblong, or several, nearly equal, leaves, in a simple row, Cor. compound, uniform, disfoid. Flores all uniform, perfect, fertile, funnelf-shaped, with a five-leaved spreading limb, not numerous. Stam. Filaments in each floret five, capillary; anthers united into a cylindrical tube. Pet. German oblong; style thread-shaped; stigma two, long and slender. Peric. one, except the permanent upright calyx. Seeds solitary to each floret, oblong; down chaffy, or partly bristle. Recept. small, naked. Eff. Ch. Receptacle naked. Down chaffy. Calyx cylindrical, of a simple row of leaves.

Obs. This genus is distinguished from Eupatorium and Ageratum, by its simple row of calyx-leaves. From the former, moreover, the chaffy head-down keeps it clearly distinct.

1. S. lineare. Linearis Stevensia. Willd. n. 1. Cavan. Ic. v. 4. 32. (Ageratum lineare; ibid. v. 3. 3. t. 205.)—Stem shrubby. Leaves simple, linear, entire. Seed-down of five lanceolate scales.—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 stalks, entire, obtuse, narrow, an inch and half long, the lower ones often opposite. Flowers pale rose-coloured, terminal, corymbose, not numerous. Bracteae foliary, at the base of each partial stalk, linear-lanceolate. Calyx three-quarters of an inch long. Scales of the seed-down spreading, linear-lanceolate, acute, whitish, about the length of the downy seed.

2. S. Eupatoria. Three-ribbed Stevensia. Willd. n. 2. Ait. n. 1. (Muifelia Eupatoria; Sprengel in Tr. of Linn. 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 Buie, 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 corymbose 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. falecifolia. Willow-leaved Stevensia. Cavan. Ic. v. 4. 32. t. 354. Willd. n. 3. Ait. n. 2.—Leaves lanceolate, ferrated; 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 corymbose, more copious, but much smaller than in the first species; the flowers flesh-coloured, with a red tube. Seeds slender, each crowned with two very narrow, rather spreading, bristles.

Jacq. Hort. Schovenbr. v. 3. 28. t. 300.)—Leaves linear-lanceolate, most forked 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 Ashill, 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 base, 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-leaved Stevia. Cavan. Ir. 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, striated. Leaves seven, halved, 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 most of the 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, whole own talents 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 decreasing upwards, acts with the same preliure on the base as if the tube were every where uniform. He was also the inventor of a sailing boat, which was moved entirely by the impulsion 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, intituled "Iter Currus Velferti," and he has made it the subject of more than twenty epigrams; in one of which are the following lines:

"Ventivolum Tiphys deduxit in sequora navem; Jupiter in tellas atereamque domum. In terrre fleum virtus Stevinia: nam nescit Tiphym tuum fuerat, nec Jovis itud opus."

It is also asserted by Swertius and Valerius Andrascs, that Stevin could raise any weight with a small power, by a simple machine, called by the latter "pantactor." Stevin died at Leyden, according to Weidler, in 1633. His works are, "A Book of Arithmetic in French," printed by Plantin at Antwerp in 1565, 8vo, and republished with his Algebra in Flemish, in 1605; "Problematum Geometricorum, Lib. V," 4to. 1; and various other treatises in Flemish, translated into Latin by Snellius, under the title of "Hyponemata Mathematica," Lugd. Bat. 1608, 4 tomo. fol. of which 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, cophomorphics, that is, the doctrine of triangles, geography, and astronomy; the third, practical geometry; the fourth, statics; the fifth, optics; and the sixth, ephemerides, 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-l'Port, ou la Maniere de trouver les Havres," which was translated by Grotius into Latin verse, 1599, 4to. Montucla says, that none of Stevin's works contain any new things, except his Mechanics; but Dr. Hutton informs us, that his improvements in algebra were many and ingenious. Hutton's Dict. and Mathematical Tracts. Montuc. Weider Hist. Art. Wilkinson'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 uses 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 deepest part be in the middle, by which means the net may be drawn backwards or 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 distric, 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 some thing 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 cafes. 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-door openings for each of the different flews, made to be locked and fastened, as that no perch, 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 cafes, as preventing all risk of depredations being committed; and in some cafes, where the flews are connected with the refidences 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 lochs.

Stews, or Stews, were also places anciently permitted in England, to women of professed incontinency, for the profit of their bodies 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, glasse, hot-baths, in regard prostitutes are wont to prepare themselves for prevalent acts by bathing.

Steward, or Seneschal, an officer, of whom there are various kinds; thus called from the Saxon sican, stead, place, or room; andward, kepper, q. d. a deputy, or person appointed in the place of another. See Seneschal.

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. flatholders, and the Swedes, reichs drifite, q. d. vice reg. Chamberlayne.

Common lawyers call him magnus Anglei senzeichnet.

His office, as exprest in an ancient record, is to super- vide and regulate the whole kingdom, both in time of peace and war, immediately under the king, and after him, an authority so very great, that it has not been judged safe 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 arraignment 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 Peer.

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 Household, 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 Marborough Court.

Steward of the University, Lord High. See University.

Steward of a Ship of War, an officer appointed by the purser to distribute the different kinds of provisions 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.

Steward, Matthew, D.D. in Biography, professor of mathematics in the university of Edinburgh, was the son of the Rev. Dugald Stewart, minister of Rutheney, 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 professoors, Dr. Hutchen an and Dr. Simson. 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 1741, Dr. Simson recommended his favourite pupil to the celebrated Maclaurin, whose lectures he attended, and by which he finally profited. At this time he kept up a regular correspondence with professor Simson, 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 Lozi Plan and Purisms 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 a 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, so that he became the successor of that eminent mathematician and philosopher in September, 1747.

His new office produced 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 algebraic calculus had been employed. The first specimen of his successes in this way was the resolutions 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 "Essay of the Philosophical Society of Edinburgh," for 1756. The first volume of the same collection contains some other propositions, relating to 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 compos'd his "Treatis Physical 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, the quadrature of curves being admitted, with the utmost rigour, as not requiring the previous knowledge of mathematics, except the elements of the geometry and of conic sections. Accordingly this tract may be regarded as the bell 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 all astronomers, Dr. Stewart determined to apply the principles he had laid down to this subject; and accordingly in this year he published his "Essay of the Sun's Distance," where, from actual computation, the parallax of the sun was found to be no more than 6.9', and consequently his distance nearly 29,875 semi-diameters of the earth, or about 118,541,428 English miles, a distance so much exceeding all former estimates as to excite surprise, and to produce a severe examination of the principles on which the calculation was founded.
founded. This "Elfay" was the last work which Dr. Stewart published; but he declined engaging in any controversy on the subject. Some months before he published his "Elfay," he presented to the public another work adapted to promote the study of the ancient geometry, and entitled "Propositiones Geometricae more Varietatem demonstrat." By his constant 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 1763, 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 1775, 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 length the fate of his health would not allow him to prosecute 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 possessed 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 industrious, he read few books. After the academical labours of the winter were concluded, he spent the summer at a delightful retreat in Airlair, where he found leisure to prosecute his favourite researches. Translations of the Royal Society of Edinburgh.

W. T. STEWART, in Geography, a county of the district of Welf-Tennet, in America, containing 4,262 inhabitants, of whom 779 are slaves.

W. T. Stewart's Island, 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° 26'. E. long. 153° 18'.

W. T. STEWARTIA, see Stuartia.

W. T. STEWARTON, or Stewart-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 1801 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 2,657 inhabitants; and at the latter, the number of houses was 484, and that of inhabitants 3,049. The town and parish seem to have derived their name from the royal and unfortunate family of Stuart, who had a manor here at a remote period, and part of it still remains. The principal trade of the town is the manufacture of bonnets, which was continued for upwards of a century past to a great extent. A general post-office is here established. Here is 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-quarries abound in great plenty: its extent is upwards of ten miles in length, and some places about four in breadth. — Carlisle's Topographical Dictionary of Scotland, vol. ii. 4to. 1813. Gazetteer of Scotland, 8vo. 1806. Sinclair's Statistical Account of Scotland, vol. ix.

S. T. STEWARTSTOWN, a palt-town of the county of Tyrone, Ireland; 77 miles N. by W. from Dublin, and 5 miles N. from Dungannon.

W. T. STEWARTSTOWN, a town of America, in the county of Coos and Haste of New Hampshire, containing 186 inhabitants.

W. T. STEYR POINT, a cape on the coast of Labrador. N. lat. 58°. W. long. 61° 40'.

W. T. STEYERBERG, a town of Germany, in the county of Hoya; 9 miles S.W. of Nienburg.

W. T. STYLL, a town of the duchy of Berg, lately belonging to the abbey of Ellen; 2 miles S.E. of Ellen. N. lat. 51° 22'. E. long. 7'.

W. T. STEYNING, a borough-town in the hundred of Steyning, rape of Bramber, and county of Sussex, England, derives its name from the Steyne-street, an ancient road, which passed through this part of the country. In the population return for 1820, it is stated to have contained 219 houses, and 1,174 inhabitants; but in 1811, the houses only amounted to 187, and the inhabitants had increased to 1,210. 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 transeverile 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 constable, who is on such occasions the returning officer; and is appointed at the court-leet of the lord of the manor. The members of this place were formerly elected in conjunction with Bramber, and intermitted till 31 Henry VI.; but at present each town is entitled to return two representatives, although one part of Bramber is in the centre of Steyning, and a part of Steyning interdicts Bramber in a similar manner. See Bramber.

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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, Susex, by F. Shoberl, vol. xiv. Carlisle's Topographical Dictionary of England, vol. ii. Representative History of Great Britain, by T. H. B. Oldfield, vol. iii. 8vo. 1816.
STI

separated from Stiria, it was added to the country above the Ets, and since deemed merely a seignory. It has often suffered much by fire; 28 miles W. of Vienna. N. lat. 48° 17'.

STERYE, in Geography, a town of Austria; 4 miles W. of Vienna. N. lat. 48° 17'.

STEYRSPERG, a town of Austria; 5 miles E. of Glaggitz.

STEZZANO, a town of Italy, in the department of the Serio; 3 miles S. of Bergamo.

STHANUS, 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 σθένος, strength, a word of great import in the Bronzonic theory of medicine, implying an inflammatory diathesis, and standing in opposition to ασθενία, or debility, to one of which that ingenious but mistaken pathologist ascribed all diseases incident to the living body. See Excitability.

STHENUS, in Antiquity, a festival of Argos, supposed to be kept in honour of Minerva, tunique as Σθενας, from σθένος, strength.

STHENUS, in Mythology, denoting powerful or strong, one of the epithets of Jupiter; as Σθενας, or rebull, was one of the epithets of Minerva.

STILE, a word used by some of the old authors for pebbles found on the sea-shore.

STIBIUM, among the Romans, a low kind of table-couch, or bed of a circular form, which succeeded to the trichina, and was of different sizes, according to the number of guests they were designed for. They were called hexaedra, octaedra, or enneaedra, according as they held six, eight, or nine guests, and so of any other number.

STIBIUM, in Geography, a town of Pomerelia; 30 miles S.S.E. of Dantzic.

STIBILIA, a term used by some to express the antimonial medicines.

STIBINUS, in Geography, a town of the duky of Stiria; 7 miles N.N.W. of Graz.

STIBINUS, 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 eye-brows with stibium, or antimony.

STIBIUM. See Antimony.

STIBINUS, in Geography, a town of Bohemia, in the circle of Koniggratz; 24 miles N. of Koniggratz.

STICA, a name given by some authors to all external afferent glands used in hemorrhages.

STICA, in our Old Writers, a copper or bullion haephtic coin, of the value of half a farthing, four of them making an elfing. This small piece was only known in Northumbria, and in the later period of that kingdom. See Penny, and Skeatta.

STICHOGRAPHIA, εικοσιγραφία, in Antiquity, a fort of divination by verses (commonly those of the Sibylline oracles), which being wrote on little pieces of paper, and thrown into a well, the first drawn out was supposed to contain the will of the gods. See Sortes.

STICHEOMETRY, formed of εικοσι, twenty, and μετρος, a measure, in Scripture History, a catalogue of books of sacred literature, 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 marrubium, or horehound.

STOCK of Eels, a quantity or measure of twenty-five. A bond of eels contains ten picks, and each pick twenty-five eels. Stat. Weights and Measures.

STICKADES, in Botany. See Cassidiony.

STICKELSTA, in Geography, a town of Norway, in the province of Drammen; 46 miles E.N.E. of Drammen.

STICKHAUSEN, a town and citadel of East Friadland, founded by the Hambourgers 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'.

STICKLEBACK, in Ichthyology, a name given by us to that small fish called by authors the several names of spinacia, Spinax, and punigius pescis; also pisculus After pisculus aculeatus, and the like; and finally, by Arcted, by the much more expressive name of gaferolarius, expressing that great singularity it has in the bony structure of its belly.

The common stickleback, or gaferolarius aculeatus of Linnaeus, is distinguished by arteries by the name of the gaferolarius 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 parents of its own kind, and that from it all other fishes are bred.

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 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 nowhere 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 flocks that appear in the Wold, 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. N° 225. For the characters of this and the other species, see Gasterosteus.

It is observed in the Norfolk Report 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. Rogerfon, of Narborough, has gone largely into this husbandry, laying out 300l. in one year, at from 6d. to 10d. per bushel, besides carriage from Lynn: he formed these into comports 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 sifted with good rich earthy fulvities, as above, they are probably in the best line of application for the production of arable crops. The operation of such fulvities, as marlure, is readily elucidated and explained. The limy parts of them, the writer of the work on "Agricultural Chemistry" considers as principally confiding of gelatine, which, from its light flake 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 fulvities, that are particularly wanted for this use.

Little fill of the pricklyback, 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; 3 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 file-kicks, which are placed at the side of the page, and fixed in the same manner by means of quoins. See Reglet.

STICTA, in Botany, from robus, robustus, 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 Linnæan genus of Lichen, and which is now received as a genus by itself, like Stereocaulon, Spiloma, &c. (See those articles.) — Schreb. Gen. 768. Achar. Meth. 275. Lichenogr. 86. t. S. f. 1—8. Syn. 520. Clasf and order, Cryptogamia Alga. Nat. Ord. Lichenet.

Eff. Ch. Shields orbicular, flat, bifidule, with an elevated border of the fulvity of the frond, scattered. Frond coruscous; downy beneath, fringed with little bald pits.

One of the most handsome of this natural order, found on old trees in various parts of the globe. The species in the Synopses of Acharius amount to twenty-two, of which seven are British; but the last in this list, S. lyriatica, is not attainted 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.

S. flabellina. Ferny Sticta. Ach. Syn. n. t. (Lichen Ficus; Swartz in Linn. fil. Meth. Mufc. 36. t. 2. f. 2. Platima Ficus; Hoffm. Pl. Lich. v. 3. t. 55.) — Frond somewhat falked, glaucous-grey, doubly pinatifid; strongly ribbed, tawny and almost smooth beneath, with bordered pits. Shields reddish-brown; their border entire. — 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, finetted, finely pinatifid lobes, lying over each other. The upper surface is quite smooth, even, and veinless, of a pale greenish-greyish grey-colour, beprinkled with small, slightly elevated, flat, shields, red when young, then chefant-coloured; their border tawny, finely ribbed, following 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 ribs, which run down into a fort of channelled common falk. The pits, cyphelle, have an elevated polished border, raised above the smooth back of the frond, not funk, as usual in other species, amongst down or pubescence.

S. corniculata. Fringed Sticta. Ach. Syn. n. 2. Meth. 276. t. 5. f. 1. — Frond dilated, greenish-white, with wedge-shaped, somewhat forked lobes; piousy 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'Héritier, a remarkably handsome species, larger than the last, spreading in broad imbricated matts, and distinguided by the conspicuous large red fields, bordered with black spreading hairs. The pits of the under surface are, in fact, pale brown elevated cups, imbedded in dense piony pubescence of the same hue.

S. crocata. Yellow-veined Sticta. Ach. Syn. n 6. (Lichen crocatus; Linn. Munt. 310. Dickf. H. Sicc. falc. 4. 24. Engl. Bot. t. 2110.) — Frond roundly lobed, dilated, cellular, glaucous-brown, with bright-yellow powdery cracks and margins; brown and piousy 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 Eall and West Indies. The dark hivy hue of the wrinkled cellular frond, is strikingly contrasted with the lemon-coloured powder, which lies from all the cracks, edges, and warts. The piousy down of the under side is nearly as dark, though some what reddish; and the pits, though very small, are rendered conspicuous by their bright lemon-colour. We never saw the shields. — Acharius misapplifies to this the synonymy of Dilenninus that belongs to the following.

S. aurata. Golden-edged Sticta. Ach. Meth. 277. Syn. n. 7. (Lichen auratius; Engl. Bot. t. 2359. Platima crocatum; Hoffm. Pl. Lich. v. 2. 52. t. 38. f. 1—3. Lichenoides lacunofum rutulum, margnibus flavis; Dill. Mufc. 549. t. 84. f. 12.) — Frond finituated, roundly lobed, nearly even, of a bluing reddish-glaucus light 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 upon unmarked specimens, found in Mr. Hudson's British herbarium. This was first finituated from the leaf, by the writer of the present article, in Engl. Bot. v. 53. There can be no doubt of its being abundantly different, the paler redder colour of the upper side, and want of veins, wary cracks, or cellular depressions, are sufficient characters. The margin is more timid and wary, with a rather more golden than lemon-coloured powder, which line also appears in the inner fulvity of the frond, when broken, and in the minute pits of its brown under fide. Nothing is known of the fields.

of the earlier botanists, and given rife 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. It is very prominent reticulations, usually smooth,
are occasionally rough with warts, or rather minute fibres.
The under side is downy, pale-brown; in an early flat
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 tumid, 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 disk, flat, of a chestnut-brown, with a narrow border
disappearing with age, when also the shields sometimes
tumid 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 mucilagi-
ous, like the famous Iceland Mofs, Lichen ifandicus of
Linnæus, and may therefore agree with that species, in
whatever virtues the latter may possess.

S. fribulatus. Pitted Sticta. Arch. Syn. n. 13. (Par-
melia fribulatus; Ach. Meth. 219. Lichen fribulatus;
Lichenioides pulmonium villosum, superficie fribul-
cteta; Dill. Mufc. 216. t. 20. f. 114.)—Frond
dilated, roundly lobed, crenate, deeply cellular, obfolutely
reticulated, glaucous, with grey mealy warts; brown and
villous beneath, with pale, ovate, smooth spaces. Shields
small, scattered, chestnut, with a roughish border.—Found
in the mountainous parts of Europe, on trees and mossy
rocks, but rarely in fruticisation. We met with it in this
state, but sparingly, near Luss, on the beautiful shore of
Loch Lomond. This has much broader rounder lobes than
the foregoing, spreading loosely in large patches; the pale
glaucous colour likewise marks it at a distance; and the
surface, though deeply cellular, is scarcely rubbed or reti-
culated. Grey mealy warts, looking like a sort of moulds-
iness, occur towards the edges of old plants; and the fsiels,
when present, are feated more towards the central part of
each lobe. The under side is clothed with dark-brown
fpongey down, vanishing near the edge, and interpersed
with oval, whitish, very smooth spots, evidently of the nature
of real Dryinea, though rill to much resembling what we
have described in S. pulmonacea, as to confirm the genus
of that species.

Syn. n. 20. (Lichen limbatus; Engl. Bot. t. 1104.
Lichenioides, Dill. Mufc. 10. t. 26. f. 100, varietas far-
ifoba, B.C.)—Frond roundly 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 shaly mossy rocks, and about the roots
of trees, in Scotland, Wales, Oxfordshire, and, according
to Acharius, in Switzerland. We have a specimen with nu-
merous shields, which are extremely rare, from Mr. Hudson's
herbarium, and another from M. Ménzies. Much smaller
than the last, each plant rarely exceeding two inches in
diameter, and consisting of a few concentric, lax, rounded
fronds. Its very prominent reticulations, and brown by age
or brown fattin, with scarcely any depressions and reticulations;
the margin only, often tumid and reflexed, 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,
frond-like, white-bordered pits, sunk in the down. Shields small,
whitish, with a broad base; their disk dark-brown, at first
conceal, with an elevated, smooth, thick border, but soon
becoming flat, or slightly convex, almost black, the border
affirming the fame hue. This border is not sufficiently ex-
name the shields, and hence the former supposed this very
difficult 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 spe-
cimens collected and fluided with no small care and at-
tention.

n. 21. (Lichen fuliginosus; Dickl. Crypt. fusc. t. 12.
Engl. Bot. t. 1103. Lichenoides fuliginosum et pulv-
tentium, fuscules rubiginosis; Dill. Mufc. 108. t. 26. f. 100,
A.)—Frond roundly 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 island of Bourbon.
We have it from Cornwall, Wales, and Wightmoreland.
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 grey, dense, mealy warts, which distinguish S. limbata.
The under sides of both species are similar. The little
fronds of the present, very rarely met with, are more elevated;
at first reddish, with a pale tumid border; then convex and
dark brown, their border disappearing. This has been very
erroneously considered as a variety of the following.

Pl. Lich. v. 21. t. 4. f. 2. Lichenoides polychichides,
villosum et feelrum, peltis parvis; Dill. Mufc. 199. t. 27.
f. 101.)—Frond deeply lobed, bluntly cut, divaricated,
greenish-brown, somewhat uneven and granulated; downy
beneath, with white pits. Shields marginal, vertical, con-
vea, dark-brown.—Abundant in the mountainous woods of
moss parts of Europe, clothing the ground in loose extensive
tufs, intermixed with moss, under the shade of rocks or
old decaying trees; but the fruticisation 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. limbata or fuliginosa, and are longer,
though narrower and much more divided, with abrupt
divaricated segments. Their upper surface is usually
smooth and even, of a greenish rusby brown, scarcely to
green as in Hoffmann's plate. Sometimes it is obfuscely
cellular, and besprinkled with dark granulations, like those
of fuliginosa; with which species likewise the under side
accords, the pits being those of a true Sticta. But the
shields, as represented by authors, appear very different from
every known species, being more like the petes, or targets,
of the genus Pelidea, and falted, like most of them, on
marginal elongated portions of the frond. (See Pelidea.)
Whether they are orbicular and bordered in a young state,
smoothly has not obseived. If so, this ambiguity needs it
would prove a genuine Sticta; but otherwise it would, as a Pe-
leida, overturn the importance of the cyphella for generic
distinction. Indeed this importance is much weakened by

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S. pulmonacea and verdicula, in which these pits are so imperfectly defined; to lay nothing of Parmelia glauculiace, Ach. Syn. 195. (Lichen glauculiace; Engl. Bot. t. 2935) and other species, in which they dilutely, though not occasionally or sparingly, occur.

We beg leave, further, to observe that S. obvoluta, Ach. Syn. n. 19, has no character of the present genus, but, though villous on both sides, seems naturally of the tribe called Cerraria.

STEICHOWITZ, in Geography, a town of Bohemia, in the circle of Beraeus, in the Muldaw; 10 miles S.E. of Beraeus.

STIEGE, or Stige, in Commerce, a term of reckoning used in Germany, containing 20 pieces.

STIENTA, in Geography, a town of Italy, in the department of the Lower Po; 9 miles N. of Ferrara.

STIEPANO, a town of Bohemia, in the circle of Kaurzin; 15 miles S. of Kaurzin.

STIERNHIELM, George, in Biography, a learned Swede, was born in Dalecarlia, in the year 1598. Enjoying the friendship of Burkus, 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 moralities in the Gymnasion newly founded at Velleros; but destined for a wider sphere of usefulness and reputation, he was appointed, in 1630, alderman in the court of justice at Dorpat; and in the following year was ennobled. In 1639 he occupied an important office in Livonia, where it was his fate to be regarded by the ignorant and superstitious populace as a forcerer, 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 lation of vice-president of the court of justice at Dorpat; but being obliged to fly from the Russians, who threatened this place, the vessel in which he embarked was wrecked in its passage; and though he escaped himself, he lost all the property which he had preserved from the ravages of the Russians. When he arrived at the capital, he was penniless and almost naked; but he was soon relieved by the munificence of some steady friends. Queen Christina treated him with respect, and nominated him antiquary of the kingdom; entailing him also with the care of the public records, and conferring on him the title of "Culos Regni." In 1658 he was appointed by Charles X. provincial judge of Drosteheim, in Norway; but when Drosteheim was restored to Denmark, he became, in 1661, a member of the council of war; and when the college of antiquities was established at Upsal, in 1666, he was appointed director. He died at Stockholm in 1672, at the age of 74. Stiernhelm 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 Upsal, to hold a disputation on this subject with professor, afterwards bishop, Terfehus. His taste for poetry led him to an acquaintance with the principal compositions of the ancient poets; and his own verses are said to be still 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 distress as to be under a necessity of writing to the chancellor Oxenhius, requisitioning public relief. When his friends regretted his poverty, they received for answer, "Bone mentis comes et paupertas. Aut philosophum aut divitem operet vivere." He preferred the former; and always feemed contented, cheerful, and happy. Being asked on his death-bed what epigraph should be inscribed on his tomb, he replied, "Vixit, dum Vixit, latum." 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 any thing contrary to that respect which is due to the Supreme Being, or to the principles of true religion. Among his numerous works were, "Magog Araméez Gothicus, five origines Vocabularum in Linguas pane omnibus, ex Linguæ Svecica veteri," a work printed at Upsal in 1640, but never completed; "Leges Velthrogothicæ antiquæ, cum Praefatione et Indice Vocabularum obfusciorum," Stock. 1662; fol.; "Uphilias, seu Verbo quatuor Evangeliorum Gotica, Litteris Latinis quam Gothicæ editis F. Junesium, cum Verfionibus paralleliis, Svecogothica, Islandica, et vulgata Latina," &c. 1671; ibid. 4to.; "Epitola ad Olaus Verelium de Origine Vocabularum Gothi et Svedi," prefixed to Hervara Saga; "Antichveriæs, litteræ de Originiis Sveo-Gothicæ," Holm. 1683; 8vo. The "Archimedes Reformatæ" of Stiernhelm, 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 these microscopes and tables, which were very rare in Sweden at this time. He was well versed in languages, history, and the northern antiques. His memory is particularly venerated 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 fame 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 Stiernhelm's "Hercules" is and will continue to be a master-piece. Gen. Bong.

STIERNHOK, John, 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 Velleros; and in 1640 made professor of jurisprudence in the newly established academy at Abo. In 1658 his flight 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 affluence. He was the author of various esteemed works, among which was "De Juris Sceuomin et Gothorum vetulio Libri duo," Holm. 1672; 4to. Gen. Bong.

STIE, the quality by which a ship is enabled to carry a sufficient quantity of sail without the danger of overfetting. Vessels having this quality, arising from their construction, will certainly fail fatter than others, which, in order to carry the fame quantity of sail, require to be builded. The illibors of many ships, however perfect in their construction, may be materially injured by an injudicious mode of lollowage; although, on the contrary, this defect in the construction can be seldom rectified, to any considerable degree, by the lollowage. See Ship-Building and Stowage.

STIFF Joints in neat cattle, a disease of these parts, which is often troublesome and very hurtful to them. It is most probably of the rheumatic kind, and not unfrequently termed joint felloen by the country people. It affects, for the most part, such old milch cows as are near calving, or such young cattle as are much exposed in the
the held 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 starvations for the winter season, on their being suddenly turned out in the early summer months, and greatly exposed in low damp 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 con- sequently 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 lassitude and incapacity of stirring which attend it.

On the disease first making its appearance, the beast should be removed, and be taken to some proper building of the cow-house kind, which is rather which is situated in moderate warmth, and much use in the removal of the complaint. Here proper remedies should be given, such as calomel and gum guaiacum, in pretty full doses, as from half a dram, to a whole dram 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 balam of copaiva into the form of a small ball. This may be given once or twice in the day, in a hornful or two of warm ale. And afterwards, recourse may be had to guaiacum, in combination with Peruvian or oak bark, camphor, and fumach 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 drachms of the camphor; 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 disease 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 lassitude in their joints.

But cows and other neat cattle sometimes have lamenesses and flinfinenes, which appear to be at one time in the fore-quarters, and at another in the hind ones; and which are attended with considerable pain. These often proceed from hard driving, or other similar causes, and not from the same causes as the above; but in these cases, too, the calomel-ball, as well as such remedies of the bark kind as have been advised above, will be found useful.

Stiff Joints in lambs, a disease or affection in these parts of them, which mostly takes place during the hot summer season, as about the month of June, coming on with a flinfinnes in the different joints of the extremities, and sometimes feizing several lambs in the same flock at the same time. It is commonly supphed to be occasioned by the low state or condition of the ewes to which they belong; but it is more probable that it arises from the sudden change of colds and damp which are liable to take place, and to which they are particularly exposed at this period of the year. At such times, however, the lambs are believed to be disposed to grow fat, and, for want of proper and sufficient nourishment, to become flinted, and to have their joints stiff and swelling out; they, however, for the most part, recover from the complaint. It is most likely a disease of the rheumatic kind, which, when it does not readily go off, may cause the use of calomel with a little opium in the form of a small ball, to the ex- tent of from a scruple to half a dramh, once or twice in the day, or a small spoonfull or two at a time of the spirit of turpentine.

STIFFLE, or STIFFLE, the name of a disease in the patella, or knee-pin, in a horse or other animal, which part it properly signifies. A lameness in the stifle 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 set that heel to the ground. Some strains in the stifle are violent, and swell pretty much; but Gibbon affirms, that he hardly ever knew any of them incurable, unless bad methods had been tried in the beginning. They commonly may be cured by cooling saturnine applications, such as have been prescribed for the shoulder strains; but if the swelling be very large and puffy, which sometimes happens, recourse must be had to fomentations, to take off inflammation. Sometimes, however, impojishments follow: in such cases, and when these break and run, there is commonly an end of danger.

STIFF, in Etching. See Etching.

STIGLIANO, in Geography, a town of Italy, in the Patrimonio; 9 miles E. of Civita Vecchia.—Alfo, a town of Naples, in Basilicata, celebrated for its baths; 24 miles S.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 fertilization of Plants.) For the accomplishment of this important purpose, the part in question is so situated 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 Orchidea and Conotera, 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 ringen flowers the two stigmas are tapering, but of the mall simple structure, devoid of all evident pubescence, so that it is hard to understand which is the efficient part; while in most graces 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 vifid moisture, are evident in these organs; their rich purple or scarlet colour contrasting with the large yellow pollen, whose burbling, or explosion, may almost be seen by the naked eye. The stigma of the Ama- ryllis formosiflora is furnished, as Linneus observes in his
Dilertation on the Sexes of Plants, with a large drop of clear fluid, which is protruded in the day time, so as to seem in danger of falling to the ground. 'To this the pollen adheres, rendering it turbid or striated, in which state it is re-absorbed towards evening into the style. The concave stigma of the Violet gapes to receive the pollen; that of the Martynia is said to be irritable, closing 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 Linnæus, in the Dilertation 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 cafes where the styles remain, to form a crown, or hooks, afiliting in the dispersion of the seeds, the stigmata will generally be found decayed or separated. See Germen and Stylus.

STIGMANTHUS, in Botany, a name of Loureiro's, formed of repyn, the stigma, and wies, a flower, in allusion to the unusually large size of that organ. — Loureir. Cochinch. 146. — Clafs and order, Pentandria Monogynia. Nat. Ord. Rubiaceae. Julf.

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-oblong, spreading segments. Stam. Filaments five, very short, inserted below the segments of the corolla; anthers oblong, reflexed (we presume between the segments). 

Per. Germen 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.

Ell. Ch. Corolla funnel-shaped. Stigma furrowed, very large. Berry dry, crowned by the calyx, of one cell, with many bony seeds.

1. S. cympaeus. Cay luim rong of the Cochinchine.—Native of woods and hills in Cochinchina.—A large, branching, climbing, fawls, 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 Muffenda, from which he says, it differs chiefly in its feed-selv and stigma. We cannot refer it to any known genus, but it seems to range near the Solena of Willdenow. See that article.

STIGMAROTA, from figma, and rota, a wheel, alluding to the large, orbicular, toothed stigma. — Loureir. Cochinch. 633. — Clafs and order, Diastea Polyandria. The name is bad, and of the genus itself we have not sufficient materials to form an opinion. Loureiro gives the following.

Ell. Ch. Male, Calyx in four or five deep segments. Corolla none. Stamens thirty.

Female, Calyx in five or six deep segments. Corolla none. Stigma wheel-shaped, fix-clerk. Berry fleshy, with fix seeds.

The species are two.

1. S. Jangomas. — Stem arborescent, with branched spines. Stalks scattered, many-flowered.—Cultivated, and perhaps wild, in Cochinchina. This the author confounds as Jangomas, Bunt. Jav. 111, and Spina Spinorum, Rumph. Amboin. v. 7. 36. f. 1. 1. He the foregoing rightly observs, that the latter synonym can have no reference to Curifa spinorum, 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 tracheæ, or air-vesels, and serving for the office of respiration.

Nature has given to these minute animals a much larger number of tracheæ and bronchia, than to us. We have the ramifications of the trachea reaching no farther than into the break, whereas, in the bodies of these insects, we find them extended through the whole, and finely and admirably interwoven with one another. We have but one mouth to respire by; and the organization of the parts, indifferent to respiration, is very admirable in us; but in the insect class, the mouth 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 stigmata 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 best way to find them, in the generality of flies, is to examine them first in the larger species of the bumble, where they are very distinct and plain, and after their situation is well known in that species, they will be much the more readily found in the cell.

These stigmata 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 those seems not a little to resemble a fea-muscle with its feel a little open, or is somewhat like the opening of an eye. It is also surrounded by two eye-lids, proportionally thick; and beside these, which make its outer circumference, one may discover two others within, which are bordered with hairs, and which, when elided, often quite shut up the opening.

The colour of the stigmata 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 fellow colour, in flies whose corselet is brown, or black, or blueish.

Flies have, besides these, several stigmata also in the rings of their bodies, perhaps in every one of them, though common those in the two or three first are only to be dilligence; these are not like those of the corselet, but are round, usually a little eminent above the rest of the surface, and resembling pin's heads; they are not easily discovered, because they are not only small, but usually hid by the folds, or commissures of the rings. They are usually two on each ring, placed on the two opposite sides, and partly under the belly.


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 stigmata, serve to give respiration to this class of animals. M. Reaumur repeated his experiments, and made several new ones; and he concluded that those apertures serve 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 stigmata: 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 respired 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 STIGMATIZATION.

STIGMATA were also a kind of notes, or abbreviations, consisting only of points, disposed various ways; as in triangles, squares, cradles, &c. STIGMATA is also a term introduced by the Franciscans to express the marks, or prints, of our Saviour's wounds, said to have been miraculously impressed by him on the body of his faithful follower, 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 same occasion, by Fred. Pizzi, a Roman surgeon, in the year 1594. STIGMATICI, among the Romans, were fervants marked in the face for fame crime.

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 worshippers 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 ensign, as the thunderbolt of Jupiter, the trident of Neptune, the ivy of Baechus, &c. or they marked themselves with some mystical 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 stigmata, because the idolaters, by that ceremony, used to confound themselves with their false gods.

Among some nations, stigmatizing was considered as a distinguished mark of honour and nobility. In Thrace, as Herodotus tells us (ib. x.), it was practiced by none but persons of credit, nor admitted by any but persons of the meanest rank.

The ancient Britons are also said to have imprinted on the bodies of their infants the figures of animals, and other marks, with hot irons. Potter Arch. Greek. tom. i. p. 64, &c.

STIGSIO, in Geography, a town of Sweden, in Angermanland, seated on a river which runs into the gulf of Bothnia; 8 miles W. of Hernosand.

STIKKESHOLM, a place on the south coast of Iceland, situated at the extremity of a small peninsula, close to the sea, amid shrubry precipitous rocks, some of which are columnar. Near the i throm, which is pilled in entering this peninsula, is a hamlet, called "Helgafell," or the Holy Hill, from its situation on an eminence, with which certain superflitious ideas and usages were anciently connected. On this spot was established one of the earlist of those settlements which the Norwegian emigrants made upon the coasts of Iceland. The access to Stikkeholm affords several fine views of the "Brecie-Fiord," which is here completely flooded with small rocky islands, amounting in number to about 150. Many of these islands contain great numbers of cinder-ducks. The houses are large, and, as well as the flore-houses and cottages, belonged (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 trade. The fishery, which begins earlier than in the Faxfiord, 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 Helgafell; but at six o'clock in the evening, the flore-houses were again opened, and the inhabitants of the place, refuming their common drestes, went to work as usual. This is also the cafe in every part of the country. The fabbath 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 their meals. The master of the house always saluted his lady, when he rose from the table.

Mackenzies Travels in Iceland in 1810.

STILL 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 Avignon berry, in alum-water, which is mixed with whiting 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. Jull. 443. Schreb. Gen. 608. 836. Wildk. Sp. Pl. v. 4. 714. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 367., was so called perhaps from the supposed permanency of its style. 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 Antidesma alexiteria. (See Antidesma.) Indeed the Stilago diaandra, Roxb. Coromand. v. 2. t. 166, most evidently agrees in genus with his Antidesma pakefenus, t. 167. We cannot account for their being kept separate by the learned editor, who well knew what Stilago was. Still more wonderful is it that Noeli talia, Riche Hort. Malab. v. 4. t. 56, should be quoted by Wilkensow, without any remark, for both Stilago Buxius and Antidesma alexiteria. 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. Perianth inferior, double; the outer of three lanceolate, spreading, pointed leaves; inner of one leaf, tubular, five-toothed, at length hardened. Cor. of one petal, tunnel-flaped; tube the length of the calyx; limb
limb in four or five linear-lanceolate, nearly equal, deep segments. **Stam.** Filaments four,awl-shaped, inserted into the throat of the tube, longer than the limb, somewhat unequal in length; anthers heart-shaped, obtuse. **Pist.** Germ. superior, ovate; style thread-shaped, the length of the filaments; stigma acute. **Peric.** none, except the inner calyx becoming cartilaginous, inclosing the feed, and falling off with it. **Seed** solitary.

Some plants are said to bear only male flowers.

**Eff. Ch.** Calyx inferior, double; the outer of three leaves; inner five-toothed, cartilaginous. Corolla funnel-shaped. Capsule of one cell and one valve, separating entirely from the base. **Seed** solitary.

1. **S. pinifera.** Fine-leaved Stilbe. Linn. Mant. 305. Wild. n. 1. Thunb. Prodr. 29. (S. veitita; Berg. Cap. 30. t. 4. f. 6. Selago pinifera; 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 *Vaterianella*, Hort. Amst. v. 2. t. 110, surely can have nothing to do with this plant. The stem is shrubby, with many straight, round, upright branches, 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 Raliks. Spikes terminal, sterile, solitary, erect, oblong, with a bract under each flower, reeling 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 Linnæus, confounded two species, one with longer whitish hairs upon the corolla, and shorter less pungent leaves, than what his plate represents.

2. **S. cernua.** 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 in the foregoing. Their form is triangular or prismatic, with a fleshy rib. **Spikes** shorter than the lal, 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 shrub than either of the preceding, with small leaves, like some Heath or Thyme, imbricated in four rows, ovate, thick, smooth, with a fleshy lanceolate keel, lodged in a furrow. Spikes short and erect. **Flowers** apparently purplish. **Calyx** fringed with white wool. No figure is extant of this or the last, nor have they appeared in any garden.

**STILBITAE.** In Mineralogy. See ZEOLITE.

The French mineralogists, after Haiy, have divided the mineral called zeolite into two species, metotype and filbitæ. The latter is often called nacy zeolite, being distinguished by its nacy infusc. The properties of this mineral will be described, with the other varieties of zeolite, under that article.


**Eff. Ch.** Seeds, or seed-cailes, naked, imbodied collectively in a black substance, flowing from the branches of trees.

This cannot but seem a very doubtful genus of the vegetable kingdom, though not more obscure than the *Chase* of Linnæus, or the *Hydatid* of Hunter, amongst animals. Peron. remarks that there is no *fisbaula*, or capillary receptacle, as in *Spilaria* (see that article): and that a compound microscope is necessary for the determination of the different shapes of these minute granular bodies, which he knows not whether to call *feed-waffles*, or feeds, or perhaps buds, all forming, to the naked eye, one uniform black mass. He defines six species.

1. **S. afterofera.** (S. afterofera; Hoffm. Germ. v. 2. t. 13. f. 3.)—Cafes foliated.—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, crossing each other, and divided internally into three or four cells.


3. **S. ovata.** Perf. Obs. Mycol. fasic. 1. 31. t. 2. f. 2. (S. pyriformis; Hoffm. Germ. v. 2. t. 13. f. 2.)—Cafes? or feeds? ovate.—On the trunks of beech. The shape is exactly oval, but no distinct partitions, or cells, are discernible, according to Peronson, though Hoffman’s figure seems to express them.

4. **S. angulata.** Perf. Syn. n. 4.—Seeds minute, ovate, inclining to cylindrical.—Intermediate between the last and the following, nearly agreeing in minuteness with the latter.

5. **S. microspora.** Perf. Obs. Mycol. fasic. 1. 31. t. 2. f. 1.—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, delibuted of partitions.

6. **S. fihrofera.** Perf. Obs. Mycol. fasic. 1. 31. t. 1. f. 6.—Seeds minute, globose.—Found on the same of the Common Reed, *Arrundo phragmites*, appearing to have run out of filitures in the Straw, and sometimes collected in round spots.

**STILBUM.** From στενος, shining, a genus of fungi, which Fison can in his *Synoplia*, p. 608, thus defines.

**Eff. Ch.** Little, flaked, muceo-like fungi; with a roundish folid head, at first warty or gelatinous, becoming generally opaque, or turbid, as it ripens.

He defines sixteen species, found on rotten wood, of which the most conspicuous and remarkable is the first.

**S. birutum.** Perf. Dips. Meth. Fung. 39. 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 largess of its genus, and may even be dried and preferred. The brightly aspected of the falk, one or two lines in height, readily distinguishes it.

We cannot perceive why this genus may not be comprehended under MUCON. See that article.

**STILE, and Stilus.** See STYLE.

**Stile** in Rural Economy, the name of a well-known contrivance for the admission of foot-passengers, without permitting the flock 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 liones 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 cord stone or bar fixed, to prevent horses or cattle jumping over. Another file of a simple construction, and which is well calculated
calculated for situations where the traffic is not great, is formed by having flapping-frames fixed in the sides of the wall. In the Corinithian flute, the foundation is a fluted wall, in which a gap is left, and flutes are laid across a ditch of some depth, made lengthways in the gap; the foot-paftengers step on the flutes, but four-fooled animals mfs through and fall into the ditch.

Where wood is employed in forming flutes, they have many different forms, according to the nature of the situations, and the ingenuity of the workmen who construct them. Common flutes of this fort are made with two framed pieces of timber let upright, part of them parallel to each other, leaving sufficient space for a perfon 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 paftengers are enabled to get over. There is likewise the wallet flute, which has somewhat 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 flue-form, with a rail.

It is probable, too, that there are other different kinds and forms in use in different places.

STILES, in Carpenter, denote also the upright pieces which go from the bottom to the top in any window, or the like.

STILLFRIED, in Geography, a town of Austria; 7 miles N.E. of Weikendorf.

STIL, an island in the Grecian Archipelago. N. lat. 37° 25'. E. long. 22° 49'.

STILICHIO, in Biography, a commander who distinguished 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 master-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 depress 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 entrusted by him with the guardianship of his two sons, Arcadius and Honorius. The latter, who had the Western empire for his share, appointed Stilicho for his prime minister; and he began his administration by renewing the ancient alliances of the Romans with the German nations, and established peace. In 397, Stilicho restored 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 confiscation 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 provinces, Stilicho opposed this disgraceful measure, and collecting a powerful force, vanquished the Goths at Pollentia, and obliged them to retreat; neverthelefs Alaric, breaking through the passage of the Apenines with his cavalry, spread an alarm that reached even Rome, to 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 405, Italy was again invaded by a vast multitude of barbarians, who penetrated as far as Florence, laid siege to the city, and reduced it to great distress. Stilicho hallowed to the relief of the beleaguered, who forced 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 ambition, or of late necessity, entered into a negotiation with Alaric, by virtue of which he was declared master-general of the Roman armies in Illyricum. Whilft Stilicho was forming a purpose of leading an army of Romans and Goths to Conflantinople, and concurring 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 treasonable 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 distinguished posts in the army and state. Stilicho received intelligence of this measure at Bologna; and a council, which he summoned, advised him to march immediately, and revenge the slaughter of his friends. Whilft 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 Herachian, 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 submitted with a firmness becoming the military character which he had acquired. His son Eucherius was soon after apprehended, and put to death; and his daughter Thermantia, who had succeeded her father in the imperial bed, was divorced. Stilicho's surviving friends were cruelly tortured, in order to procure the confession of a supposed conspiracy against the emperor; but they suffered in silence. This catastrophe occurred in the year 408. The apparent piety of Olympus, the new favourite of Honorius, has induced 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 him as the hero of his age. Univ. Hist. Gibbon's Rom. Hist.

STILL, the name of an apparatus used in distillation. See Distillation and Laboratory. See also Alum, Bic, Retort, Worm, &c.

Dr. Lewis has contrived a still, adapted to his portable furnaces, which is sufficient for the purposes of an experimental laboratory. The body of the still is a wide copper pan; and, for distillation in a water-bath, another vessel of the same figure is received into it almost to the top, 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 purposes.

All the parts are made of thin copper plates, and well tinued on the inside with pure tin. In consequence of their thinness,
thinneth, 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 sit close; the juncture is easily made perfectly tight, by applying round it narrow slips of moistened bladder, which are more convenient than lathing, as being readily stripped off when the operation is finished. A short pewter pipe, with a pewter flapper fitted to it, for returning the distilled liquor, or pouring fresh liquor occasionally into the still, without the trouble of unluting and separating the vessels, is inserted 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 caulked, by inferring between it and the brash, a thin copper pipe about two feet long. A worm and refrigeratory are necessary, as for the common still; and a glass head is requisite for some ues, 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 ufe of the metallic worm also is to be avoided, and the glafs or flone-ware receiver joined to the pipe of the head.

Lewis's Com. of Arts. p. 9, 10.

**Still-Bottoms**, in the **Dilillery**, a name given by the traders to what remains in the still, after the working of the wath into low wines.

Those bottoms are procured in the greatlest quantity from the malt wath, and are of no much value to the distiller in the fattening of hogs, &c. that he often finds them one of the most valuable articles of the business. They might also be put to other ues, such as the affording of a large proportion of an acid spirit, an oil, a fuel, and a fixed ual; and with some address, and good management, a vinegar and a tartar. Another very advantageous ufe of them, is the adding of them to the next brewing of the malt for more spirit: the increafe of the produce from this is more than could easily be conceived. It also more readily dispofes the new wath to ferment, and gives the spirit a vinofity that it cannot have without it; the proportion, in this cafe, 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 caulked 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, ufed for curiosity. The liquor left in the still, after the rectifying of the proof spirit into alcohol, is also of the fame kind.

The bottoms of molasses spirits seem calculated for many ues. It is very probable that the vinegar-makers would find their account in trying them, and the strong and lafiting 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 wineless, may be brought to afford Mr. Boyle's acid spirit of wine, and that substance called by Becher the molia flantia vini. A parcel of tartar may also be procured in very great perfection; and the laft remainder may be converted into excellent and genuine salt of tartar. The liquor may otherwise be serviceable in making vinegar and white lead.

**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:

1. The first caution is to lay the floor 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.

2. The stills should be placed above and on that side of the still-house to which the floor has its current. The largest stills in Holland, for their greatest works, are of these monolithic size which are constructed in England, but much more manageable and convenient, as seldom containing more than six or eight hogsheads; 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 let 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 refuse wath, or still-bottoms, should be discharged by means of a hole, 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, malt spirit will be made with little more trouble than molasses; for by this means the basins of brewing and cooling the wath, which, according to the method generally practised in England, takes up 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, exprefion, &c.

**STILLATORY.** See **Still-House.**

**STILLINGFLEET, 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 Ringwood, was elected in 1648 to St. John's college, Cambridge. Of this college he was chosen fellow in 1653, and presented to the rectory of Sutton, in Bedfordshire, in 1657, having previously received episcopal ordination from Dr. Browning, the deprived bishop of Exeter. In 1659 he published his "Trinitium, or the Divine Right of particular Forms of Church Government examined," hoping, by this publication, to remove the prejudices, and consolidate the attachment of those who were alienated from the church of England. In this treatise he maintains, that Chrit is not determined the form of the government of his church by any positive laws; that the apostles 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 Trinitium was highly commendable for its learning and moderation; but the author himself, as bishop Burnet says, desirous of avoiding the imputations of hostility to the church which
which it occasioned, retracted the book, and gave way to the humours of a high feat of people, beyond what became him, perhaps beyond his own sense of things. Whilst he was employed in performing the functions of a country pastor, he presented to the public a second work, of extensive learning and periphrastic style, which has been always esteemed one of the best defences of the Christian religion; and which was intituled "Origines Sacrae; or a rational Account of the Christian Faith, as to the Truth and divine Authority of the Scriptures, and the Matters therein contained," 1669. This work established his reputation as a writer, so far as he had a commission from Dr. Hanchman, bishop of London, to draw up a vindication of archbishop Laud's conference with Fisher the Jesuit; and the title of his work was, "A Rational Account of the Grounds of the Protestant Religion," 1664, folio; which Dr. Tillotson affords to be fully answerable to this appellation. So soon after, he was elected preacher at the Rolls chapel, and in 1665 presented 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 divinity, distinguishing himself on the occasion by keeping an act in which he displayed great fluency in the Latin language, and logical acuteness. At the election of Charles II., to whom he was chaplain, he was nominated canon-residentiary of St. Paul's, to which preferment succeeded the deanship of London, and in 1678 the deanship of St. Paul's, which was his highest promotion during that reign. Whilst Dr. Stillingfleet was thus advancing from one dignity to another in the church, he was occupied in a variety of compositions on doctrinal and controversial subjects, more particularly directed against the Socinians. He also published a number of tracts against the Roman Catholics; one of the first was "A Discourse concerning the Idolatry practiced in the Church of Rome, and the Hazard of Salvation in the Communion of it," 1671; which produced a great number of answers and replies. Although much of his time must have been occupied in controversial writing, he found leisure to prefer to the public "A Letter of Resolution to a Peron unsatisfied about the Truth and Authority of the Scriptures" which was considered as an excellent piece of refutation. He also preached a sermon about the time of the Popish plot, the design of which was to unite the Differents in the common cause, and to induce them to abandon their separation from the established church, which involved him in a controversy with Baxter, Owen, and others, which were not likely to acquit him of his fundamental position; that, "peace, according to the judgment of divers among themselves, a conformity to our church's worship was not unlawful, by consequence their separation must be sinful and dangerous." To their strictures on his sermon 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 vindicated the right of bishops to vote in criminal cases, in a treatise on "The Jurisdiction of Bishops as capital Cafes," which proved his extensive acquaintance with parliamentary history, as well as statute and common law. A second work, published in 1685, and entitled "Origines Britannicae, 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 conversion of the Saxons. In this research, Stillingfleet had been preceded by the learned archbishop Usher, in his work "De Ecclesiariarum Brittonicarum Primordiis," King James having instituted an ecclesiastical commission, summoned Vol. XXXIV.

Stillingfleet, who had long been prolocutor of the Lower House of Convocation, to appear before it; on which occasion he drew up a "Discourse concerning the Illegality of the Ecclesiastical Communion, in answer to the Vindication and Defence of it," which was not published till the year 1689.

At the Revolution, the services rendered by Dr. Stillingfleet to the established church were recompensed by the bishopric of Worcester, to which he was consecrated in October 1689; in which high station he was dubious 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 1694, the queen is said to have wished for the advancement of Stillingfleet to the see of Canterbury, but the Whigs opposed it, from an apprehension "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 intitled "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 apprehension that the definition of subsistence, and the account of ideas contained in that work, were unfavourable to the doctrine of the Trinity. The cause was not decided late, who is thought on this occasion to have flurried a defeat. An edition of his 50 sermons appeared in 1707, folio.

Dr. Stillingfleet injured his constitution, which was naturally strong, by his tedious and sedentary 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 memory, with a Latin inscription by his chaplain, the celebrated Dr. Bentley, in the high style of panegyric, part of which has been thought to exceed even the jilt 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. Marsh, archbishop of Armagh, as the foundation of a public library at Dublin. Biog. Brit.

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 Norwich school, was entered, in 1720, at Trinity college, Cambridge, 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, palled 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-matter at Kenfigton. To Mr. Windham, of Felbrig, Norfolk, he was more substantially indebted, being often refuted at his house, and receiving from him an annuity, which was considerably augmented when he became Mr. Windham's executor. He is well known as the author of several pieces in prose and verse, particularly for an "Essay on Conversation," which was published in the first volume of Cc Dodo.
Stillingfleet.

Dodder's Collection of Poems; and also from a volume of "Miscellaneous Tracts," printed in 1759, and conflicting claims of discovery from Linné's Amoenitates Academica. To this work were annexed valuable "Observations on Grafs," 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 feed some perfons, properly qualified, to refine 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 fodder's in Piccadilly, where he died in 1771, at the age of 69. He ordered all his papers to be destroyed at his decease. Gen. Biog.

This ingenuous, learned, and worthy man, was well acquainted with the theory of music by reading and meditation, and with the practice by hearing all the Bell performers in Italy during his travels, and intimacy with Mr. Price of Foxley, Mr. Tate of Mitcham, and Mr. Smith, the disciple and successor of Handel in carrying on the oratorios, for whom Mr. Stillingfleet wrote new sacred dramas, which he set and had performed in turn with the music of Handel.

His work, intitled "Principles and Power of Harmony," the most clear, agreeable, and interesting tract 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. Tho' those who treat music merely as a science, without posseffing the practical part, are naturally contracted in their ideas, and ufeles for profefors: and, on the contrary, mere practical musicians, who have feldom had either education or leisure to qualify themselves on the fide of learning, produce nothing but crude and indigefled reveries, which a man of taste in literature difdains to read. That this has been the cafe with fome of the moft able practical musicians, we can, from our own knowledge, affert. They have the ambition of paffing 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 fyllem; but arithfute calculations being neceffary in the bufinefs, he had recourse to his friend De Moivre, who was no musician, and underflood the doctor as little as the doctor underflood Euclid: they never met without a quarrel; for as each would talk about what he did not understand, each must by turn have been abfur'd. The fame thing happened in France between the famous Rameau and d'Alembert; at Padua, between Tartini and Padre Colomba, his friend, the professor of mathematics in that university. The work of which we are now speaking, however, contains free reftrictions upon objections; as it was written by no half scholar or shallow musician; but by one posseffed of all the requifites for fuch a task.

In the author's commentary on Tartini's firft chapter, he explains clearly the now well-known phenomenon of a single string or found producing its own harmony, upon which Rameau has built his fyllem of a fundamental base. (See BARNE Fundamentals.) The author, in the history of this discovery, traces it no farther than the time of Merfennus, with whom he leaves it; but it seems to have been long known before his time, as the organ is constructed upon the fame principle; the fops of that instrument being proportioned to each other in the fame manner as the founds above-mentioned, which are generated by a single string or tone: when the fops, 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 fruck, and it is imagined that no other founds 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 fyllem, was quite new, and discouvered by himself. It is that of the third found produced in the medium by the concurrence of two founds that can be sustained for any time upon one or two instruments, as trumpets, horns, flutes, hautbois, two violins, or one in double fops, two founds on the organ, with only the open diapason out, &c. a third found will be heard, which is its true fundamental base. See TERZO Suono, where these invisible bases will be specified to every interval, but chiefly those that are confonant.

Tartini's second chapter concerning the circle, its nature and signification in harmonics, Mr. Stillingfleet examines with great candour, and some pleafantry. It is in the third chapter that Tartini unfolds his musical fyllem, and treats of concords and discords, their nature and definition. The commentator's remarks on this chapter are very bold and luminous.

The fourth chapter of Tartini gives the origin of the musical scale and genera, their use and confquences. In our author's commentary upon this important chapter, he acquires himself with great dexterity, and proves that he is not only profound in the theory of found, 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 finging in almost every Christian town and village, which inquisitively teach intervals and the fcale 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 fages.

Our author's praise of the harp, and wishes that there were better music for it than old and vulgar Welth tunes, would have been highly gratifying, 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 Crumpolzh made not only the firft great performer upon that instrument in our country, but the firft who had good music to perform, to f盛典 its powers; with which she had been furnished by her husband and master.

It is enough for us to make Stillingfleet 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 surprizing effects, with no other accompaniment 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 railed, both in the profeflors and in the ret of the audience, such and fo great a commotion of mind, that we could not help flaring 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 fame 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 sign. 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 nurseries, to which our ears have been accustomed from our infancy; for this reason, perhaps, perhaps, the hundredth at the playhouse, will prefer them to any other music. In fo mixed and popular an assemblage 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 fame 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 E这场比赛 on Man, or Milton's Paradise Lost? Simplicity is an 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 too, delicate taste, be governed by the ignorant and unpolished, any more than thole 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 one piece, as those of the Beggar's Opera, which are made up of Scotch, French, Italian, Irish, and English; and is a lover of music to be thought affectingly 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 so in Plato's time; the custom has been continued by every writer on the subject; and every musician, who, like Timotheus, adds a new string to his lyre, will be said to endanger the flat; 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 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 MS. 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. 646. Willd. Sp. Pl. v. 4. 588. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 337. Walt. Carol. 239. Pursh 609. Jiff. 390.—Chas and order. Monocoty Monadelphia. Nat. Ord. Tricoceae, Linn. Euphorbia, Julii.

Gen. Ch. Male. Cal. Perianth feven-flowered, coriacous, hemisphorical; pitcher-shaped, entire. Cor. of one petal, tubular, funnel-shaped, gradually dilated upwards, much narrower than the calyx; its margin undivided, but fringed ia a jagged manner. Stamina. Filaments two, thread-shaped, twice as long as the corolla, spreading at the summit, very nightly connected at the bafe; anthers kidney-shaped, of two round lobes.

Female, at the bafe of the same spike, Cal. Perianth as in the male, but single-flowered. Cor. superior, shaped as in the male. Pet. Germen roundish, between the calyx and corolla; filyle thread-shaped; stigmas three, distinct, recurved. Peric. Capsule somewhat turbinate, bluntly triangular, three-lobed, of three cells, surrounded at the bafe by the enlarged calyx. Seed small, oblong, obliquely triangular, marked on the inner side with a transverse furrow.


Obí. The "two cup-shaped glands," which Schreber, after Walter, describes in the male flowers of the original species, appear to be either a bractea, or abortive calyx. They perhaps contain honey.

1. S. Jfloriaca. Wood Stillingia. Linn. Mant. 126. Willd. n. t. Ait. n. 1. Pursh n. 1. —Stem herbaceous, Leaves elliptic-oblong, obtuse, finely serrate.—Native of pine-woods on a barren soil, from Virginia to Florida, flowering in May and June. A greenhouse perennial herbaceous plant, flowering at Kew in July and August. The flowers are milky when broken, a yard high, round, smooth, leafy. Leaves scattered, on short stalks, elliptical, three inches long, smooth; paler beneath. Flowers yellow, in a terminal spike, resembling a catkin; the male flowers numerous. Linnaeus says this plant is esteemed in a specific verdoraceous.

2. S. Jflorír0s. Privet-leaved Stillingia. Michaux Boréal-Americ. v. 2. 213. Willd. n. 2. Pursh n. 2. —Stem shrubby. Leaves lanceolate, tapering at each end, entire.—In shady woods of Carolina and Georgia, flowering in June and July. Pursh.

3. S. febíerea. Poplar-leaved Stillingia, or Chinefe Tallow-tree. Michaux, ibid. Willd. n. 3. Pursh n. 3. Ait. n. 2. (Croton febíerea; Linn. Sp. Pl. 1425. Ricinus chinesinis febíerea, populi nigra folio; Petit. Gazoph. t. 24. f. 3. Euonymo affinis Sinanum, populi nigra folio, &c.; Pluck. Amath. 7. t. 350. f. 2.)—Stem arboreous. 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 flves, or rather greenhouses. The habit is that of a Poplar, with smooth leaves, on longer slender stalks. Spikes terminal, dense, cylindrical. Male flowers with a roundish sepal or gland at each side of the calyx, analogous to what we have mentioned after the Eff.

C C 2 Ch.
STILPO, Ital. Style, in Music, a peculiar manner of finging, playing, or composing. In ancient ecclesiastical music, the styles of Palestrina, Tallis, and Bird, are venerable, and highly esteemed by masters, and all good judges of that species of composition. In oratorios, the styles of Handel, Leo, and Jommelli, are marked with an original art of excellence; the opera styles of Pergolesi, Hasse, Piccinni, Sacchini, and Paisiello; in symphonies, the elder Stamitz, the Mannheim school, Haydn, Mozart, and Vanhal at the Vienna school, are original; as are the quartets of Haydn; the quartets of Boccherini and Mozart; the harpsichord pieces of Domenico Scarlatti, Alberti, Schobert; the piano forte pieces of Emanuel Bach, Haydn, and Mozart; but the comic operas of this last must be inrolled among the first for genius, originality, and good composition, that modern times have produced.

Padre Martini says, there are three kinds of style for the imitation of young ecclesiastical composers,—the sublime, the middle style, and the inferior; all which may be perfect in their kind.

There is likewise a recitative style, Stilo di recitativo, Stilo madrispazio, Stilo semplice, and Stilo sinnemario. There are likewise national styles, such as the Venetian, Sicilian, Scots, Irish, and Welsh. All these national styles have characteristic marks or paffages, which an attentive and experienced hearer instantaneously discovers.

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 249 B.C. He is considered as belonging to the Megaric sect, and to have been a disciple of one of the successors of Eucleid 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 the present, and chose to retire during Ptolemy's stay at Megara to the island of Zegen. When Demetrius, son of Antigonus, took Megara, the soldiers 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 him upon 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 elegant philosophers of Athens took pleasure in attending upon his discourses. Nevertheless, he excited prejudice by not paying respect to the Athenian superlubitions, of which an instance 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.
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When Crates put the question to him, whether the gods took pleasure in prayers and adoration? — experience having taught her several habitants, "you fool, do not question me on this subject in the public street, for when we are alone." But there is no proof of Stilpol's modality with respect to the existence of a supreme divinity. Some of his peculiar doctrines were, that species, or universals, have no real existence, and that one thing cannot be predicated, or ascertained, 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 ascertaining the one to be the other: he further argued, that goodness is an universal, and universals have no real existence; consequently, since nothing cannot be predicated of any thing, goodness cannot be predicated of man. Some have supposed that Stilpol was not serious in this kind of reasoning, and that it was his intention merely to expose the sophistry of the schools. If he was serious, it could not be wholly without reason that Glycerus, a celebrated courtezn, when he was reproved by Stilpol 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 sophistries. Of moral topics, Stilpol 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 Normenton-Cross, 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 in 1800 amounted to 592; and in the succeeding 11 years which occurred before the next report, it appears to have increased to 657 inhabitants and 197 houses.

This village is chiefly noted for a peculiar species of cheese, which obtained the name of Stilton from having been first sold here; but it is manufactured mostly in certain districts of Leicestershire. In a former part of this work, (see Cheese,) it has been described; but since the time of writing that article, (about 1805,) this cheese has become a more common article in the London markets, and is rendered at a cheaper price. The usual retail charge is now 1s. 6d. per pound. Each cheese is made of about 2lbs. 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 stations of Godmanchester, called Darobridge, and at Calor, called Duraliporte. About one mile N. of Stilton is Norman-Cross, 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, denominated Connington, at a short distance south-east of Denton, and many of the descendants 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.

STIMMERDORF, a town of Bohemia, in the circle of Leitmeritz; 5 miles W. N. W. of Kamnitz.

STIMULANT, in Medicine, any agent which has the property of increasing the mobility, or of exciting the motions, of the living body, or its moving parts.

It would be a waste of time to enter into any of the hypothetical speculations of physicians and physiologists respecting the mode of operation by which stimulants influence the living fibre; for the corpuscularian doctrines of the chemist, the chemical notions of combination, and the supposition of a nervous fluid, are all equally gratuitous, and equally inadequate to account for the phenomena. Our object is merely to observe the phenomena, and to mark the different effects of different agents, according to their nature, or to the parts of the body to which they are applied.

In the first place, the organs of sense are excited or stimulated by the impressions of certain matters only, light, noise, odours, &c. It must be observed, however, that every exercice of sensation is a stimulant power, by which the mobility of the living system is supported; and the stimulant effect is proportionate to the impression. Dr. Cullen remarks, that this impression, though it acts through the medium of the brain, as the common fenonour, yet it acts also on the adjoining parts, especially by exciting the action of the blood-veiles. Thus a strong light excites a stronger action in the numerous blood-veiles intermixed with the nerves of the retina; strong odours inflame the internal membrane of the nose; and strong and painful impressions upon the tongue inflame the surface of it. — The partial effects of these stimulants on the blood-veiles, independent of their agency on the fenonour, is proved by the operation of certain Substances applied to the skin. The first sensation which they produce, is that of heat in the part, with some degree of redness, from the greater fulness of the veiles, which at length proceeds to every circumstance of inflammation; to pain, tumour, blistering, suppuration, and gangrene.

Other stimulants, however, which are of more importance in a medical consideration, act principally upon the system at large, and chiefly through the medium of the stomach. It is not necessary to point out here the well-known facts, which prove the connatt and regular communication of all impressions made upon the stomach to other parts of the system, and particularly to the fenonour, through the medium of which perhaps the other organs are exclusively affected. The operation of many stimulants taken into the stomach, is too speedy to allow of the suspension of their being taken up by the absorptions, carried into the circulation, and thus transported to the brain in the blood-veiles. The impression is obviously communicated through the medium of the nerves. The energy of the vital powers is thus excited, as evinced by the activity of the mental and corporeal powers, under the influence of stimulants applied to the stomach; by the increase in the frequency and vigour of the pulse; by the general determination of blood to the surface of the body, producing at length, flushing, heat, and even sweating. Various substances have been contrived and manufactured in all ages, for the purpose of producing this pleasurable sensation in health, and have been also employed in the cure of certain diseases. The most powerful of these are the products of fermentation, in which may be included every thing containing spirit, all wines, and malt liquors, mead, cider, the koumis of the Tartars, and every species of alcohol distilled from these liquors. There are besides many other substances of a stimulant quality, though of much less power, taken from the vegetable and animal kingdoms;
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kings; among which may be enumerated all the aromatic plants, with their seeds, bark, and roots, the bal- foms, gums, and essentinal oils, procured from them; am- moniac, etc.

However these stimulant substances may have contributed to the sensual gratifications of mankind, there cannot be a doubt that they, especially the vinous and spirituous matters, have contributed quite as largely to their pains, diseases, 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 stimulation induces, are well known, as well as the disorder of intellect, and the dilatation of the moral principle, which so frequently result 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 observ- ing part of the profession make a very sparing use of them in practice, they experience much difficulty in counteracting the mischief which popular and vulgar medical prejudices are constantly inflicting by cordials, and nervous drugs, and by the use of heating and irritating diet. There are few morbid conditions in which the constitution is benefited by stimulants. In all diseases that are called nervous, 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 amuse the patient, while the symptoms remain unmitigated or increased. In respect to many febrile diseases, indeed, the general acknowledgment of the truth has at length prevailed, and since the sweating and stilting sphygm was abandoned, we now never see the military fevers, the lingering diseases after child-birth, the low nervous fevers, &c. which were once so prevalent and so fatal. But too much of this stimulant plan, too much of bark, and wine, and brandy, remains in the common treatment of all fevers, which, how- ever, the most intelligent of our contemporaries have nearly banished. The Brunonian sphygm, whose founder was pragmatically too fond of the diffusible stimulants to see clearly upon the subject, contributed to prolong the reign of stimulation in medicine, longer than unbiased reason and experi- ence 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 vio- lent diseases, when the morbid action has ceased, and no organic disorder remains. The powers of the constitution often languish under such circumstances; the circulation is fecile, and the digestive function weak; and the muscles, therefore, very slowly recruit their vigour and subsistence. Under such a condition of tardy convalescence, these func- tions are materially assisted by a supply of gentle stimula- tion; 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, Cinclus, 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 mecha- nism; it consists of a hollow tube, at the root of which is a bag full of sharp penetrating juice, which, in stingins, 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.

One of these spears in the ring, or sleet, 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 forearm board, the other then strikes in too; and so they alternately pierce deeper and deeper, their beards tak- ing more and more hold in the flesh: after which the sleet 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 ring behind it, when disturbed, before it can have time to withdraw the spears into their scabbard. See Anatomy, &c. of Dee.

STING or STENCH, a disagreeable smell exhal- ing 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 of scrobicular gums, &c.

A stinking nose, factor naris, is the result of a deep ulcer within the nose, whence arterial fces, &c. Its cause, according to Galen, is a sharp putrid humour falling from the brain, on the procefsus mammillares. This is reckoned, by the civilians, one of the legal causes of annulling mar- riage.

STING-HORN, in Botany. See PHALUS.

STINK-Pot, an earthen shell 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 HOREHOUND, in Agriculture, a common weed in hedges and rubbishy places, of the more troublesome perennial kind. By the Swedes it is considered as an univer- sal remedy in the diseases of cattle. See BALLOTA NIGRA.

STINKING-ILL, a name sometimes provincially applied to a disease of the brazy kind, often met with among sheep in some situations. See STOMACH-ILL.

STINKING ISLANDS, in Geography, a cluster of islands near the E. coast of Newfoundland. N. lat. 40° 28’. W. long. 52° 50’.

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 Linnaus, in Ornithology, the name of a small bird common about the sea-shores in many counties of England, and seeming to be the same with the Cinclus prior of Aldrovandus, and the scinthus, or junco of Bellonius, called by the French alouette de mer, the sea-lark; and by Pennant, parre.

It is somewhat smaller than the common lark, and in shape resembles the smaller pipit. Its beak is black, flen- der, 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 froke divides the bill and eyes; the chin white; under side of the neck mottled with brown; the back is of a brownish ash- colour; the breast and belly white; the coverts of the wings and tail of dark brown, edged with light ash-colour or white; the greater covers dusky, tint 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 evolu- tions with great regularity; appearing like a white or dusky cloud, as they turn their breasts or backs towards you,
you. They leave our shores 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 Büchel-Zell.

STIO, a town of Naples, in Principato Citra; 16 miles S.W. of Cangiano.

STIPA, in Ichthyology, a name given by the Dutch in the East Indies to a fish of the class of our European ones which have two back-fins, the anterior of which is prickly, the hinder not so. Its skin is spotted, and its flesh very delicate, and well tasted. It is generally caught by books. Ray.


Gen. Ch. Cal. Glume fingle-flowered, of two laxes, pointed valves. Cor. of two valves; the outermost terminated at the tip by a very long, twilled, erect awn, jointed at the base; inner valve the length of the outer, awl-feaves, linear. Neotyly of two linear-lanceolate, membranous scales, gibbous at their base. Stam. Filaments three, capillary; anthers linear. Pif. Germen oblong; styles two, hairy, united at the base; stigmas downy. Peric. none, except the glume adhering to the seed. Seed solitary, oblong, covered by the corolla. Ob! 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, fingle-flowered. Outer valve of the corolla terminated by a very long awn, jointed at the base.

1. S. penata. Soft Feather-grafs. Linn. Sp. Pl. 115. Engl. Bot. t. 1356. Knapp. t. 88. — Awns feathery.—Native of many parts of Europe, and admitted into the British Flora on the authority of Dillenius, to whom specimens were sent from Westmoreland, fast to be gathered on lime-rove 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, simple, jointed. Leaves upright, long, slender, acute, roughish, their flabels very long, dilated, embracing the stem, frillated, smooth, shining on the upper side. Stipula lanceolate, adhering to the leaf. Flowers in a simple panicule, burbling 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 plummy 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."


5. S. poleacea. Chaffy Feather-grafs. Wild. n. 5. Vahl. Symb. v. 2. 24. Fl. Græc. t. 86. (S. tortilia; Desfont. Atlant. t. 31.) — Awns hairy at the base, twilled. Calyx longer than the seed. Leaves involute-awl-shaped, downy.—Native of Turkey, and also of the Peloponnæus. Root annual, fibrous, downy. Stems several, a foot high, erect, jointed, leafy, round, smooth. Leaves linear, pointed, involute when old, fringed, smooth and furrowed above, frillated beneath; their flabels furrowed, fringed, the uppermost generally elongated and ventricose, embracing the panicule. Stipula fringed. Flowers erect, in a branched, archèd panicle.


7. S. caprifolii. Cape Feather-grafs. Wild. n. 7. Thunb. Prodr. 19. — Awns hairy at the base. Panicle spikied. Leaves sword-spiked.—Native of the Cape of Good Hope. All that we know of this is from the specific character given in Thunberg's Prodromus.

8. S. ficata. Spiked Feather-grafs. Linn. Suppl. 111. Thunb. Prodr. 20. — Awns hairy at the base. Flowers in a spiked cluster, all inclining one way.—Native of the Cape of Good Hope. Root perennial, creeping, producing numerous smooth flabels, a foot and half high. Leaves grasy, smooth, the upper ones shorter. Flowers fiddle, scarcely downy, hairy at the base, in a narrow spike about three inches long.

branched, spreading panicle. Corolla rough at the top. Cavaniiles rightly determined the plant of Vahl.


11. S. membranacea. Membranaceous Feather-gras. Linn. Sp. Pl. 116. Wild. n. 11. (Flower-flals 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. Panicle simple, nearly oblong, looser, feble. Flowers-flats complished, blunted. Awn of the calyx the length of the glume of the corolla. Linnaeus in his Mantilla 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.


16. S. fortes. Purple Silky Feather-gras. Michaux ibid. 54. (S. capillus ; Lamark n. 6.) —Leaves thread-spikes, very long. Panicle spreading, capillary. Calyx one-third the length of the corolla. Awns straight, naked.—In sandy fields, from New Jersey to Carolina, flowering from June to Augill. The silky purple panicles exceed in beauty every other grass. Pursh.


18. S. paniculata. Panic Feather-gras. Lamark n. 19. —Leaves laciniate, smooth. Panicle contracted, of few flowers. Awn naked, thrice as long as the calyx. Seed lenticular. —Gathered by Commerlon at Monte Video. This has the habit of a Panicum, with straight, smooth flsm, and long very slender leaves.


27. S. micrantha. Minute-flowered Feather-gras. Br. n. 8. Cavan. v. 5. 42. t. 467. f. 2.?—Stem branched, smooth as well as the sheaths. Leaves nearly flat, rough. Awn naked. Corolla smooth, nearly sessile. Calyx pointed.—Gathered near Port Jackson, by Mr. Brown, who has some doubt respecting Cavaillies's synonymy. 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, divided into short branches like a spike. Flowers very small, smooth, each with a bent awn, not an inch in length.

downy. Calyx pointed. —Native of Mexico, near the town of Chalma, flowering in August. The flang, three feet or more in height, is nearly covered by the long flaccid leaves of the flill longer leaves. Panicle lax, compound, a foot in length. One half of the corolla were downy all over. Awn an inch and half long, bent towards the middle. 29. S. humilis. Dwarf Feather-gras. Cavan. Ic. v. 5. 41. t. 466. f. t. Lamarck n. 3. —Leaves convolute; the floral one with an inflated sheath, and taller than the panicule. Awn naked at the base; festherty below the joint. —Native of South America, near Port Defire, in a barren foil, flowering in December. Stems several, from four to fix inches high, slender, fmmooth, leafy. Lower leaves slender, involute, awl-shaped; the upper one with a long swelling flaccid, embracing the panicule, which does not rife so high as the leaf itself, and is fearcely branched, confilling of but eight or nine flowers, on short smooth flanks. Calyx white, very acute, more than twice as long as the corolla. Awn with a series of long white feathery hairs, below its joint. 30. S. ukrainensis. Tartarian Feather-gras. Lamarck n. 22. Ill. Gen. v. i. 157. (" Tifs; Guettard. Mem. v. i. 19. t. 1. 2." )—Leaves channelled, keeled. Awn naked, ftraight. Calyx coloured, longer than the corolla. —Native of the Ukraine. The radical leaves are copious, forming denfe tufts. Stem two feet high. Panicle eight inches long, a little drooping, with almost fetaeous branches. Calyx redifh, with pale taper points. Corolla downy at the base, with a ftraight, naked, capillary avon, four or five inches long. Hairs are laid to be very fond of the seeds. STIPEL, in Geography, a town of Prufia, in Oberland; 9 miles N.N.W. of Soldau. —Alfo, a town of Germany, in the county of Mbrk; 3 miles S. of Bockum. STIPEND, STIPENDIUM, among the Romans, signifled the fame with tribune; and hence stipendarius were the fame with tribunarius. 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 ftronc; fee that article. Thus the flake of a fern is a true Stiper. The fame term is alfo used in fango, for the flake of an agricic, &c.; but never for any thing except cryptogamous plants. STIPITE. Naum de Stipes. See NATIV. STIPILLING is a mode of engraving on copper by means of dops; and is contradiftinguifhed by this word flippin, from that mode of the art which consists of courses of continued lines. The dots in flippel engraving aie either round, that is to fay, each dot forms a fmall cone in the copper, whose apex is downward; or they are angular, each dot forming a peck, or fmall iffaceous triangle, on the furface of the plate; or, when the dot conflits of more than one of these peeks, (as is commonly the cafe in engraving in the chalk manner,) its form is of course multigular. The round dots in flippin are performed by means of a dry needle, or an etching-point; and the angular dots by means of that well-known itefil inlament which is termed a graver. Stippling with the graver is alfo much ufed 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 practifed, it was much fought after by the English traders in art, on account of its cheapnefs, and the novelty which then rendered it attractive; and that now,—to fkee is fale or fashionable, and fuch an unhappy influence on art; fo crafty are the majority of dealers, and fo heedles the majority of the public;—now chalk-engraving is improved, it is neeq-dift. In the hands of the older Schiaovetetii, Cardon, and Holf, it acquired a variety, a rich and harmonious copiousness, and an energy it had not before difclofed; of which "The Land of General Abercornphie's Army in Egypt," after De Loutherbourg, and " The Woman taken in Adultery," after Rubens, are felicitous examples. In the former of these, the water, fly, smoke, broken ground, and other passages of the landscape part of the performance (which had hitierio oppofed most difficulties to the progres of chalk-engraving), are fearcely less happily differentiated than they would probably have been, had Schiaovetetii employed the fine-engraver's art, in which he was fo great a proficient: but it is observable, that the clear- nefs of the water, the crumby criraphs of the ground, &c. are in a great degree owing to the flipping being wrought into lines, fuch as are ufually hitched in drawing with chalks. The belt line-engravers have always, from the very ini- fantasy of the art, intermingled with their word a large por- tion of flipping. The works of the celebrated portrait en- gravers of France more especially abound with it. And the belt chalk-engravers have either mixed positive lines with their flipped work, or brought their flipping into courses of chalky lines, as is exemplified in the work above-men- tioned by Schiaovetetii, 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 afered that the modern improvements in chalk-engrav- ing have "been effected chiefly by living profeflors:" but Schiaovetetii and Cardon are now no more! STIPILLING is a term alfo ufed 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 conflit, and which give that mottled or granulated sur- face 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 stubule, as well as for the fheaths of the leaves remaining upon fraw or reeds. Linnaeus has adopted it for those appendages to the herbage of plants, which ac- company the leaves in a great many infances, though not premarked in all. See Pelcura. STIPULATION, in the Civil Law, the act of flipu- lating, that is, of treating, and concluding terms and con- ditions to be inferted in a contract. Stipulations were anciently performed at Rome with abundance of ceremonies, the first of which was, that one party should interrogate, and the other answer, to give his conient, and oblige himself. By the ancient Roman law, nobody could flipulate but for himself; but as the tabelliones were publice fervants, they were allowed to fhipulate for their mailers; and the notaries, succeeding the tabelliones, have inherited the fame privilege. The flipulation had its origin in the law Aquilina, and another law of the emperor Arcadius. See SATISDATIO. The word is formed from the Latin fipula, a fraw, becaufe in making a fale, a fraw was given to the purchaser, in fign of a real delivery; which custom is flill retained in some parts of France, particularly at Verdun. The custom always has been on this occasion, for the two parties to break a fraw between them, and each take his moiety, which they afterwards joined again, to recognize their promife. STIPULICIDA, in Botany, from fipula, the appendix-
ages of the leaves, and *cedo*, to cut, because the flippulae are divided into many fine segments, a supposed genus of Michaux, *Pl. Boreal-Am. v.* 1836, t. 6, of which he then describes a delicately divided species, *S. fuscans*. This is *Polycarpus flippuliferus*. Pursh, 1800, after Persoon. It occurs in barren gravelly soil of Lower Carolina, flowering in May and June. The root is annual. Stem erect, very slender, a fawn hue, repeatedly subdivided in a forked manner, with a pair of small feathery *flippulae* under each joint. Leaves all radical, small, ovate, falcate. 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 S. 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 Acanthos to the N.W., and the town of Arfinne to the S.E.**

**STIRIA, or Styria, 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 Carinola, and on the west by Carinthia. It is divided into Upper and Lower. Upper Styria is bounded on the north by Austria, on the east by Hungary, on the south by Lower Styria 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 Styria is bounded on the north by Upper Styria, on the east by Hungary and Carolia, on the south by Carinola, and on the west by Carinthia: its extent from north to south is about 80 miles, and about 48 from east to west. Upper Styria contains many lofty mountains, but, by the industry of the inhabitants, the whole country is pretty well cultivated: isomuch 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 cullom 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 enmities themselves are likewise fertile. They cultivate a fine sort of wheat, which is sufficient not only for the supplies of their own necessities, 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 Styrian fleec 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 1658, the mines have been filled with water. In the mountains, likewise, are hot-baths and medicinal springs. At Aulnitz are some good salt-works. The principal rivers which run through this country are the Much or Mura and Ena. Judenburg is the capital. Lower Styria 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. Graz is the capital. In the whole duchy are nearly 1120 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 Ciliccy are Winds or Wends, and speak the Wendish language, which is in use even among the common people, for some miles from Gratz. 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 Seekau 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 Styria. The most important manufactures in the country are the iron and steel works, the produce of which is exported in great quantities. Styria 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-Serrès, (Voyage en Autrich, &c. published at Paris in 1814,) was 86,000.

**STIRIA, in Ancient Geography, a town of the Phociade, situated in the environs of the frontiers of Eucaria. Here was a temple dedicated to Ceres Stiritis: the statue of the goddess was of fine marble, holding a flambeau in each hand. Ceres was highly honoured in this place. Paufanias.**

**STIRK, or STIRK, a term used among country people for a young ox or heifer.**

**STIRLING, formerly STRYVELING, in Geography, an ancient town, and capital of the county of Stirling, Scotland, is noted, in the annals of Scotish 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 Stryveling arose, it is thought, from the frequency of skirmishes 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 Scotish 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 conferred 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 royal 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 fort building. Within the towers of Stirling, several of the Scotish 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
Stirling

5th century, flayed William, earl of Douglas; and the cloot 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 valor 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 exit 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 contiguity 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 garnished by 100 men.

The houses and public buildings which constitute the town are chiefly of an ancient style; particularly that began by the earl of Marr, while regent of Scotland, in 1570, yet unfinished, and entitled Marr's work; and one known by the name of Argyle's lodging, some time polluted by that family, but originally erected by Alexander, vicount of Stirling. Two churches, denominated from their situations, the east and west kirk, have also a claim to antiquity; they constituted, it is fuppofed, 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, in 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 raised his batteries in this church-yard in 1651, when the castle was besieged. The fleete and roof yet retain the marks of having been violently battered by the shot from the garrison.

The town-houfe is a large building, with apartments for the town and county courts: in the council chamber is kept the jagg, appointed by law as the standard for dry measure in Scotland. Stirling contains three hospitals, viz. one, endow'd by Robert Spittal in 1530, for poor tradesmen; a second, founded by John Cowan in 1659, for decayed brethren of the guild; and a third, instituted by John Allen in 1735, for the education and maintenance of the children of poor tradesmen. Befide these charitable institutions, the merchant company, the kirk feoff, the kirk feoffion of the burgh feoffed, 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 3251 inhabitants, with 620 houses; and at the latter period, to 3820 inhabitants, and 749 houses. The manufactures which are carried on here are those of carpets and cotton, which have been introduced from Glasgow; formerly, hallows 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 dean of guild, a treasurer, 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 where that of Camuludun, formerly stood. The abbey of this place was originally denominated abbey of Stirling. This was founded, as already noticed, by David I., in 1147, and supplied with inhabitants from Arloch, near Arras, in France. For about 200 years after its erection, it rapidly increased in ecclesiastical power and splendour. In the reign of David Bruce it was defpoiled 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 depoiled, and the reformed religion received by many of its former inmates. In the commotions attending the reformation, its benefits were seized, its revenues forcibly dispofed 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 parifh does not exceed 200 acres.—


STIRLINGSHERE, 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 Dumbartonshire. 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, Britifh and Roman colonists of these islands, to wage continual wars with each other. Hence this county is particularly noted in the historic annals of Scotland.

The Romans erected one of their celebrated fortresses on the edge of this district; and the most famous of the Scottish 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 north-east of this district. Several of his caverns are yet remaining. The parish of Kilcarn is noted for the birthplace of the poet and historian George Buchanan, and Kilkenny for the greatest victor James, marquis of Montrose, gained in behalf of Charles I. The toponographical 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 lift," and remains of early fortifications along the course of the Forth. The embalmed bodies of lady Kilkenny, with her son, 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 suppos'd to have been a temple to the god Terminus, the protector of land-marks, erected by Agricolus, when he fixed the boundaries of the Roman empire. The parish of Dunkipace is also suppos'd to have derived its name from...
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, Baldernock, Campsie, Kilflyth, 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 Campsie falls, Kilflyth 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 Campsie falls, 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 present more of the character of the Lowland than of the Highland mountains, for their surfaces are either verdant, or covered with moly pasture, and they do not present terrific and precipitous naked peaks. In the parih of Kilflyth, these mountains never exceed in their elevation 1200 feet from the valley, or 1368 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 supposfed, at a moderate computation, to embrace an area of 12,000 square miles.

Mineralogy and Mineral Products.—The minerals of Stirlingshire consist chiefly of coal, iron-stone, and lime-stone. 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, intersected 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 Campsie, Kilflyth, and towards the exit, large strata of coal run within the bowels of the mountains. In various parts of the hills, passing from Dumbarton to Stirling, are lumpy masses of bafaltic rocks; and a grand colomnade of basaltic columns rises in a hill called Dun or Down, in the parish of Fintry. This consists of seventy pillars in front, of a gigantic stature, some appearing to be separated in loose 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 the distance of three or four inches. This gradually lefens towards the west side, till nothing more than a mark is to be dected, 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 front of a precipice in the parish of Strathtbaine, for the space of a furlong, is lined with lattely columns of the fame kind. They consist of four, five, and six fides; are 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 fegment of a curved line. In the latter mentioned parish, at the water-fall called the Spout of Ballagan, a very remarkable fection of the hill is prefented. The fide of it, being perpendicularly cut by the water, diflopes 192 alternate strata of earth and lime-stone; but towards the bottom of the fection are fiemal strata of the pureft alabaker. Near the fame place, in a late inundation of the river, fome fragments of antiquity were thrown up, which on trial were found to be of the finift quality. The vein, however, from which they were torn, has not been discovered. In what are fided the fconadary hills, coal is very abundant. The strata of these mountains, immediately succeeding the vein of coal, consist of lime-stone mixed with clay, here denominated cam- stone, and which burns into a heavy lime, but requires to be flaked while hot. Above this mixture of lime and clay are several strata of excellent iron-stone, of different degrees of thickness, with a soft flate, which interpose between the layers. The summit of the mountains is formed of layers of rock, called moor-stone. In the inferior hills, about the Glauffart, is a large field of coal on both fides of the fream, at the depth, on the north fide, from two to fifteen fathoms, and on the fouth of nearly twenty-two fathom. The coal is, in the latter part, immediately below the pebbles, and in the former part, immediately above them. The ftrata of the latter part are all folid and ftraight, and the thickest, in a circle about the breadth of the town, are about one foot in thicknefs. The neighbouring parish of Baldernock, upon the Kelvin, contains likewife abundance of coal and lime-stone. The coal refembles that of Newcastle, caking together, and giving out a strong heat when allowed to reek for hours undisturbed.

The parish of Kilflyth contains also very valuable minerals in great abundance; and iron-stone, 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 western part of the above parish are found great quantities of ball iron-stone, and confiderable beds of lime-stone. In the Garrel Glen is a large quarry of freeclose; loft and easily wrought when fill drawn from the quarry. The bed whence it is taken is generally from ten to fifteen feet, and is placed upon a beam of coal about as many inches thick. There is a variety ofiftals arifing, from thin leaves 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-stone; and they differ as much in diameter as in length, being all fizes, from an inch to two feet. Thfe are esteemed as confiderable curiosities, and have furnished much matter for fpeculation. They exceedingly resembfe a petrifaction, and yet the fubfance is not calcareous earth, but folid fress-stone, of a fimilar texture with the circumjacent rock. One of the largeft of them is defcribed as being nearly sixteen inches in diameter, and about fix 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 Scottifh rivers. (See Forth.) The Carron river rises in the centre of the county, and running eafward, enters the Frith 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 poftifles as a river, being only a small fream. (See Bannockburn.) The leffer rivers in this county are the Avon, which rises in the south-eastern parts; the Enrick; the Kelvin, which descends from the west and fows to the south-east; and the Blane, which gives its name to the parish of Strathtbaine, fprings from a high hill called the Earl's feat, amidit the Lennox hills. In a fhort courfe this river forms feveral 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 flurms 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 ground.

Lakes.—This county contains no lakes of importance, unless Loch Lomond be considered as partially belonging to it. In the parish of Buchanan, near Loch Lomond, there are three small lakes, Dulochan, Lochardie, and Lochamancairn. 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 bellow a degree of huskiness upon a defolate region. In the parish of Killyth, 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 moles and coarse grasses. The subsoil is mostly a hard till, impenetrable by water, or else an argillaceous kind of grit, of a reddish colour, blotched and veined with white, grey, and yellow. The surface lands comprise 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, 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 belt quality, when dug first from the natural bed, is of a bright-blue colour, and of a substance resembling the richest loam, and sometimes evenoverride as a substitute for fuller's-earth. In many places, the clay is excellently fitted for making bricks, tiles, and a coarse kind of stone-ware. The depths are from five to sixty feet: the subsoils are stiff clay, hard till, and tea-hills 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, whisks, and some other shells at present found in the Frith. Patches of rich and fertile loamy soils are intermixed in different parts of the shore. 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 high moors of Stirlingshire, as in other parts of Scotland, consist of a moily foot, extremely loose when dry, but when wet, retentive of moisture. Of the many peat-moors in this county, some have been formed upon the kerf 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 beside their roots, which still continue firm in the ground in their natural position; and from impreissions 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 thin brass, and of curious workmanship, 25 inches in diameter and 16 inches in height, was discovered upon the surface of the clay, buried under the mosses. It was denominated by the Edinburgh Society of Antiquaries, a Roman camp-keilee.

The agriculture of this county is very varied. In the parish of Gargunnock, and elsewhere upon the Carle or Kerf, all elevates consist of moor, dry field, and kerf farms. The dry fields occupy the space between the hills or moor and kerf grounds; and upon these, great improvements have of late been effected. The kerf 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 pattered only. Almost universally the farms are occupied by the persons who rent them. Small possessions, from 2 to 20 acres, are to be met with in several parts, and in the old language of the country are still designated parcles. The occupiers of them are generally 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 Kerf, wheat is usually preceded by summer-fallow; and much barley is reared. The cultivation of turnip-grasses is become very general. Peas and beans are little cultivated in the high parts of the county, but very generally in the Kerf as a mixed crop. The turnip-handy is 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 parish of Killyth. About 12 or 16 years after this introduction, a Mr. Graham of that place cultivated them in great quantities for sale. He was one of 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 elevates, the farm-buildings are substanital and well arranged, and a good situation is generally chosen. Dwelling-houses on many elevates 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 quickset hedges, are to be seen. One proprietor in the neighbourhood of Falkirk, has inclosed within eight years no less than 7000 Southfield acres. The fences are mostly of white-thorn, with double ditches, between which a mound or dyke of earth is placed. 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
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 carse supposed to be sufficient fences; several of them are ten feet wide, and of considerable 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 paddled 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 Bea Lamond, 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 stock 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 woods of Callander, in the parish 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 hour of danger to that bold colony whose name it bears, and a party of his followers. The oak, the ash, 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, amounts, exclusive of hedge-rows, to between 2000 and 3000 acres. The trees generally planted are those before named, with various pines, especially the larch, which at 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. 1.

STIRPFING, a town of Aulafia; 4 miles N.E. of Weikendorf.

STIRRUP, or Stirrup, in the Mange, a reft or support for the horfeman's foot, ferving to keep him firm in his feat, and to enable him to mount. The great art of a cavalier in the ancient tournaments was to make his antagonist lofe 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 feen 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 paffage, however, is not to be found in his epiftles; and if it were there, it would prove nothing, becaufe St. Jerom lived at a time when stirrups are fuppofed to have been invented, and after the use of faddles. Montfaucon denies the authenticity of this paffage; and, in order to account for the ignorance of the ancients with regard to an instrument fo ufeful and fo caufy of invention, he obferves, that while cloths and houfings only were laid upon the horfes' backs, on which the riders were to fit, stirrups could not have been ufed, becaufe they could not have been fanned with the fame fecurity as upon a faddle. But it is more probable, that in this inftance, as in many others, the progress of human genius and invention is uncertain and flow, depending frequently upon accidental caufes. Berenger's Hist. and Art of Horfemanship, vol. i. p. 65, &c.

To foil one's stirrups, is to fuffer them to flip from the foot.

Stirrup-foot is the near or left foot before.

Stirrup-leather is a thong of leather defending from the faddle down by the horfe's ribs, upon which the stirrups hang.

Stirrup-bearer, called in French porte evrier, is an end of leather made flat to the end of the faddle, to trufp up the stirrup when the rider is aughted, and the horfe fent to the flable.

Stirrup, in Ship-Building, an iron or copper flrap or plate, that turns towards on each fide of a fhip's keel and dead-wood, clofe forward or abait, and bolts through all. Stirrups are only ufed to British fhips, when the after-piece of the keel is carried away by accident, and is replaced without the dead-wood bolts being driven through. See Horse.

STISSIC MOUNTAIN, in Geography, a mountain of America, that lies between Connecticut and Hudson river, near which the Mahikandi Indians formerly refted.

STITCH, in Agriculture, a term which in foine districts signifies a ridge or butt in a field which is under the plough. The forms and breadth of fitches are liable to vary according to the nature and ufe of the land in different districts and places. In the county of Exef, their variation is laid not to be confiderable. In the greatest part of the western portion of it, the more wet land is laid out on two-bout ridges, or four-furrow work; and a fattering of thefe is everywhere, it is laid, to be seen; but on the strong land in the tea-diftricts, eight, as they are termed, or fitches of eight furrows, are more common. And towards the south of the county, ten-furrow work is rather more general. Thefe form the chief variatics in refpect to this matter. But there is a melancholy manner of forming the fitches in foine inftances, where they are laid by the plough in an admirable way. In particular cafes, not one furface furrow can be seen, nor any fort of tendency to any thing of the hog-troach kind, upon the whole extent of fitches on the farms: the form of the lands is perfectly correct, and fo 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 fo flift a quality to thoroughly well. They are all ten-furrow lands or fitches, and the harrows and other tools for them are made for the breadth in a fuitable manner.

Some farmers are particularly cautious in ploughing down old fitches or ridges, efcpecially 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 fitches for the purpofe of forming granf-land, but have repented it ever afterwards; confidering that the incapable of cultivation; and if it should be buried, and the under foil be brought up by fuch levelling, is injurnt for an age, or
for ever afterwards. They are consequently decided 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 rarely ever when ploughed down. In such cases, if brought to good pasturage, 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 badly 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 molly, perhaps, in a regular and gradual manner.

STITCHEL, in Rural Economy, a term applied to a kind of hairy wool met with on some sorts 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 alfme, or bellaria of botanists, otherwise called chickweed. See Bellaria.

STITHY, or STUTY, is used either for a smith's anvil, or a diface in oxen, causing their feet to stick so close to the ribs, that they cannot fir.

STIVA. See THIBIS.

STIVER, in Commerce, a money of account and copper coin in Holland and Flanders. The older gilders or forms of account contain 20 flivers, each of which is divided into 16 pennings. A fliver contains 2 groats Florins, and 8 duits; and a duit, 2 pennings: a gold fliver, with which accounts are kept in the coin-trade, is worth 28, and the wolfe, 26 flivers. In fliver, there are pieces of a fliver; and in copper, duits which are the 8th part of a fliver. At Antwerp, and the whole of the Brabant and Flanders, accounts are kept mostly in florins and gilders of 20 flivers, 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 fliver coins are the new pieces of 5 and 2½ fl Ch. flivers, and plaquettes of 3½ flivers current. A piece of 5 flivers is valued at 44¼, and a plaquette at 36. See COIN.

STIVING, in Sea Language. See STEEVING.

STIXXYS, in Geography, a town of Austria; 3 miles N.W. of Brugg.

STIXIS, in Botany, a species of dicot or prickling, because of the dotted rind of the fruit.—Loureir. Cochinch. 295.


Loureiro supposes the Avisus, Rumpl. Ambossi. v. 1771. t. 66, to belong to the same genus. But that is an upright tree, with ployandra or icofandrous flowers. If, indeed, there be no mistake in the author's account of the flower in his Stixis, it cannot belong to the natural order we have guealed, 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 65½ 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° 38' and 45° N. lat., and 79° and 80° W. long. from New York. Its number of towns is 12, the capital being Osgoodville, 212 miles from Albany; its population consists of 7894 persons. The soil is principally sand or loam, thickly wooded with maple, beech, ash, tilia or bass wood, butternut, elm, and groves of white and yellow pines: it is not mountainous nor even 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, see, in Antiquity, the porticoes at Athens. There were full of exedras, 125 ep, and side buildings, furnished with seats for study or discourse. Here it is probable philosophers and their scholars used to meet. See EXEKI.

STOA KED, in a Stoa. When the water in the bottom cannot come to the well of the pump, they saw, the top is afford, or floated: to say that they also, the timber holes are floated, when the water cannot pass through them; and that the pump is floated, when something is got into it which choke it up, so that it will not work.

STOA, in Zoology, the name used by many for the animal whose skin is the erin: see Erinus


This genus consists of nine species, all natives of the Cape of Good Hope, only one of which had previously been described by Linnaeus. With this original species, Carlina atratylodes of the Amaranthaceae, v. 6. 96, the younger Linnaeus confounded two other very distinct plants, which are perhaps the S. glabrat and rigula 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. glabrat. Thum. Prod. 141. Wild. 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 allied to above.

2. S. carinoides. Thum. ib. Wild. n. 2.—Leaves heart-shaped oblong, smooth, with runcinate spinous teeth.

Phyt. e.g. Commerce, 273. fuch small mountain Willd. the European Geography, Willd. Leaves for 4 rough ifh S
The Calyx-fcales upper fpine. " Willd. ftrong, commercial town Ancient mere taken 25 Ancient rigid a, principal
STOBjEUS, 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.
STON, in Geography, a town of European Turkey, in Macedonia; 42 miles N. of Edessa.
STOBORRHUM, or Stoborum Promontorium, (Mers-el-Berber) in Ancient Geography, a promontory of Africa Propria, upon the coaft of the gulf of Numidia, between the promontory Hippus and the town of Aphrodifium.
STOBREZ, in Geography, a small sea-part of Dalmatia, near the coaft of the Adriatic, on the fitcfe of the ancient Epetum, a colony of the Illi; the ruins are full vi fi ble; 4 miles E. of Spalatro.
STOC and Stovel, in our Old Writers, a forfeiture where any one is taken carrying fliples and pubulum out of the woods; for flec signifies flecks, and flovel, pubulum.
STOCK, in Commerce, a fund raised by a commercial company; or a principal item 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 fett apart for the purpose. This mode of raising supplies by levying taxes for the payment of interest, is called the "fund ing 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 flock, that is, he may transfer his claim, and thus obtain his capital, more or less, according to the price of flock, which fluctuates from various caufes. The different funds or flocks 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 flock is to give a fpecific sum for a nominal hundred: e.g., if the price of the 3 per cent. be 60l., this sum is paid for 100l. flock, which yields a dividend of 3l. a year, that is 5 per cent. per annum; for at the fame rate 3l. for 60l., 100l. would yield 5l. If flocks are low, the interest is high; and vice versa. In fome funds there is a higher interefl than in others, and this is chiefly owing to the preference given to that flock 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 flated periods, and they generally comprehend different kinds of flocks, which together are called "omnium." If they 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 fometimes given by government of an annuity for a limited time: fuch are called "terminable annuities," and "irredeemable;" but the regular flocks, on which the common interefl is paid, are called "perpetual annuities," and are redeemable. Loans are called a "funded debt," when taxes are appropriated for paying the interefl; but fums raised for which no fuch provision is yet made, are called the "unfunded debt." Of this latter defcription are exchequer, navy, victualling, and ordinance bills, which are iffued by thefe different offices, and bear an interefl until they
they are paid off. The interest is mostly 3d. or 2½d. per day for every 100l.

Stock, Capital. See Capital, and Stock supra.

Stock Brokers. See Brokers.

Stock-Exchange Fund, an institution formed in the year 1801, for the relief of the decayed members of the Stock-exchange and their unprotected families. The annual subscription is one guinea, and that for life is two guineas. The annual relief does not exceed 40l. to any applicant; donations are restricted to 20l. 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 gambolling at the Stock-exchange, which runs 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. (7 Geo. I. A.D. 1734.) The broker who is unable or unwilling at the settling day to pay for himself or his principal the difference, becomes, in the cast language of the Stock-exchange, a "lame duck," so that he can no longer frequent the house, nor do any more businesfs 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 fame fund at an advanced price, and receive a profit, which he has called the "difference." It is this man's interest to propagate false intelligence in time of war, of victories, negociations 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 fund 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. consol. 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 in the funds. But foreigners involved with public characters, and persons connected with them, have the best opportunities of playing a pure game, by means of early intelligence; and so they generally carry their gains out of the country: this is a great evil. Commerce likewiseuffers considerably by stock-jobbing, for tradesmen are tempted, by the hope of more rapid profits, to sell any cheap market, in the name of businesfs, to frequent the Stock-exchange; and not being in the secret of obtaining true in-

intelligence respecting public affairs, they lose instead of gaining, and too often become fraudulent bankrupts. See Stock-Broker.

Stock, in Agriculture, a term signifying any fort of crop, or other kind of farm property. All kinds of flocks of this nature should constantly be well tended and adapted to the size, quality, and nature of the farms, so far especially as relates to tools, machinery, crops, and the different forts 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 accuratelyattiug his crops and live-stock of different kinds, as well as other things, to the lather, 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 flock applied to it, by different writers on husbandry.

Stock, Livestock, that kind which comprehends all forts of domestic animals. See Live-Stock.

Stock, Live-Stock, 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 shewn by animals, however, is said, affords no fort of proof of its nutritive properties or powers; as different sorts of neat cattle, sheep, 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 fame 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 ryegrass (lolum 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 feed approaches towards perfection, they leave it for almost any other kind, its place at the above place was laid down in two equal parts, one part with the above grass and white clover, and the other with cocks'foot and red clover. From the spring till midsummer, the sheep kept almost constantly on the ryegrass 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 (dactylis glomerata), oxen, horses, and sheep, are stated to eat this grass readily. The oxen continue to eat the flowers and fruits, from the time of flowering until the time of perfecting the seed. 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 ryegrass and white clover. In the experiments published in the "Amenitates Academicae," by the pupils of Linnaeus, it is asserted, it is said, that this grass is rejected by oxen. The above facts, however, is in contradiction of it. As to the grass which is usually known by the title of meadow fox-tail grass (alopecurus pratensis), sheep and horses feed 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 Prielle, near Oxford, every year, water is being pumped for the purpose of producing this excellent produce. It there, it is said, invariably keeps pollietion of the top of the...
the ridges, extending generally about six feet from each side of the water-course; the space below that, to where the ridge ends, is flanked with cock's-foot, the rough-flaked meadow-grass, the meadow fescue, the hard fescue, the agrostis flabinfera and palustris, with the sweet-fcented vernal gras, and a small admixture of some other kinds. In speaking of the nature of the meadow cat's-tail gras (phleum pratensf), it is said that it is a gras which is eaten without science by oxen, sheep, and horses. It is noticed, that it has been said by doctor Pulteney, that it is disflked 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 other animals as are growing with it. In respect to the fiorin gras (agrostis flabinfera), in the experiments detailed in the Accomplishments Academic, it is said that horses, sheep, and oxen, eat it greedily. On the Duke of Bedford's farm at Maulden, fiorin hay was placed in the racks before horses, in small distinct quantities, alternately with common hay; but no decided preference for either was, it is said, manifested by the horses in this trial. But that cows and horses prefer it to hay, when in a green state, seems rurally proved, it is thought, by Dr. Richardson, in his several publications on fiorin; 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 gras, it is observed, whereas twenty-three milch-cows, and one young horse, besides a number of pigs, were kept a fortnight on the produce of one acre of ground. In regard to the rough-flaked meadow-gras (poa trivialis), oxen, horses, and sheep, eat it, it is said, with avidity. Hares also eat it; but they give a recided preference to the smooth-flaked kind, to which it is, in many respects, nearly allied. Respecting the smooth-flaked meadow-gras (poa pratensis), oxen and horses are, it is said, oberved to eat it in common with others; but sheep rather prefer the hard fescue, and the sheep's fescue, which affect a similar foil. This, it is noticed, is a species of gras that exhausts the foil 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 crefted dog's-tail gras (cynoferus criffatus), the South-Down fheep, 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 pumilis, fheeta ovina, durifcula, and cambrica, is seldom touched by them. But the Welsh breed of fheep almost constantly browse upon these, and neglect the crefted dog's-tail, the rye-gras, and the rough-flaked meadow-gras. The fine, or common bent gras, (agrostis vulgaris or capillaris,) is noticed to be a very common gras 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 fheep, however, prefer it, as has been just observed; and it is singular that thole fheep, being bred in the park, where some of the best gras are equally within their reach, should still prefer those grasales 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 habitat. As to the fheep's fescue gras (fheeta ovina), all kinds of cattle are faid to relish, and perhaps to have a fort 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 polfession of such kinds, being soon over-powered by the most luxuriant forts. 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 it is seldom or ever, in its natural state, found intimately mixed with others, but by itself. Regarding the hard fescue gras (fheeta durifcula), it is noticed, that it is certainly one of the best of the dwarf sorts of grasales. It is grateful to all kinds of cattle: hares, too, are very fond of it; they cropped it close to the roots, and neglected the fheep's fescue, and the fheeta rubra, which were contiguous to it. It is preuent in most good meadows and pastures, it is laid. The meadow fescue gras (fheeta pratensis), is a gras, it is faid, which is seldom abfent from rich meadow and palure lands, and which is observed to be highly grateful to oxen, sheep, and horses, particularly the former. It may possibly be preferred to some other grasales by thole. It is noticed as appearing to grow moff luxuriantly, when combined with the hard fescue, and the rough-flaked meadow-gras. The tall oat-gras (avena elatiolis) is also noticed to be a very productive gras, which is frequent in meadows and pastures, but which is disflked by cattle, particularly by horses. This perfectly agrees, it is thought, with the small part of nutritive matter which it affords. It is said that it seems to thrive belt on a frong tenacious clay. The yellow oat-gras (avena fla-feefens) is likewise a gras which, it is said, feems partial to dry foils and meadows, and which appears to be eaten by fheep and oxen equally with meadow barley, crefted dog's-tail, and sweet-fcented vernal grasales, which naturally grow in company with it. It is noticed, that it nearly doubles the quantity of its produce, by the application of calcareous manure to the land on which it grows. The meadow foft gras (holcus lanatus) is a very common gras, it is said, and grows on all foils, from the richest to the poorest. It is noticed to afford an abundance of feed, which is light, and easily difpersed by the wind. It appears to be generally disflked by all forts of cattle. The produce of it is not fo great, it is faid, as a view of it in the fields would indicate; but being left almost entirely untouched by cattle, it appears as the most productive part of the herbage. The hay which is made of it, from the number of downy hairs which cover the surface of the leaves, is loft and fpong, and difflked by cattle in general. And the half, or the sweet-fcented vernal grasales (anchoferus and cymoferus), which seem to be fair to be eaten by hares, oxen, and fheep, though in festivals, where it is combined with the meadow fox-tail and white clover, the cock's-foot, and the rough-flaked meadow grasales, it is left untouched, from which it would foom unpalatable to cattle. It is noticed, that Mr. Grant of Leighton, in the fame district as the above place, laid down one half of a field of confiderable extent with this gras, combined with white clover; the other half of the field with fox-tail and red clover. The fheep would not touch the sweet-fcented vernal, but kept constantly upon the fox-tail. The writer raw the field, when the grasales were in the highest flate of perfection, and hardly any thing could be more fatisfactory. Equal quantities of the foeds of white clover were fown with each of the grasales; but from the dwarf nature of the sweet-fcented vernal grasales, the clover mixed with it had attained to greater luxuriance than that mixed with the meadow fox-tail. This is perhaps nearly the whole of what has yet been done on this interefting subject, which is important in several respects; as, though it may not lead exactly to the knowledge of the difference in the nutritive properties or qualities of different substantes as the food of live-flock of the farm kind,
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 such flock in the belt 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 farmer, see Live-Stock.

Stock Account, that fort 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 forts of flock on the farm be kept in a perfectly accurate and proper manner; as it not only shews how he stands in respect to profit and loss, but, in some measure, directs the management which is the belt 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 tradesmen's accounts and charges are to be got in, and the state and worth of the household property taken, but without any very great degree of minutenes in this particular; then more particularly exact accounts made out for the hores, the neat cattle, the sheep, and other forts 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, harness, traces, sacks, and small implements of all forts; 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 memorandum being at first made out upon a blank 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 minutene.

After the whole of this fort of work has been completely and properly adjusted, a debtor and creditor account may be made out in the manner of Stock Dr., and Contra 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 possesses of every kind, and all which is owing to him. Every thing 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 the common rate 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 fort 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 usual 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 rolled oxen, for instance, or on the crop of any particular field, his belt and 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 colt or expense, including every minute particular; on the creditor, the returns: in course, on the sale of the articles, the account is closed, and the balance demonstrates the profit or loss.

The keeping of both a day-book and ledger is 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 fiddulous of forms, but enter down in the former whatever he may think needful, with the date; as besides other things, the times when the mares were put to the females of different forts 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 transfections 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 everlasting 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 home-stead or residence is necessarily surrounded with different forts 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 forts of live-flock may likewise be probably injured 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 locks.

Stock-Shave, 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-flap, that is driven

E. c. 2 into
into an elm-block: it is used to pare off the rough wood from the shells of blocks, &c.

Stock-Fish, in the Fish-Trade, a name given to the common cod-fish, when cured in a particular manner, which makes it necessary to beat it with fists before it is fit for dressing.

The commerce for stock-fish is very considerable in Holland, both from the great consumption of it in the country, and from their victualling their vessels with it. See Cod-Fishery.

Stock-Gilly-Flower, in Botany. See Cheiranthus.

Stock Rock, in Geography, a rock on the W. coast of South Wales, in St. Bride's bay.

Stockach, a town of Germany, in the landgraviate of Nellenburg, of which it was the capital; 15 miles N.W. of Constance. N. lat. 47° 52'. E. long. 9° 1'.—Alto, a river of Germany, which rises in the landgraviate of Nellenburg, and runs into the lake of Constance, 5 miles S.E. of Stockach.

Stockau, a town of Germany, in the principality of Culmbach; 5 miles S.E. of Bareuth.

Stockbridge, locally situated in the upper half of King's Sombourne, and division of Andover, Hampshire, England, is a small market-town on the eastern side of the Test, and on the road from Winchester to Salisbury. The population, according to the report of 1811, amounted to 663 inhabitants, occupying 149 houses. A new bridge was erected here over the river Test a few years since; about two miles to the westward, on Houghton-down, is a good 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 mace. This place sends two members to parliament, which privilege was first policed 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 flicking a large apple 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 Repertamen. Hist. 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 here are three annual fairs. It is 66 miles W.S.W. from London, and 15 E. from Salisbury. The parish of Stockbridge contains the borough, and Stockbridge-parish, alias White-parish.—Beauties of England and Wales, vol. iv. by J. Britton and E.W. Brayley. Oldfield's Representative History, vol. i. part ii.

Stockbridge, a township of America, in Windsor county, and county of Vermont, situated on White river, and containing 700 inhabitants.—Alto, a post-town in the rate 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 1372 inhabitants.

Stockbridge, West, a town of Massachusetts, in Berkshire county, containing 1049 inhabitants.

Stockbridge, New, a tract of land, six miles square, in the S.E. part of Orenda Reservation, in the rate 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.

Stockdale's Harbour, a bay of the North Pacific ocean, in Prince William's Sound, on the W. coast of America. N. lat. 60° 50'. W. long. 148°

Stockdorf, a town of Sweden, in the province of Smaland; 54 miles N.W. of Calmar.

Stockem, 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° 10'. E. long. 5° 45'.

Stockler, in Ichthyology, a name given by the Germans to the sarrus of the ancients, the trachurus of the later writers. It is a species of the family, known among us under the name of horse-mackerel.

Stockerau, in Geography, a town of Austria, on the left bank of the Danube; 12 miles S. of Sommenberg.

Stockery, a town of Sweden, in the province of Smaland; 28 miles N.N.W. of Wexio.

Stockheim, a town of the duchy of Wurzburg; 2 miles N. of Neufadt.

Stockheim, Froben, a town of the duchy of Wurzburg; 4 miles E. of Kitzingen.

Stockheim, Main, a town of the duchy of Wurzburg; 2 miles N. of Gerolzhofen.

Stockheim, Tiefen, a town of the duchy of Wurzburg; 6 miles E.S.E. 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 flates of the kingdom; but the count and royal residence were not removed hitherto from Upsal 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, seven small rocky islands, scattered in the Maler, 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 island, from which the town derives its name, and the Niddarholm, are the handomest parts of the town. Excepting the suburbs, where several houses are constructed of wood, painted red, the buildings are generally of stone, or brick stained white, mostly erected on piles. The palace, situated in the centre of Stockholm, and on the highest point of ground, was begun by Charles XI., and is a large quadrangular stone edifice, the style of architecture being both elegant and magnificent. From an eminence in the fourth suburbs, called the "Mount of Moles," the spectator commands a bird's-eye view, almost unparalleled in its kind, of the city and various islands, of the harbour, the channel, and the lake Maler, forming an affluence of rocks, houses, wood, ships, and water, in all the variety of rugged, beautiful, and romantic scenery. The several parts of Stockholm communicate with one another by 12 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 glafs, china, wood, 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, confilling in obliging the cows to suffer the pans 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 anything 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 flock-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 supplying and providing them with all the different forts of appropriate flock, 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, fellowing, 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 a matter which the farmer should neatly attend to and adjust, as much depends upon these several different kinds of flock being well fitted, suited, and adapted to the nature, size, rate, situation, kind, and quality of the farms, whatever they may be, otherwise great inconvenience, loss, and disappointment, may be experienced.

In addition to what has been laid on hiring and flocking 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 flocking, managing, and carrying on with proper spirit, and in the belt, 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 forts of flock, 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 rate of taxation, render the charge of flocking in different kinds of farms, with all the different kinds of flock, moily 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 flocking any farm which he may be about to enter upon. See Farm.

In regard to flocking different forts and qualities of land with different kinds of live-flock, in the view of keeping them merely, or those of feeding and fattening the animals, 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 delitute of keep, no food being wasted or flock injured in either case, as there may be impropriety and loss in having the grounds too closely, heavily, or hard flockcd, as well as in having them too thinly or lightly supplied with animals; though hard or heavy flocking may be necessary and useful in particular cases, circumstances, and situations, and with some particular kinds of flock. The difference, however, between these two modes of flocking, has not yet been well decided upon; for though some farmers are of opinion, and strongly contend, that light flocking is less hurtful to the land than clofe 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 palfline is preferable, especially for some forts of flock, which do well 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 hot period; that it admits of the feeding of the gristles 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 flocking which flave the animals, especially some forts, as those of sheep, which are those of flocking too hard, and too lightly; that in close flocking or feeding, times and seasons are to be confulted and fixed upon; continual hard flocking 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 mofs kind, while occasionally hard or clofe flocking, and not flocking at all, at short intervals, will prove more beneficial; that there is not so much waste of food in clofe flocking, as by under-flockling, and the lands are more regularly fed down; that the young sprouts or shoots of gristles are more nutrient, and more powerful in fattening flock, especially of some forts, while short than when long; that where lands are suffered, from light flocking, 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 clofe-flockling, 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 flock, especially of some forts, are not found to lie down and rest themselves more often in lands which have much keep, from being lightly flockcd, than in those which are hard flockcd, and closely fed down; while they constantly prefer those parts which are in a clofe 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 frequents for light flocking, does not
not prove that their flock is in any way superior, or carried on better, or fattened more quickly, than those in the same vicinity, which flock clover, or in a heavier manner.

In the busines of stocking lands with live-flock, it consequently seems, that their nature, quality, present state, 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 seafons in regard to them. The plans and methods of stocking for different purposes and seafons 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 grab up or eradicate any thing, as trees, hedges, woods, and other lich 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.

Anciently, the only stockings in use were made of cloth, or of milled fluffs sewed together; but since the invention of knitting and weaving stockings of silk, wool, cotton, thread, &c. the use of cloth stockings is quite discontinued.

Mozesfays that Henry II. of France was the first who wore silk stockings at his sister's wedding to the duke of Savoy, in 1559.

Dr. Howell, in his History of the World (vol. ii. p. 322.) relates, that queen Elizabeth, in 1561, was presented with a pair of black silk silk stockings, by her silk-woman, Mrs. Montague, and thenceforth she never wore cloth ones any more. The fame author adds, that king Henry VIII. ordinarily wore cloth hose, except there came from Spain, by great chance, a pair of silk stockings. His son, king Edward VI., was presented with a pair of long Spanish silk stockings by sir Thomas Grefham, and the present was then much taken notice of. Hence it should seem, that the invention of knit stocking 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, vis. 1561.

Others relate, that one William Rider, an apprentice on London bridge, seeing at the house of an Italian merchant a pair of knit worlled stockings, 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 wore in England, anno 1564. Anderdon's Hist. Com. vol. i. p. 40c.

The modern stockings, whether woven or knit, are a kind of plexus formed of an infinite number of little knots, called stitches, loops, or meshes, intermingling in one another.

Stockings, Knit, are wrought with needles made of polished iron, or brass-wire, which interweave the threads, and form the meshes of which the stocking consists.

This operation is called knitting, the invention of which...
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 or stocking-weavers hall is situated in Red-Cross street. They were incorporated 19th August, 1663.

In this hall is the portrait of the author of this ingenious art, pointing to one of the iron frames, and disengorging with a woman who is knitting with needles and her fingers. These words are on the picture: "In the year 1589, the ingenious William Lee, A.M. of St. John's college, Cambridge, devised this profitable art for stockings, (but being defiled went to France,) yet of iron to himself, but to us and to others of gold, in memory of whom this is here painted." Hatton's View of London, vol. ii. 605.

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, &c. where, it seems, says Anderson (Hist. Com. vol. i. p. 435.) by Sir Joshua Child's excellent Difcours on Trade, first published in 1670, 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, N. 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 famous in this country. This account of the invention, he adds, is most generally received, though it has also been attributed to a Mr. Robinson, curate of Thurcaston, in Leicestershire. The first frame, we are told, was brought into Hinckley, in Leicestershire, 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, Longborough, Nottingham, and Derby, with the villages in their dependencies, are the principal seats of the stocking manufacture in England.

About the year 1756, Messrs. Jedidiah Strut and William Woollatt, of Derby, invented a machine, by which, when annexed to the stocking-frame, the turned ribbed stockings are made the fame with those made upon the common knitting-pins: this is known by the name of the Derby rib. These, together with the manner of making the open-work mills, in imitation of the French mills, a curious sort of lace for caps, aprons, and handkerchiefs, as well as a great variety of figured goods for waistcoats, &c. have sprung from the same machine, and form a considerable additional branch of the stocking-trade.

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 difficult from cloth woven by a loom, as the flighthel inspection will shew; 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, united or looped together in a peculiar 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 unravelled, because the stability of the whole piece depends upon the ultimate falling off the first end of the thread; and if this is undone, the loops formed by that end will open, and release the subfluent loops one at a time, until the whole is unravelled, and drawn out into the single thread from which it was made. In the same manner, if the thread in a stocking piece falls or breaks at any part, or drops a fitch, as it is called, it immediately produces a hole, and the extension of the hole can only be prevented by falling off the end. It should be observed, that there are many different fabrics of stocking-fitch for various kinds of ornamental hosiery, and 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 represented 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 bafs is a wooden frame, consisting of four pillars N, and various cross-pieces, called rafters; the two uppermost, M, are called caps; upon the top of these the small parts of the machine are situated, being fastened in a frame of wrought iron. The pieces which compose the iron frame are two fol-e-bars a, which are ferewed down upon the wooden caps M, and at the ends have joints, g, to support the prefser-bows G, G, of which we 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 fol-e-bars a, a.

To give motion to this machine, the workman leats himself before it, upon a board or seat A, and puts the different parts of the machine in motion by his hands and feet: he applies his feet upon two treads B, C, which have cords, b, c, ascending from them, and falling in opposite directions round a barrel or wheel, upon the axis of which is a large wheel, D, called the flart-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 he presses his foot, when he wishes to bring down what is called the prefser-bar, marked F, the use of which will be afterwards explained. This bar is attached to two small rods G, which the fabric able round the fixed centre pins or joints g. The ends of the levers are of a curved form; hence the pieces G are called
STOCKING-FRAME.

The connection with the treadle \( E \) is by a 
fling or wire \( r \), which works behind the machine, and is 
attached to the cross-bar \( H \), which is extended from one of 
the presser-bars to the other, and is cranked down, to avoid 
such parts of the machine as it would otherwise interfere 
in its motion. The return of the presser and middle treadle, \( E \), 
is produced by the re-action of the wooden spring \( I \), which 
draws it up with two flings; but in some frames a counter-
weight is used instead of the spring.

The weaver produces all the other movements by his 
hand; for this purpose, he applies them to the ends 
\( K, K \), of the hand-bar, and he can then very conveniently 
use 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 to be 
made is kept upon a bobbin \( M \), stuck upon a pin 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 suf-
ficiently 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 presser-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 fink in the stem of the needle, imme-
diately beneath the barb, of sufficient depth to receive 
the point, when an adequate preasure is applied upon the 
hook to bend the barb down. The barb then becomes a 
closed eye; and if a thread is looped over the wire or stem 
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 
whilst 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 deprefion of the 
barbs of the needles is produced by the edge of the 
presser-bar \( F \), which is extended horizontally over the whole 
length of the needles, and actuated by prefling the foot on 
the middle treadle, as before explained.

Between every two adjacent needles, 1, 1, a thin plate of 
fluel, 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 deprefed, 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 \( K \) (fig. 2 and 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 finker-
bar, because the finkers are fixed to it, being united for-
ward, and not far from each other, being united fore-
ward, and not far from each other, 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 two arms \( Y, Y \), 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 end: of iron uprights \( V \), called the back standards. 
By the motion of the spindle-bar upon its centres, the 
frame of finkers can rise and fall, and the quantity of this 
motion is limited by stop-fersews 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, \( Q, Q \), a tendency to rest always against 
the upper stop-fersews, \( X \), 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 
below the nips. If then the jacks and finkers are all deprefed 
down between the needles, it is evident that the nips of 
the finkers must carry the thread down before them, and form 
the circles into loops hanging down between each needle, as shown 
at \( X \). This, then, is the principal office of the finkers: but 
to perform the operation of spinning in the manner now de-
scribed, by depreffing the whole number at once, would not 
be practicable; because, as a greater length of thread is 
required when it is deprefded 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. 2.), 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 contrivance to render this depreffion or looping down 
of the thread between each needle practicable is very in-
agenious. 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 hi-
therto 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 disfipèd between every other needle, 
so that the space between each lead-finker has two needles 
in it. The back-finkers are made of the same form as the 
lead-finkers, one being placed between each of the two 
needles contained between each lead-finker; therefore the 
lead-finkers and jack-finkers are disfipèd 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, \( b \), 
(fig. 3.) called a jack, freely movable on a centre-pin: 
the opposite end \( i \), or tail of each jack, is preflèd by a 
spring \( k \), which has a notch or indentation at a particular 
place; and when the jack-finker is elevated, so that its nip, 
\( f \), is above the level of the needles \( t \), ready to receive the 
thread, the end of the tail, \( i \), is received in the notch of the 
spring \( k \), which retains it in that position; but at the same time a flight 
force applied beneath the tail, \( i \), or for jack to lift, it up will 
dercape the nip, \( f \), of the jack-finker, \( V \), between the needles.

It is to be understood, that all the jacks, \( b \), are arranged in a 
row, and move upon one wire, which is a common centre of 
motion;
STOCKING-FRAME.

The operation of finking or forming the loops between the needles is thus conducted: the nips of all the finkers are raised above the needles, as in fig. 4; the thread is then extended lightly across the flur-wheel, between the nips. By precribing on one of the treadsles, B or C, the flur-wheel 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, j, 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 former 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 lead-finkers are caused to rise up by means of the locker-bar, p, extending over all the treadsles. Each end of this bar is screwed to a lever, g, called a locker, which moves upon the same centre as the jacks, and the front ends of these levers are made with inclined ends, so as to be lifted up by wedges fixed at the back of the thumb-plates, L, which move on joints fixed to the finker-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, preffes back the two thumb-plates L, at the same 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 finker-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, z, of the finkers, which open part is made purposely to admit the loops last made to remain upon the items of the needles, quite detached from the action of the finkers, 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 items of the needles, will not be a single thread, but the loops at the upper part of the work S, fig. 2: 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 finkers rise above the needles: the hand-bar is then drawn forwards a little, to advance the finkers 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 infert 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 items of the needles, so that it will be situated in the arch, or opening, z, of the finkers.

When the finkers 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 suspend 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 these parts are framed upon a strong bar called the camel; and upon this is placed four wheels, which run upon the sole-bars, as to become a carriage. To communicate motion to this carriage, a link is jointed to a piece at each end, marked r, fig. 2 or 4, which is screwed to the finker-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 jack-finkers together; and the links are the same length between the centres of the jacks, for which reason they are called half-jacks.

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 finker-frame is drawn forwards, by pulling the hand-bar 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, z, of the finkers, as before described.

The first row of loops being thus difposed of, the frame of finkers 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 finkers; moving the flur by the two outside treadsles B, C, which depresses all the jack-finkers, and makes a loop of double depth between every other pair of needles; this is called drawing the jack: next precribing on the thumb-plates L, and depressing the hand-bar, K, at the same time, which elevates the jack-finkers, and depressing the lead-finkers 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, which

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which advances all the finkers together, and their points, \( t \), pull forwards the thread till it comes into the beards, 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, \( t \), quite clear up above the needles between which they were situated, and applying the foot to the upper treads, \( E \), to bring down the pruffling-bar, \( F \), upon the beards of the needles, to close them up, and while so closed, they hold 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, \( s \), 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 beards of the needles, and consequently over the lof;formed loops, which remain under the beards, in the position shown at \( R \), fig. 1; or, in other words, the loops last formed, and rising under the beards 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 last course of the finished work, become secured from opening or unravelling, and the loops under the beards now become the last or upper course of the work, and are preferred from unravelling by the needles, one of which palls through each loop; and these loops will not be drawn off from the needles until there is another row of loops prepared, and rized under the beards of the needles, ready to be drawn through them.

When the piece of work is finished, and taken off from the frame, the last 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 recession towards the item, takes place upon the centres, called the top joints \( a \), and the wheels of the carriage, 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 \( O \), 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, \( s \), 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 funk 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 finkers-frame will be at its lowest position, and the top arms, \( Q \), will rest upon the lower flop-screw of the standards \( W \). When the finkers are brought forwards, to draw the loops from the items of the needles into their beards 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 flop 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 flop. The finkers are then brought forwards upon their centre of motion, while the prefler is drawn down to close the beards of the needles and draw the loops over them; in doing which, the hook quits the arch, and the frame comes forwards without any guide, the same being unnecessary, because the elevation of the finkers is determined by the upper flop, again 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, so as make his work close.

In returning the frame of finkers, in order to put back the work upon the items of the needles, so as to be out of the way while a new row of loops is made, the hook, \( s \), must be carried back beneath the arch, which will keep down the points of the finkers, so 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, so as to come into the arched or open part \( s \), fig. 4, of the finkers: this is done by depressing the finkers low enough for their point, \( s \), 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, \( f \), of the finkers; and by depressing the slant-treadle \( j \), the jack-finkers are depressed one by one, so 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, whilst 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 beards of the needles.

The fourth movement is to bring the work forwards from the items of the needles. To do this, the finkers-frame is lifted up, by elevating the hand-bar \( K \), so that the point, \( s \), of the finkers will be quite drawn out above the needles; and in this situation, the hand-bar and finkers-frame being brought forwards, the breast or curved part of the arch, \( s \), of the finker will bring forwards the piece of work which hangs upon the items of the needles, by its loops laid made.

The fifth movement is closing the work, or drawing the loops laid made, through the finished loops of the work. The slant-treadle \( E \), being borne upon at the same moment, will bring down the prefler, and it will bear upon the beards, and close them, while the loops are drawn forwards; consequently the loops of the old work will be drawn over the beards, and quite off from the needles; this draws the loops thereof over the loops laid made, which remain...
main in the beards of the needles. To draw the work tight, the hand-bar, \( K \), 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 frogs 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 pressing back the hand-bar, and all the finkers together, the points, \( r \), will enter between the ends of the needles, and carry back the loops of the work upon the frogs 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 detaching it into large loops between every two needles, by the motion of the feet; 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 frogs of the needles towards the beards; 5th, closing the beards by the pressure of the prelfer-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 deferred; and as fast 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, 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 it 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. The number of needles in an inch is called the gauge of the frame, and they vary from 15 to 40, which latter are used for the finest firkings. 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 loose 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 beneath 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 flight 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 firs, and the notches nicks: 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 upper right standards, \( W \); and through these stops, firk-screws, \( y \), 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 firk-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, as that 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 firs: this is done by a simple screw-press. The point of the needle is next formed by the file and burnisher, and the hooks are then bent to form the bars: next the needles are flattened, each with a blow of the hammer. To fallen 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 needles. 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 loop through each. The leads of finkers are made of steel-plates, which are put together by calling lead round them at the upper ends, in the same manner as the needles. The rack or piece, which contains the centre of the jacks, 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 hose 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.

STOCKPORT, in Geography, a town of Saxony, in the Vogtland; 3 miles S.E. of Plauen. — Alto, a town of the duchy of Wurzburg; 3 miles S. of Königshofen in der Grabfeld.

STOCKPORT, anciently written Stockeport and Stocport, a town in the hundred and deanery of Macclesfield, is feated 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 Heaston-Norris, and is united to the Cheshire part by a bridge. In 1811 it contained 859 houses, and 5232 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 Melish, Lysons's Statement in 1810, there were then 25 factories for cotton goods, one silk-mill, and several establishments for the making of muslins. The parish of Stockport contains fourteen townships, viz. Stockport, Bramhall, Bredbury, Bresford, Didsbury, Withington, Eccles or Stockport-Eccles, Hyde, Marple, Norbury, Offerton, Romiley, Torkington, and Withington. 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 Stockepour, 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 he no charter extant, yet a mayor is annually elected, or rather nominated, at the lord of the manor's court. Soon after the Norman conquest, the manor of Stockport belonged to the De La Speencers.
it is now the property of lord Viscount Balkeley, in right of his lady. In the year 1773, the castle of this place was held by Geoffrey de Calvente 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 3000, 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 1568, 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 1487, by Sir Edmund Shaw; an almshouse, endowed, in 1659, by Edward Warren, esq.; a dispensary, on a very enlarged plan, established in 1792; 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 was erected by subscription in 1805. — Lysons's Magna Britannia, Cheshire, 4to. 1810. Beauties of England and Wales, vol. ii. 8vo. by J. Britton and E. Bracey.

Stockport, a town, or rather village, of America, in the state of Pennsylvania, and county of Northampton, on the W. side of the Popanunk 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 same 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 goose-quill to half an inch, or not more than an inch thick in the part where the graft, &c. is to be inserted; but they are sometimes used when two or three inches in diameter: these are made of in mottled kind of fruit-trees, and occasionally for some varieties of forest and ornamental trees, and many of the shrub kind: they should in general be specie, or varieties of the same genus as the trees with which they are to be engrafted.

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 red and black cherry, &c.; and also of such trees as have been grafted or budded: some sorts, being strong suckers and hardy, are preferred, on which to graft particular species, to improve the size and duration of the trees; 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 distinctions 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 prove more free clean suckers 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 for dwarf standards in small gardens, and others occasionally for varieties, as well as for planting in forcing-frames, or to pot for forcing, or curiosity, &c. as the paradise apple and codlin stock, for dwarfing apples; the quince stock, for pears; the bird-cherry, morello, and small May cherry stock, for cherries; the baluce and mulice stock for dwarfing apricots, peaches, and nectarines, and sometimes dwarf-almond stocks for the latter, when designed to have these 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 baluce, 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 codlin dwarf stocks, quince stock, morello cherry, and mulice-plum stocks, 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 kinds, they are those of their own sort, raised from the kernels of any of the cultivated apples or crab for common standards, and the larger kinds of dwarfs; but the wild crab stock is often esteemed preferable to the free stock, for its hardy and durable nature, on which to graft common standards; and sometimes used for espaliers: and for lower dwarfs, the codlin, Siberian crab, and paradise stocks are sometimes used; the former for middling dwarfs, and the latter for the smallest dwarfs: they are all easily raised, the free stock and the crabs from the kernels of the fruit; and the codlin and paradise stocks, likewise from suckers, layers, and cuttings. See Pyrus Malus.

But for the pear, it is chiefly grafted and budded on pear stocks for general use, but on quince for dwarfs; the former chiefly raised from the kernels of any sorts of pears; and the latter freely by suckers, layers, and cuttings: but the pear stock is always to be preferred for the general supply of larger trees, for all common standards, and the larger dwarf pear-trees for extensive walls and espaliers: the quince stock is esteemable principally for its dwarfish property, or in being productive of moderate floaing trees for walls, espaliers, or middling standards, sooner arriving to a 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
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prosper well; as the good sports 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 bell summer and autumn pears, as much as possible; and the prime sports should be worked always on the finest free-shooting stocks of the most cultivated-like growths; sometimes, to improve the quality of particular choice kinds of pears, it is the practice to double-work them, which is to graft the bell sports into free stocks in the spring, which shall the same year; then about midsummer, or soon after, to bud the young shoots of the graft with buds of the prime sorts of pears, suffering only the stocks from the second budding to run up to form the tree: the breaking kind of pears are often rendered less hard and flisty in this way, and the melting property of others is considerably improved. See Pyrus Communit.

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 feed, suckers, layers, &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 fame by layers and cuttings, it renders the raising of stocks for grafting or budding them on almost unnecessary. See Pyrus Cydnum.

Also for plums, the operation is performed only upon stocks of their own kind, raised from the flowers 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 muske-plum stock, which many prefer as the bell stock of all on which to work the finer kinds of plums, as generally producing very thriving moderate growing fruitful trees; raising it, not from feed, which would vary exceedingly, but by suckers from the root of real muske-plum trees, or of those worked upon the true muske stock, or from layer stocks of the muske-plum tree; the plum will also grow upon the apricot and cherry stock, but not in a thriving late for any length of time. See Pyrus Doméstica.

For cherries, the proper sports 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 flowers of the fruit, and the latter also by feed, or by layers and cuttings: for general use, the wild black and red cherry stock, being strong free growers, are preferable for all common large standard cherries, also the larger dwarf trees for extensive walls and efpaliers; 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 morello and May cherry, as being moderate growers, are used to raise the smaller cherry-trees upon, either in dwarfs for low walls and efpaliers, or for small standard standards; but the former, when raised from layers, is more certain of producing the real fruit in its naturally moderate growth: the common bird-cherry, as being a very moderate grower, is used to raise dwarf cherry-trees on, either to plant in borders, pots, forcing-frames, or to pot for forcing, &c.: they are raised plentifully from feed, 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 Pyrus Ceragulis.

For apricots, these prove the most durable on stocks of the plum kind, as common plum stocks of any variety for all common wall, efpalier and standard trees; and the buckeye stock for small dwarfs; the plum stocks are raised from the flowers of any kind of cultivated plum, or by suckers from the root; and the bollace from feed, 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 muske-plum stock, like peaches, &c., as being of a more moderate regular growth, and more prolific nature: the bollace 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 on its own, and on peach and almond stocks raised from the flowers, but never in so prosperous or durable a manner. See Prunus Armeniaca.

For peaches, several sorts of stocks are occasionally used; as almond, peach, nektarine, apricot, and plum stocks: they are all raised from the flowers 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 ufe; 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 foot of plum stock in particular is generally preferable on which to work peaches, which is that of the muske-plum, as producing the most prosperous trees, and a more moderate, regular, and fruitful growth, the fruit being of a superior quality, when the stocks are genuine; being raised from suckers or layers of the true muske-plum tree, or by suckers from the roots of such peach, nektarine, plum, &c., as are worked on muske-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 ufe: double stocks, or double working, is sometimes ufed for the more delicate peaches, to improve their bearing, and the flavour of the fruit.

For nectarines, the same stocks as in the peach are used: as almond, peach, nektarine, 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, nektarine, apricot, or plum, raised from the flowers, 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 feed, 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, when defigned as 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 trees of smaller growth, for low standards, efpaliers, &c.

For the wild maple-leaved service berry-trees, the proper stocks are either their own kind, or those of the hawthorn,
thorn, raised from the seed; they also take upon pear
flocks, &c.,
For hazel-nuts, the filbert, &c., the flocks of the com-
mon nut-tree, raised either from the nuts, or by suckers
from the root, may be used; but this method is seldom em-
ployed. See Corylus Avellana.

For orange-trees; these are worked upon flocks of their
own kind only, as any kind of orange, lemon, or citron
flocks, raised from the kernels of the fruit; though the
Seville orange, as being a very free frangl fouture, is gen-
erally preferred for orange flocks; but the lemon and citron,
being also free growers, form very proper flocks 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 flocks, raised
from the kernels of the fruit, as for oranges. It is evident,
that in this method, for curiosity, the same flock may be
made to support two, three, or more different varieties of
fruit, grafted or budded, either all into the flock, being
previously trained with branches, forsking off for the pur-
pone one for each graft, or by cleft or crown grafting
ingle large flocks, with two or more different buds by in-
oculation; likewise the flock being finely grafted or budded,
different flocks may be infected into the flocks arising from
the graft or buds; and thus two, three, or more flocks of
apples may be had on the same root; and by the same
method, different flocks of fruit may be had upon the same
flock, as plums, cherries, and apricots all on a plum flock
or peaches, nectarines, and apricots on the same, or on
flocks of their own kind; and pears, medlars, and quinces
upon the pear flock; also red and white currants, or cur-
rants and gooseberries, on a currant or gooseberry flock;
or white and red grapes on a vine flock; likewise red and
white roes, or other different flocks, upon a common roe
flock; as well as on 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 flocks may
be raised by seeds, suckers, layers, and cuttings. In the frill
or feed mode, various sorts of flocks may be raised from
the stones and fruits of different sorts of trees: as the ker-
nels of all the apple kinds, pears and quinces; and the
stones of plums, cherries, and apricots all on a plum flock
or peaches, nectarines, and apricots on the same, or on
flocks of their own kind; and pears, medlars, and quinces
upon the pear flock; also red and white currants, or cur-
rants and gooseberries, on a currant or gooseberry flock;
or white and red grapes on a vine flock; likewise red and
white roes, or other different flocks, upon a common roe
flock; as well as on numerous other trees and shrubs, which
are species or varieties of the same genus. See Citrus
Medica.

But before the appearance of the plants above ground,
where the surface of the bed is hard-bound or caked, it is
often beneficial to stir the surface lightly with a small iron
rake; also, if very dry weather prevails, to give frequent
moderate waterings, both before and after the plants are up,
repeating the waterings occasionally in very 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-weedicings; and by thus giving
every encouragement, the feeding flocks will grow to
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 the open quarters, in rows two feet asunder,
to 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 frangl flocks
should be planted out, leaving the red growing until the
next autumn, when they will be all of full size for plant-
ing out wholly into the open prepared nursery quarters,
forking the feeding plants up out of the beds, shortening
any perpendicular tap-root and long ftragglers, but leaving
all their tops entire, and then planting them in lines, either
by trench-planting, flat-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 frill spring, hoeing over the
ground every summer, digging between the rows annually
in the winter or spring, and training the flocks each to one
stem; preferring their top always entire, but trimming off
the frangl laterals below, to encourage the strength of the
main stem, 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
obferred, 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 succeed, and the sooner they
form trees. See Grafting and Budding.

In some cafes, however, where the flocks have start 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 eiplachers, &c.; or, even, in some
flocks, for full or half standards, provided the frill main
flock from the graft or bud is trained up finely, two or
three years, to form the stem, of from four or five to fix or
five feet stature; however, if they have grown but mo-
derately the frill and second fessions, 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 flocks; to that,
after being transplanted into the nursery, they often, in one
or two years' growth, afford proper flocks for the reception
of grafts and buds; and many of them are often fit for bud-
ging 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 flocks; 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, cutting off all knots or knobbled
woody parts of the old roots that may adhere to their bot-
tom, trimming the frangl flings, and cutting off all fide-
flocks from the stem; then planting them in rows two feet
asunder, and one foot distant in the lines; treading the
mould gently to their roots, and infilling the work by level-
ing the surface baked out. This the colli gratings
afterwards, until grafted or budded, is nearly the same as that of the
feeding flocks, keeping them clean from weeds in summer
by hoeing; and probably some of the strongest shooters may
may be fit to bud in the July or August following, though the general greater part will require two years' growth, before they are proper for working; still continuing them all to one item, by timely displacing strong laterals, and preferring their top or leading shoot generally entire until grafted, &c.

The third or layer method is practised 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, mulch-plum for peaches, &c. that may be obtained of the real fort with certainty; but as this method of raising flocks would be attended with great trouble for general grafting or budding, it is only practised 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 laid out 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 feeding anducker flocks.

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 asunder, managing them as the others. They should be kept with upright items, except any should assume a flunted or crooked growth; in which case, they should be headed down to the ground in the spring, when they will pull 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 focks advance in growth, they should be divested of strong lateral fhoots below, repeating it particularly in the taller fstandard 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 focks, are shown more fully under the culture of the different kinds, as well as under the heades Budding and Graffing.

In regard 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 horticullural 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 "Transactions 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 focks 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 suppress the plum flock, under all circumstances, the best adapted to the peach; and still further, that Du Hamel, to whose opinions the greatest deference is confidently to be paid, pronounces the plum flock as never to be eligible, and affrets that he has seen the peach-tree thrive upon focks of the apricot, in soils where it would not succeed either upon the almond or plum flock. It is also stated by the ball writer, it is said, to be the opinion 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 selection of focks of a species different from that of the bud or graft inserted, except in cafes where it is necessary to render any tree more dwarf 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 cafes, with considerable advantage. The growth of the peach-tree, it is said, is so rapid under those circumstances, that, with the aid of artificial heat, the flock which is raised from a seed in the spring may be budded and headed down in the same season, and afford a tree large enough to bear many peaches in the succeeding year; and for foreign-houses, where exuberance of growth may be effectively 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 circumstances is stated by Mr. Knight, in respect to the Moor Park apricot. In his garden, this tree, as in many others, he says, becomes, in a very few years, diseased and debilitated, and generally exhibits, in spaces near the head of its flock, liches alburnum, beneath a rough and februous bark. About sixteen or seventeen years ago, a single plant of this variety was, it is said, obtained by grafting upon an apricot flock; 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 reputable 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 cafes, to have more lasting 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-grounds, in Rural Economy, the focks which are made use of in raising and providing them with trees of these sorts, in different districts. Several kinds of focks are employed in this in- tention, sometimes by way of having the branches or parts of suitable and proper trees of these kinds imparted into them, and at others as feeding-trees, without that being done; though the first mode is the most ready, and for the mult
The most part had recourse to, especially in some districts. The pear is, however, the most advantageously raised on blocks 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 seed-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 autumn or spring season, and carefully raked or lightly harrowed in, so as to be well covered with the surface-mould: the latter of these actions is, however, supposed to be the best and most practised, as there is then less danger of their being destroys 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-feast; and in the second or third autumn, the young blocks are most ready to be put out into the nursery-ground. This is to be dug with the same care as the seed-bed; and at the time of the removal of the blocks or plants, the roots of them are to be pruned and restrained, by taking off the tap or down-striking ones, and shortening the fibres of 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 blocks may be raised on the acre, or thereabouts. They remain in these grounds from eight to ten years, when they will most likely have attained sizes proper for being finally put out into the field fruit-grounds. While in the nursery-ground, they are kept regularly pruned and trained: the side-shoots 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 blocks 11 6d., and for those of the pear 21 6d. consequently the profit of an acre of ground thus employed is very consider- able: 9522 blocks, disposed of at the above prices, amount, it is laid, in the first case, to 714; in the latter, to 11626 5½: and that after the third year, the profit may be reckoned on as neat, since the occasional crops, raised in the void spaces and parts between the blocks, will pay the ex- pences of labour and rent.

In some districts, when the young block plants are come up from the seed, in the progress of their ensuing growth, care is taken to select all such as produce the largest and most luxuriant leaves, as it is from that character that the best expectations are formed for procuring the most valuable fruit in this view. The rejected plants or blocks are drawn out from time to time, and the preferred ones left, for the purpose of discovering their specific qualities. The, when approved of, which point is most commonly ascertained by the end of the sixth year from the time of sowing the pips, their heads being previously formed upon stalks 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 blocks 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 Stocks out in the Fruit-Grounds.—As soon as the blocks have arrived at or attained the height and growth of six or seven feet, and are become 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 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-iciapings or way-foil in the proportion of about two feet or hor- loadst 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 30 and upwards, and opposite to each other in some places: the particular distance of the rows, however, depends greatly on the band of the ridge, as they are planted on the tops of such as most cafes: 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 wind land, the quincunx order of planting the blocks is sometimes practised, in order that space may be gained for spreading of the heads of the trees, as the distance allowed in such cafes is less.

When the planting is performed on tillage lands, advantage is supposed to arise not only from the manuring and keeping the mould loofe over the roots of the block plants, but from there being a considerable saving of expense in the articles of fencing and defending the plants. The young blocks or trees are to be protected and defended from external injuries of all kinds, until they have gained a con- siderable 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 blocks 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 blocks, though something may most probably depend upon the season 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 left to that of the autumnal season. It is, however, much easier to protect the roots of the blocks during the winter, than to be continuously watering them during the summer-feason.

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 ensure the mould as it comes out of them; but in the latter, the digging of holes is complete ruin to the block plants, as the whole depth underneath the cultivated soil is so retentive as to form a port of irritable 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 bell prac- tise is, therefore, probably, to take off the surface-turf to some depth in a circle of about four feet diameter, and to lay the under soil in a light manner; on this to place some good earth, and then to plant the block, with another layer of good earthy mould, covering the whole with over with the sod or turf, generally laid upon flat. The tap-roots of the blocks 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 blocks are to be headed down; or at least the branches are to be shortened to fix or eight inches, to guard
STOCKS.

guard against the power of the wind, and throw the juices more into the limbs, by which the vigour of the flock is increased. The newly planted flocks 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 cases where the surface and under foil has been well prepared by digging and properly manuring the ground.

Grafting the Stocks.—When the flocks 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 the most expeditious, may have been the most frequently had recourse to, it has been supersed by some, that no method of performing the operation that has yet been attempted, has been found fully adequate to the purpose. For the flocks 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 flocks, they then often decay, decline, and degenerate, or run into all the infirmities of their parent trees. Of course, on this principle, the refining 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 endowed with life, lives to propagate its kind, and after a time relinquishes its place to a new. It has been observed, that the head and 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 raised from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken. Alto, that the habits of feeding trees are very essentially different, that their leaves are small and thin, and that the general habit changes gradually, affording in a natural manner a more cultivated character; that if a flock for grafting with, be taken from a feeding tree of one or two years' growth, it will retain the character, and 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 raised from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken. Alto, that the habits of feeding trees are very essentially different, that their leaves are small and thin, and that the general habit changes gradually, affording in an annual manner a more cultivated character; that if a flock for grafting with, be taken from a feeding tree of one or two years' growth, it will retain the character, and 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 raised from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken. Alto, that the habits of feeding trees are very essentially different, that their leaves are small and thin, and that the general habit changes gradually, affording in an annual manner a more cultivated character; that if a flock for grafting with, be taken from a feeding tree of one or two years' growth, it will retain the character, and 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 raised from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken.

Thrift taken off by means of a proper saw, and then rendered quite smooth by the use of a 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 practised in this fort of work, as either by the simple common method, that of the crown method, or the root and whip methods.

A new plan of the root kind, has, in some districts, been lately had recourse to. In this, when the flocks 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 leaf-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 feion is then inserted 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, shoot 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 proceeds, or for grafting in the fruit-grounds. It is stated, 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 six of the flocks, 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. Shelton of Gloucester.

In some places it is the practice, in performing this fort of work, to infect two shoots or feions, one in or on each side of the head of the flock; but one is mostly sufficient to form a head large enough. With some, where two are infected, it is the enrolm, however, to remove that which is the leaf promising, where both thrive, in the ensuing year, and with a knife, or chisel, to pace off the top of the flock in a flogging 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 infrequently separated, and the trunk rendered by strong blowing winds, or even by the weight of the branches alone.

In case the grafts do not strike or take, it is considered dangerous, if not fatal to the flock, to infect new feions or shoots until the third or fourth year. Where they do strike, it is but seldom that any farther 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 dragging, irregular, and useless branches, as by these and other means, the interior of the trees may be prevented from becoming loaded and incumbered with a red expanse of wood. See Grafting.

Defending the Stocks.—These are to be well guarded, protected.
S T O

tected, 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 cases, by different forts 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 substances 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 croak pieces being nailed against them at suitable distances apart. Though this requires more wood than some other modes, theearer forts may answer the purpose very effectually. There are objections to many of these methods from the flocks and trees, when they begin to frot 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 flocks 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 flocks are liable to become naked and be rubbed by fleep, which is very hurtful to them.

The trees raised and formed from flocks in this way mostly come into bearing in from fix 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, Ciprus, 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 town, is indigible for not having a pair of stocks, and shall forfeit 5/.

Street, in Ship Carpenter, a frame erected on the shore 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 Lauch.

Hence we say, a ship is on the flocks, when she is building.

Stocksee, 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 Aichelau.

Stocksund, a town of Norway, in the province of Drammen; 60 miles N. of Drammen.

Stockton upon Tees, is a borough by prescription in the fourth division of Stockton ward, and parish 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 south 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 fortress 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 demolished; which was so completely executed, that not a stone of the former edifice remains. The only vestiges are the most, which defended the cattle on three sides; and a barn, which appears to have stood within the area of the works. In the year 1325 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 4220, and the houses to 812.

Stockton consists of two parts; one, called the Borough, where all the land is freehold; and the other, designated the Town, where it is copy or leasehold; the latter held under the vicar and vestry-men, and is not within the borough jurisdiction: for this reason there are two constabularies, with peculiar officers, though both form one parish. The civil government is vested in a mayor, alderman, and recorder, (who is always aeward 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, 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 townhall, 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 handfome column, 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 pleasant village about two miles to the north, but was constituted a distinct parish 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 cased with stone; 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, Sunday-school, and an almshouse, or hospital.

The manufactures of Stockton are sail-cloths and cordage, both of which are carried on to a great extent. The making of damasks, 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 Eecol. The tolls on this bridge
bridge gradually augmenting, now let for 200l. 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 York- 
shire, jointly. The shock of an earthquake was felt at Stockton in December 1780: and in August 1783, a violent storm of 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 Bras Crosby, esq. born in 1726, who rose 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 Wynchard, the seat of Sir Harry Vane Temepl, bart. The house, a handsome, modern edifice, occupies the site of an old build-
ging, in a park which presents some interesting scenery. —
History, &c. of Stockton-upon-Tees, by the Rev. J. Brew-

STOCHUM, a town of Welfphalia, 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 N. of Walpole, on Connecticut river, containing 1,132 inhabitants.

STODE, a town of Sweden, in Medelpada; 18 miles W. of Sundfwall.

STODGED, in Rural Economy, a term provincially signi-
fying filled to the flretch, 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 fynomynous with Pbleum. If the latter be, as many have believed, our Tarya, the ufe made of its downy feeds, for buffing cushions or beds, may account for the origin, or rather the application, of the name. The plant we have here referred to, appears to have designated a plant used for flrewing, or for making what was, doublets, the most ancient and simple sort of beds. The eros of Dios-
cordes however, merely mentioned by him as a well-known plant, useful for the afigrant properties of its feeds and leaves, is believed to be Petrium spinatum, whose qualities anfwer to this defcription, and which is called in modern Greek evous. How Linneus came to felect the name of Stoeb for the genus before us, in his Hortus Cliffortianus, where, without any explanation, it is for the firft time appears in his works, we are at a fofs to explain. The hard rigid African shrubs which compose it are, like the above Petrium, of all things moft unfit to make a bed, except for a rhinoceros or a hippopotamus. He seems to have taken up this name, for a new fynegenous genus, becaufe it had been variously applied by old botanifs to certain compound flowers, and was then vacant, nor did headvert, in any manner, to its fene or etymology.—Linn. Hort. Cliff. 390.


Gerrtn. t. 167.—Clafs and order, Syngenefa Polygona-freg-
gata. Nat. Ord. Compofta nudifemteae, Linn. Corymbi-
ferae, Jull.

Gen. Ch. Common Calyx roundifi, imbricatd; its scales awl-
shaped, permanent, invelving the common receptacle on all fides. Partial Parianthl folitary within each scale of the common calyx, fingle-flowered, of five linear, acute, equal, 

and fringed leaves. Proper Cor. of one petal, funnel-shaped; its limb in five spreading fegments. Stam. Filaments five, short, capillary; anthers united into a five-toothed cylinder. Fil-

Germa oblong; fyle thread-shaped, the length of the flaments; fligma acute, divided. Peric. none, except the unchanged calyx. Seeds solitary, oblong. Down fheathery, 

long. Proper Receopt. naked.


Obf. Garten 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 dicoid, fection of the order Polygonata eaudata, and we are much disposed to concur in that opinion.

The difcoveries of Thunberg have greatly enriched this, as well as other Cape genera, fo that Wildfaw reckons up twenty species, about half of which were known to Lin-

nus. But two or three of these really belong to Scatt-

trium, and are abfolutely fingular. Stem. Filaments five that article. Nin-

ten are natives of the fourth of Africa; one of the ifles of Mauritius and Bourbon. Scriphium, which has also a feathery feed-down, differs from Stoeb in having only one flower in each outer calyx.


Wildl. n. 1.—"Leaves sharp-pointed, thread-shaped, woolly."—Gathered by Thunberg at the Cape of Good Hope. We have seen no specimen.


Wildl. n. 2. Ait. n. 1. Lamarc Ililtr. t. 722.

f. 2.—Leaves awl-shaped, pointed, reflexed, keeled; po-
lifhed on the under side. Stem erect.—Specimens of this plant were brought very early from the Cape; and Lin-

eus feeing it in Clifford’s herbarium, though not alive in his garden, founded hereon the genus of Stoeb. Miller cultivated it in 1759, but no figure, except Lamarc’s and Garten’s, has ever appeared, Petiver’s tab. S. f. 1. being a different plant, as we shall mention hereafter. The stem is feburly, of humble growth, with round leafy branches. Leaves crowded, almof imbricated, scarcely half an inch long, twifted, recurved, entire, concave, with a fpinous point; fringed with long soft hairs towards the base. 

Flowers terminal, fesflie, hemifpherical, three-quarters of an inch in diameter. It is from this, the original fpecies of the Hortus Cliftonianus, that the character and idea of the genus are taken.


excluding the reference to Brenyus and Morifon. Wildl.

n. 3. Thub. Prodr. 169. Berg. Cap. 359 (Espatat-

roides capenis capitatus; Petiv. Gafoph. t. S. 1.)—Leaves minutely pointed, linear, revolute, oblique, reflexed. Stem er-
craft. Some ligulate florets.—Native of the Cape. The stem is a fpan high, determinately and repeatedly branched, 

twifted, leafy. Leaves about two lines long, spreading every 

way, obtufe, with a minute point, roughish, with a 

few little difperfed tubercles; hoary when young. 

Flowers round, fesflie, terminal, pale red or fesf-coloured. Each 

partial calyx usuallly contains, along with its proper tubular 

perfect flore, another short ligulate nueter one. The fede-
down is lloofly fheathy. Petiver’s figure undoubtedly re-

depresents this plant very charactetically. That of Brey-

G g 2
STOEBE.

m. erroneously quoted t. 9, instead of 69, by Linnaeus, is S. sylvestris, the leaves of which are much spreading.

4. S. prostrata. Prostrate Stoebe. Lindl. Mant. 291. Willd. n. 4. Thunb. Prodr. 169.—Leaves pointed, lanceolate, obtuse, with a concealed rib, beneath. 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. phylleoides. Phylleoid-leaved Stoebe. Thunb. Prodr. 169. Willd. n. 5.—Leaves pointed, lanceolate, obtuse. Stem erect. 1.—From the same country. Thunb. This description is insufficient to give any distint idea of the plant. We have seen no specimen.

6. S. gomphrenoides. Amanantie Stoebe. Lindl. Suppl. 391. Willd. n. 6. Berg. Cap. 336. Thunb. Prodr. 169.—Houttuya Linn. Fl. Syl. v. 4. 435. t. 34. f. 1. 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, most branched at the bottom. Leaves half an inch or more in length, imbricated; conves, green and somewhat silky, at the back, with a flabby marginal fringe. They are mostly obsolete, without any minute sharp point, except on the lower ones. Flowers round, white, rather polished, resembling the heads of a Gomphrena. Each floret 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. gomphrenoides. Cudweed Stoebe. Lindl. Syll. Veg. ed. 13. 664. Willd. n. 7. Thunb. Prodr. 169. (Seriphium corymbiferum; Linn. Mant. 119. Gomphaëon niveum; Linn. Sp. Pl. 1192. G. incanum, fohio lineai cauli acumbente; Burm. Afric. 215. t. 77. f. 1. and incomplete.)—Leaves sharp-pointed, ovato-lanceolate, concave; woolly on the upper side; polished at the back. Panicles cymoïde.—Gathered at the Cape by some of its earliest botanical visitors. The stem is shrubby, rigid; its upper branches leafy, woolly. Leaves erect, crowded, yellow-green, rather thin, slightly 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 flover cylindrical, with a squarrose, imbricated, tight, partly woolly, common calyx. Florets two or three. Seed-down club-shaped, very slightly feathered. We cannot but conceive the genus of this plant to be very doubtful, the inner calyx being fearfully distinctable.

8. S. joabah. Rough-leaved Stoebe. Lindl. Suppl. 391. Willd. n. 8. Thunb. Prodr. 167.—Leaves erect, linear, woolly above; imbricated at the back. Flowers racemose.—Found at the Cape by Thunberg. The minute ciliated leaves, and outer calyx, are rough with glandular prickles. Florets 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 floret, making the plant a true Seriphium; so nearly are these two genera related!

9. S. cinerea. Grey Heath-leaved Stoebe. Willd. n. 9. Thunb. Prodr. 169. Ait. n. 2. (Seriphium cinereum; Linn. Sp. Pl. 1136. Brachycaeris cinereaepilis; Petiv. Gazoph. t. 5. 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 his woolly obtuse scales, and contains many florets, whole partial calyx is smooth, with long bristle points, seeming to surround each floret distinctly.

10. S. jubata. Aul-leaved Stoebe. (Seriphium gnapalodes; Linn. MSS.)—Leaves somewhat spreading, involute, pointed, awl-shaped; woolly above; slightly imbricated at the back. Flowers faked. Outer calyx woolly. 1.—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 tender, and apparently thread-shaped, but they are concave and woolly above; the under side is clothed in a decussate silky web, and armed here and there with prominent prickles. Spikes terminal, short, ovate or oblong, rather compound, somewhat leafy. Common calyx very distinct 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. planifolia. Feather-leaved Stoebe. Willd. n. 13. Thunb. Prodr. 169. (Brevicynia capensis, capitus bonx spei; Bryna. Cent. 1. 69. Abrotanoides capensis, erica folio; Petiv. Gazoph. t. 5. f. 4.)—See Seriphium, n. 2, where this species will properly be placed. The stem is very commonly branched. Leaves very slender, half an inch long, embracing dense, grey, woody, axillary tufts of smaller ones. Flowers small, fidele. Common calyx many-flowered, fearfully distinguishable from the minute tufted leaves; partial one longer, with blunt, tawny, thinning scales. We cannot understand the observation in Linn. Mant. 481, "flores 5; flores 6; flores" unless each scale of the inner calyx was taken for a floret.

15. S. fulva. Brown Stoebe. Willd. n. 14. Thunb. Prodr. 170. (Eupatorium crinoides, capitis bonx spei; Bryna. Cent. 1. 69. Abrotanoides capensis, erica folio; Petiv. Gazoph. t. 5. f. 4.)—See Seriphium, n. 3, to which genus this species undoubtedly belongs, each floret having a distinct outer, as well as inner calyx; notwithstanding its great resemblance to Stoebe coccus, n. 3.


17. S. afra. Harsh Stoebe. Thunb. ibid. Willd. n. 16. —Leaves linear, pointless, smooth, reflexed. Flowers lateral. 1.—This and the last were found by Thunberg at the Cape, and do not appear to be known by any other author.

Gathered by Commerson in the isle of Bourbon. This is certainly a *Seriphium*, not a *Stoechades*. The *fem* is fix or eight feet high, with innumerable branches, resembling a *Tamarix* in habit. *Leaves minute, imbricated; smooth at the back. Inner leaves long and smooth, at length spreading widely. The *water* is cylindrical, of many roundish imbricated scales, woolly within, and contains a fugal flow, only. This should follow *Seriphium fuscum* in its proper place.

19. *S. rhinoceros*. Rhinoceros Thoebe. Linn. Suppl. 391. Wildh. n. 18. Thunb. Prodr. 170. — "Leaves triangular-awl-shaped, close-prelapped. Branches downy, drooping. Clusters proliferous." — 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 Lamarck suspects, that this may not be different from the last species.


21. *S. nivea*. Snow-white Thoebe. Thunb. ibid. Wildh. n. 20. — "Leaves triangular, obtuse, close-prelapped. Flowe terminal." — In this view of the genus *Stoechades*, as it stands in Willdenow, we have been chiefly solicitous to ascertain species and their synonyms. The intelligent reader may range some of them under this genus, others under *Seriphium*; 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 Gallia Narbonensis. These islands are the same with the islands of Hieres. Strabo mentions five of them; and three of these deferve to be recorded, viz. Prote, Mefe, and Hypea.

**STOECHADES MINORES**, or the Lesser *Sto echades*, were two small islands of the five above-mentioned, situated opposite to Marielles, called Ratoneau and Poméque.

**STOECHADES**, in *Botany*, *Stoechades* is a genus, distinct from the above-mentioned, situated opposite to Marielles, called Ratoneau and Poméque.

**STOECHADES**, in *Botany*, *Stoechades* is a genus, distinct from the above-mentioned, situated opposite to Marielles, called Ratoneau and Poméque.

**STOEHADT, a town of Poland, in Volhynia; 44 miles S.W. of Luco.**

**STOICISM**, the doctrines and opinions of Zeno's followers, called *Stoics*.
of Zeno; thus called from the Greek τοίχος, portico, or the porch; because the place where Zeno chose for his school was the "Pocile," or painted porch, a public portico so denominated from the pictures of Polygnotus and other eminent painters, with which it was adorned. This porch, which was the most famous in Athens, was called τοίχος, the porch.

The author of this sect, Zeno, was a native of Cittium, a maritime town in Cyprus, originally peopled by a colony of Phenicians, whom 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' school, as from that of Moses. 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 occasion, in his mercantile capacity, to visit Athens, purchased for his son several of the works of the most eminent Socratic philosophers. There 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 we are told, consulting the oracle how he should spend the rest of his life, he was answered, ἐξανθρωπίσον τὴν καλότην, 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 paginations, and that, being highly gratified by the perusal, and forming a very favourable idea of the author, he asked the bookseller where he might meet with such men. Crates, the Cynic philosopher, palled 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 enlisted 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 imitate 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, Diogenes 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 slyly 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 statue of brags. Amongst 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 slender; his aspect was severe, and his brow contracted. His constitution was flexible; but he preferred his health by great abstinence. 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, Ion 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 affuming temper, he commonly took the lowest place. Indeed, to 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 a contempt of external magnificence. He shewed as much respect to the poor as to the rich; and conformed freely with persons of the meanest occupations. He had but one servant, or, according to Seneca, none.

Honoured and esteemed as Zeno was by a great number of perfons, and unaffuming and irreproachable as were his manners, he had his enemies. Philosophers of distinguished ability and eloquence employed their talents against him. Thales, the founder of the sceptic school, amongst the ancients held him in profound contempt. Zeno was the founder 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 conficuousness of infirmity, that, striking the earth, he said, "Why am I thus imperturbed? I obey thy summons: and immediately going home, he strangled himself. He died in the first year of the 129th 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 subsisted for many ages. Of Zeno, Cicero says, that he had little reason for defearing his masters, especially those of the Platonic school, and that he was not so much
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much an inventor of new opinions as of new terms. A comic poet, quoted by Athenæus, thus ridicule the logomachics of Zeno and his followers:

"Ye fages of the Porch, loquacious tribe, Traders in trifles, arbiters of words, And confess! hear!"

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 disdained 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 disputation, 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 Stricturn have maintained, a mere calumny, but grounded upon fact, sufficiently appears from what is said 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 an artificialseverity of manners, and a tone of virtue above the condition of man. Their doctrine of moral wisdom was an offententious 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. Laidly, 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 vehemence contained which suffused between Zeno and the Academicians on the one hand, and between him and Epicurus on the other. Whilist Epicurus taught his followers to seek happiness in tranquillity, or a freedom from labour and pain, Zeno imagined his wife man not only free from all sense 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 considerable 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 severe 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 wife 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 those 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 Chriftian model. (See FATE.) Brucker, in his "History of Philosophy," translated by Enfield, has given an abstract of the Stoic philosophy, deduced from the writings of Cicero, Plutarch, Laertius, Sextus Empiricus, Simplicius, and Stobæus, compared with those of Seneca, Antoninus, and Epictetus, under the different heads of philosophy in general, logic, physics, metaphysics, and morals. Our limits will only admit of 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 represented 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 figuration 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 discoursing on subjects which require diffuse declamation, and the latter being the art of close argumentation, in the form of disputation or dialogue. Rhetoric is of three kinds, deliberative, judicial, and demonstrative. The dialectic art is the instrument of knowledge, by enabling a man to distingiih 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 some parts of the brain, or upon the percipient faculty, which may be called an image, ζωγραφις, since it is impressed upon the mind, like the image of a real 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 thing
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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, ἀναγνώσθειν 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 known, else if it is not examined, it is mere opinion; if it will not bear this examination, it is misapprehension. The fancies, 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 railed in the mind; and a way is opened for the investigations of reason.

Some images are sensible, or received immediately through the fancies; others rational, which are perceived only in the mind. These latter are called innate, notions or ideas. Some images are probable, to which the mind affixes 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 phantasms, are immediately derived from no real object. Images are apprehended by immediate perception, through the fancies, 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 fancies produce in the mind an involuntary emotion; but a wise man deliberately examines them, and supposes his action or approbation (προταθέω) with regard to the report of the fancies, 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 fancies, remain in the memory, after the objects that occasioned them are removed; a fusion of these continued impressions, made by similar objects, produces experience; and hence arise permanent notions, opinions, and knowledge. Even universal principles, πεποίημα, 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, dialectics consider vocal sounds, as expressed by letters; the formal 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 προσερχόμενον, phantasm, already explained.

Dialectics consider things as capable of being clasped 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. substances, qualities, modes, and relations. Things considered with respect to speech are called λόγια, capable of being expressed in words. Predicates are things predicated, or declared, concerning another. Hence arid axioms, syllogism and compound, and these admit of different characters. An argument (ἀργυρίον) commonly confits of a general truth admitted (ἀπόκομμα); a particular case supposed (προταθέω), and a conclusion (ἐπικόμμα). Argument its 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 exists. 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 emulative system (see Emulation) 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 opposite 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 confounded their essence, and maintained that they 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 fubstance, 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 delitute 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 sluggish matter, or to the elements, is said to be immaterial and spiritual.

Some perils have been misfled 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 appellations 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, so most omnipious και λοιπον, and sometimes as a warm or fiery spirit, πνεῦμα φύσεως, 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 inanimate matter. They taught, indeed, that God is uncreated, incorruptible, and eternal; possessed of intelligence, good and perfect; the efficient cause of all the peculiar qualities or forms of things; and the confiant preserver and governor of the world: and they deified 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 fulness of its diction. But if, in reading these descriptions, we fail to associate with them modern conceptions of Deity, and neglect to recur
cur to 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 unde-
rived 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 fable 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 ap-
ppears that, according to the Stoics, the agency of the
Deity is nothing more than the active motion of a celestial
ether, or fire, posseflled of intelligence, which at first gave
form to the shapeless mafs of gross matter, and being always
effectually united to the visible world, by the same necessary
agency, preserves its order and harmony.
The Stoic idea of Providence is, not that of an infinite wise and good being,
wholly independent of matter, freely directing and governing
all things, but that of a necessary chain of causés 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 neces-
fity. 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 prineiple in nature, the
Stoics called by various names; nature, fate, Jupiter, 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 appellation 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 syinem from God,
denotes, not a separate agent, but that order of things
which is necessarily produced by his perpetual agency.

The universe, according to Zeno and his followers, is
actus naturalis or actus reipublicae, "a sentient 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 Heracleitus, and
assuring that there is no real existence which is not corpo-
real, conceived nature to be one whole, confining of a subtle
ether and gross matter, the former the active, the latter the
passive principle, as effectually 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 de-
grading. Refuding primarily in the superior celestial region,
and being thence diffused, as a subtle fire through a finite
world, his universal presence 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 effential characters of the Supreme Being. The origi-
nal communication, and the perpetual preservation of forms
and qualities, by the necessary action of a subtle fire upon
matter, though this principle be fupposed to be posseflled of
reason and intelligence as well as energy, is certainly an idea
of Deity, which falls far short of that pure and sublime doc-
trine, which represents God as creating and governing the
world by voluntary agency, and with wise design. That

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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 irresistible current; cause depends upon
cause; effects arise in a long succession; nothing happens by
accident, but every thing comes to pass in the established
order of nature."

Portions of the ethereal soul of the world being distrib-
uted throughout all the parts of the universe, and ani-
mating 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,
whose which inhabited the sun and stars, which they con-
considered as deuses maximi, animated substances; the inferior,
human souls separated from the body, or heroes. "Illuf-
trious men," says Cicero, "whole souls survive and enjoy
immortality, are justly esteemed to be gods, since they are
of an excellent immortal nature." Besides 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 were endowed with human
passions, and therefore are proper objects of sacrifice and
worship.

As the Stoics held, that all the inferior divinities are por-
tions separated from the soul of the world; so they con-
ceived, 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 ge-
neral conflagration.

On the subject of the origin of evil, they had recourse to
fate, and taught that evil was the necessary consequnce of
that eternal necessity, to which the whole world comprehend-
ing 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, defi-
tute of, but capable of receiving, qualities. Considered
universally, it is an eternal whole, which neither increas-
 nor decreases. Considered with respect to its parts, it is ca-
pable of increase and diminution, of collision and separation,
and is perpetually changing. Bodies are continually tending
towards dissolution; matter always remains the same. Mat-
ter is not infinite but finite, being circumfribed 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 quidrature, and then the
other elements, fire, air, and earth, of which all bodies are
composed. Air and fire have effential levity, or tend to-
wards the exterior surface of the world; earth and water
have effential 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 effential 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, constituting 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 endued with perception and in-
telligence, and therefore to be ranked among the gods.
They are nourished by exhalations from the seas and
rivers.
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 luminary poffefled 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, through the sign of the zodiac.

Below the sphere of the moon is the region of the air. The 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, is filled from 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 dissolution, 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 inundation, 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 prismatic 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 reformation 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 doctrine of reformation, upon which Seneca has 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 defirous 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 resurrection of the body; for, according to the Stoics, men return to life, not by the voluntary appointment of a wife 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, endowed with intelligence and reason; but the energy of this principle is confined and restrained, in the birth of man, by its union with grosser 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 wife and good; and Seneca seems to have entertained the same notion. Epicurus and Antoninus alleged, 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 condensed 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 destroyed. The only idea of the immortality 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, to which, 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 divinities, 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 agitated in the lower region of the air, till the fiery parts were separated from the grosser, and rofe 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 Epicurus and Seneca, who frequently speak of the happiness of good men after death in terms which might have suited a better system.

Seneca, confounding Marcia under the loss of her son, says, "The sacred assembly of the Scipios and Catons, who have themselves defpised 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 courtes of the neighbouring fars, 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 caufes of the celestial appearances."

The Stoical doctrine of "Moralis" is founded on the principles of physics. Conceiving God to be the principal part of nature, by whose 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 fake 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...
great whole, and to accommodate all his desires and pursuits 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 real nature of things, chiefly 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. i. 18. ult.

" Sed fatea ort ara Jovem quae ponit et auro: "

Det vitam, det opes: sequam mi animam ipse parabo."

" For life and wealth to Jove I'll pray; 
The Jove can give or take away: But for a firm and equal mind, This blessing is myself I'll find." Francis.

Wisdom, 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 an invariable conformity to the law of fate, so the happiness of man is owing, that course of life which flows in an uninterrupted current, according to the law of nature. Since these 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 conductive, others unfavourable, to the life which is according to nature, and as such are proper objects of preference or rejection, προοπισ αν απορροιαμα. 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 affections 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. Serm. i. i. fat. iii. apud fin.

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 folicitous, 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 or 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, temperance, fortitude, and justice. Prudence refers to 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 of 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 befals 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 subdue his passions of joy and sorrow, hope and fear, and every pity. He who is, in this respect, perfectly master of 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 do himself kind to all, according to his ability. He will think himself sufficiently rewarded by the consciousness of well doing, and will never cease to do good, although he has no witnesses 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 cafes where reason suggests a sufficient ground for clemency, he will not treat a delinquent with rigour. He will relieve the sick, afflit the shipwrecked, afford protection to the exile, or supply the hungry with food, but with an undisturbed mind, and a cheerful countenance; disdaining all sorrow arising from sympathy, as well as from personal sufferings. No one is more ready than the wise man to exercise lenity and clemency, and to attend to the welfare of other individuals, and to the general interest of mankind.

Concerning the whole moral system of the Stoics, it must be remarked, that, although it is highly deserving of praise for the purity, extent, and variety of its doctrines, and although it must be confessed, that in many feebler passages of the Stoic writings it appears exceedingly brilliant, it is nevertheless founded on false notions of nature and of man, and is raised to a degree of refinement which is extravagant and impracticable. The piety which it teaches, is nothing more than a quiet submision to irresistible fate. The self-command which it enjoins, annihilates the vital affections of the human heart. The indulgence which it grants to suicide is inconsequent, not only with the genuine principles of piety, but even with that countenance which was the height of Stoic perfection. And even its moral doctrine of benevolence is tinged with the fanciful principle, which lay at the foundation of the whole Stoic 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 avarice and hypocrisy.

Zeno, the founder of the Stoical system, had many disciples and successors; such were Perperus, Aristo the Chian, Herillus, and Spheron. 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 Stoic sect, 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 Diodenes 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 Posidonius. See Posidonius.

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. Besides, the Stoic sect acquired great credit and authority from the illustrious examples of many persons of both sexes, who, in those times of civil oppression, bravely encountered death in the cause of liberty and virtue.

Among the heroes of this age, Tacitus mentions the two Arrius, the wives of Cæcina petus and Thraseas, and Pannia, the wife of Helvidius. For these and other causes, the Stoic sect, in the time of Junius, prevailed almost throughout the whole Roman empire. (Sat. xiv. v. 108.) 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 meteoric Eclectic system was established, Stoicism began to decline; and in the age of Augustine 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 Cornelius, 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 Cornelius); Cæsius Munonius Rufus, who was banished by Nero to Cyrena, but afterwards called by Vespasian (see Munonius); Chazremos, an Egyptian; Lucius Annæus Seneca (see his article); Dio, of Prusa in Bithynia, called for his eloquence Chrysothom; Ephrates of Alexandria; Epictetus (see his article); Sextus, of Chaeronea in Beotia; 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 Ecclesiæ philosophy. In the sixteenth century some attempts were made for reviving the Stoic philosophy by Lipsius; (see his biographical article,) Galper Scipionius, Daniel Heimius, and Thomas Gataker. See Bruck’s Hist. of Philosophy by Enfield, vols. i. and ii.

STOILS, in Geography, a town of Hungary; 10 miles N.W. of Cachau.

STOKAAM, a town of Prussia, in Natangen; 30 miles S.S.E. of Königsberg.

STOKE, a township of Lower Canada, on the St. Francis river, N. of Aletot.

STOKER’S BAY, a bay on the S. coast of Hampshire, between Portmouth harbour and Southampton river, S. of Gofport.

STOKE-COURCY, a parish of large extent in the north-west part 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 is confined chiefly of one long street, and is situated at the southern extremity of the parish; it is stilled 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 crofs, in High-street, are two fine springs, included within cilyers, 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 conventual church belonging to the priory of Benedictine monks, which was formerly founded near this place. The arcs which separate the body of the church from the north and south aisles are femicircular, and spring from very rich capitals. The name of Stoke-Courcy in Saxo, the former word signifying a village, and the latter the name of its original proprietor; whose ruined manion lies a short distance to the south of the town. This parish, inclusive of Fairfield, contained, in 1811, 1208 inhabitants, and 222 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 district, 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 fo named by L’Heritier, 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, dif-


1. S. cyanus. Blue Stokelia. Wild n. 1. Ait. n. 1. (Carthamus levis; Hill. Hort. Kew. 57. n. 5.) — Native of South Carolina. Cultivated at Kew from about the year 1705, when Mr. Gordon is said to have introduced this elegant plant. It is perennial, flowering in August, requiring shelter in winter. The flen 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 242½ miles north-west from London, and 43½ from York. In 1811 it contained 388 houses, and 1459 inhabitants. The herbage of Stokelsley, at an early period, was granted to the family of Balacl, and was poiffed by Guy de Balacl, who came into England with King John. The manor, after defending through the family of Forrester, has since been sold to the Rev. Mr. Hillyard, the present proprietor.

The town is seated on the north side of a large branch of the river Leven, and is formed chiefly by one broad street. The buildings are principally modern, with the exception of the shambles 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 Domeday survey. About 1355, a chantry was founded at the Virgin's altar, within this building, by William de Stokelsey, for the re-ude 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 1792, 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 thbeberty in front. This town is endowed with two fairs, and a weekly market, held on Saturday. The petty feisions for the western division of Langbrough are held here. The parish of Stokelsey is of considerable extent, and incloses an area of about seven square miles. Within it are comprised the townships of Stokelsey-Byby and Esby, with the hamlet of Tameton, and a part of Newby. These were manorial reidences held under feudal tenures; little remains of their ancient greattstfes are visible. Elaby 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 1340, are the only vestiges left. The environs of Stokelsey are fertile, and the lands near the town chiefly laid to pasture. — Beauties of England and Wales, vol. xvi. Yorkshire; by J. Bigland. History of Cleveland; by the Rev. John Graves, 410. 1808.

STOKILDORFF, a town of Austria; 4 miles N.E. of Sonneneberg.

STOKOLETZ, a town of Croatia; 12 miles S.W. of Petrsz.

STOLATZ, a town of European Turkey, in the province of Servia, on the Morava; 30 miles N.N.W. of Niia.

STOLBERG, a town of Saxony, in the circle of Erzgebirg; 8 miles S.W. of Chemnitz. N. lat. 50° 46'. E. long. 12° 42'. — Allo, 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'. — Alfo, a town of France, in the department of the Roer; 3 miles S.S.W. of Efchweiler. — Alfo, a county situated in Thuringa; about 20 miles long and 15 broad. It affords some 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 Kamfchatka; 40 miles E. of Kamfchatkoi. N. lat. 56° 25'. E. long. 165° 44'.

STOLCKERN, a town of Austria; 3 miles S.W. of Eggenburg.

STOLE, Stola, from sole, signifying a long robe, or Vestment, a sacerdotal ornament, worn by the Romish parih-priests over their surplice, as a mark of superiority in their resuive churches.

The stole is worn by other priests over the alb, at celebrating masses; in which case it goes across the lochen; and by deacons over the left shoulder, ferracize.

The flola is a broad lwath, or fip of cloth or stuff, hanging from the neck to the feet, with three crosses upon it. The bishops anciently pretended, that the parih priests were never to appear before them but in their floles. In Flanders and Italy they always preach in floles. It is supposed to be a representation of the borders of the long robe worn by the Jewih high-priests.

The flola 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 eldhest 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 inluted 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 Alphonso V. who mounted the throne in 1416. Jullianini 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 frole, which the knights wore over their left shouder, reaching down to the knees, both before and behind, a palm and a half broad. None are raised to this order but the patricians, or noble Venitians. Jullianini observes, that the time of the institution of this order is unknown.

STOL.
STOLHOVEN, in Geography, a town of Germany, in the district of Baden, not far from the Rhine; 16 miles N.N.E. of Straßburg. N. lat. 48° 45'. E. long. 8° 57'.

STOLLEN, a town of Prussia, in the province of Oberland; 3 miles E. of Lichibad.

STÓLMIRZ, a town of Austrian Poland, in Galicia; 28 miles E. of Lemberg.

STÖLOWICZE, a town of Russian Lithuania; 30 miles S. of Novogrodek.

STOLPE, a town of Prussia, in the province of Ermland; 4 miles N.E. of Allenstein. — Alto, a river which rises in Pomerania, and runs into the sea; 27 miles W. of Danzig. — Alto, a town of Anterior Pomerania; 5 miles W. of Anclam. — Alto, 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'.

Alto, a river of Farther Pomerania, which runs into the Baltic at Stolpemund. — Alto, a lake of Brandenburg, in the Mark of Prenzegg; 2 miles E. of Kyritz. — Alto, a town of Brandenburg, in the Ucker Mark; 6 miles S.E. of New Angermünde. N. lat. 52° 58'. E. long. 14° 14'.

STOLPENMUND, a town of Farther Pomerania, situated on the coast 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 1652, 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. 51° 3'. 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 Herminenstadt.

STOMACACE, in Medicine, from corpus, the body, and stoma, an aperture, an erosion of, and spontaneous hemorrhage from, the gums and internal surface of the cheeks, together with an unifial feter of the mouth; it, in fact, a symptom of fever, or purpura, affecting that part. The term is sometimes used as an appellation of fever. See SCURVY and HEMORRHOEA.

STOMACH, in Anatomy and Physiology, (Ventriculus, Stomachus,) the large membranous bag, constituting the ampler 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, greater or left, and small or right extremities (extremitas oesophagica, 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. The stomach is of an irregular oval figure; the greatest 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, fovea cæcus), palling about two or three inches to the left of the ephaphal orifice. The two apertures, therefore, are differently circumstanced 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 them in the former direction is called the small arch or curvature of the stomach. The curvatures, 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 Everard 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 inch. It is difficult to determine its capacity. Scourmeying 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 dilated, and the small extremity empty and contracted; often, too, there is a muscular contrition 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 croosing 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 peritoneum, 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 Spigéli and the aorta. The esophageal cartilage does not answer to the middle of the stomach, but 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 small
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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 chells, except when very full.

The relative position of the stomach is subject to change from many causes, particularly from its various conditions of fulness and emptiness. Its position in the dead subject may be called perpendicular; the bowels sink down to the pelvis, the support of the abdominal muscles is lost, and the parts naturally belonging to the epigastrial region descend into the umbilical. The oesophagus 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 organ are different in the living subject; the retinence of the bowels, and the support of the abdominal muscles, carry the stomach higher; the anterior surface is at the same time rather turned upwards, and the posterior downwards; the great arch is forwards, the small backwards; and the oesophagus entering the organ, is rather inclined forwards. When the cavity is dilated, all these circumstances are more strongly marked; the anterior surface is now turned completely upwards, the posterior downwards; the great arch bends forwards against the abdominal parietes, the inferior is turned directly backwards. When the stomach is inflated, it rises upwards to the diaphragm, rather than extends downwards. The oesophagus close to the stomach is now horizontal; the pylorus, which ascends, now goes back transversely, and consequently descends in the supine position; the stomach may be so dilated, that the pylorus will rather descend. The pyloric end is brought up against the gall-bladder. In this state of things, the liver is rather comprised between the stomach and diaphragm. The spleen undergoes a corresponding change; its ends are now anterior and posterior, instead of superior and inferior.

The motions of the diaphragm, and changes of situation in other neighbouring organs, necessarily affect the position of the stomach. When the diaphragm descends in inspiration, the stomach is pushed down into the umbilical region; and this change is permanent, when any permanent cause in the thorax protrudes this muscle towards the chest; as collections of pus or water, enlargement of the heart, &c. When the whole of the great omentum is protruded in a hernia, the stomach is drawn down by it more or less: the pylorus, from such a cause, has been seen at the abdominal ring. The stomach has pilled through fibres of the diaphragm into the chest.

The organ is held in its situation by various connections. The oesophagus, with which it is continuous, unites it to the fluffe of the diaphragm, being surrounded here by a loose cellular tissue. The continuity of the pylorus with the duodenum confines it in a similar way on the opposite side. By the little omentum its small curvature is connected to the under surface of the liver; by the great omentum, the great arch is united to the spleen and colon. (See Epiploon.) Further, two folds of peritoneum are observed, under the name of ligaments; one connecting the termination of the oesophagus to the diaphragm (ligamentum phrenico-gastricum), the other passing between the diaphragm and the spleen and fundus of the stomach (рюсто-гастральное). Thus the two ends of the stomach are connected backwards, and form two fixed points, between which the organ rises and sinks, according as it is full or empty: the principal effect taking place at the great curvature, or the situation most distant from these fixed points.

Structure of the Stomach.—It consists, like the rest of the alimentary canal, of three coats: a serous, a muscular, and a villous; which cannot be better demonstrated than on the cut surface of a simple incision. There is nothing peculiar in the structure and disposition of the former. It is thin, quite transparent, close in its texture, firmly connected to the muscular coat; and it gives the whole exterior of the stomach a polished surface. At the two arches, the serous coat does not adhere so intimately to the muscular: here the omenta are connected to the stomach; and between their two layers the blood-vessels and nerves of the organ run, surrounded by a copious cellular tissue. In this situation, confluence, the stomach is not covered by serous membrane. For some distance from the curvature, on each side, the peritoneal coat can be easily separated by deflection. When the stomach is dilated, it rises in these situations into the intervals of the two omental layers, which are then applied on 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 seems to be naturally thicker in the pyloric than in the cardiac portion of the stomach. The colour of this fibres is 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 oesophagus, 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 pyloric end, and may then be called circular. Others go towards the great cul-de-sac; and some few 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 cul-de-sac, but they increae 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 itself; but one ends, and another begins; and they partly turn aside to mix with other fibres. These circular fibres are continuous with those of the oesophagus 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 constrictor of the canal at that part.

The mucous membrane, forming the internal surface, is the most important part of the stomach. It does not perform the same 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 rugæ, when the stomach is empty, and its 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.
STOMACH.

trations 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 dilated in any way, all these prominences disappear. The principal fibres of the stomach being circular, and their contraction consequently taking place in the transverse direction, the folds produced by this cause 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, white in its colour, and raised by inflation into the appearance of a downy or cottony texture. The blood-vessels of the organ ramify in this, before they enter the mucous surface.

Besides the great folds of the mucous membrane, we observe several little considerable ones, composing a net-work with larger or smaller intervals: these are all destroyed by extirpation. 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 name usually 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 transudation of the blood through the blood-vessels 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 been often deemed the result of inflammation. (See a paper by Dr. Yelloy, in the fourth volume of the Medico-Chirurgical Transactions.) The capillary fylem exists in great abundance in the mucous membrane of the stomach; so that it becomes more or less red, when the blood-vessels are injected with size and vermin.

It has been a question, 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 describing 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 exuded from them. Once or twice I have seen the glands themselves, of the nature of crypts, fimple, 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. 130.) Soemmerring speaks of the orifices of mucous glands as being visible about the pylorus; but not always very conspicuous. (De Corp. Hum. Fabr. tom. vi. p. 223.) 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 esophageal orifice of the stomach, round which it terminates in a feathern border. See Sir E. Home’s plate.

The communication between the stomach and duodenum is formed by the pylorus (janitor, punctum), a contracted orifice surrounded by a thick ring. The feros membrane and the mucous are the same in the pylorus as elsewhere: the ring is formed by a thickness of circular mucous fibres. Soemmerring speaks of the pyloric ring being composed of "peculiar glandulose pannus substantia:" 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 distending the parts, the pyloric orifice will be found about equal in diameter to a goose-quill, and in circumference plaited. The finger can, however, be easily forced through it, enlarging the opening, stretching the muscular ring, 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 string 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 orifice of the pylorus, as its name implies (from κατα, a gate, and ὑπό, a keeper), is to prevent 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 mucous structure enables it to accomplish this effectually; for it can contract so completely as 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 digested and undisgorged substances, and the peculiar formibility of the organ: there is no mechanical explanation of the phenomenon, which is quite a vital process. The resistance 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 fylem; 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 purified by corrosors: the processes of nature restored him the treasure in a short time; and he sold one of them, by anticipation, before it had made its appearance. A boy is mentioned by Habicot, in his "Question Chirurgicale fur la Bronchotomie," who swallowed several pieces of coal, which were recovered in the same way. Half-crowns, we believe also crown-pieces of this country, have travelled safely through the alimentary canal.

The arteries of the stomach are numerous, and some of them large: they are all branches of the celiac, or its primary ramifications: viz. coronaria ventriculi, pylori, galle-
gastro-epiploica dextra and sinistra, arteriae breves. The trunks of these vessels lie principally on the curvatures of the stomach, surrounded by a loose cellular tissu, and at a small distance from the organ, in its empty state: their branches communicate most freely with each other in all directions, both by large and smaller innumerable anastomoses: they are tortuous, and thus can accommodate themselves to the full and empty state of the cavity. They penetrate the muscular coat, without producing very considerable branches to be distributed on it, giving still fewer and smaller to the ferosus, and form an extensive minute network in the copious cellular texture of the mucous coat, from which such an abundance of branches enter the mucous surface, as to occasion it to assume, all over, the colour of any fluid injected into the arteries of the stomach. See Artery.

The veins accompany the arteries, larger in size, and forming larger communications: they are without valves, as is the caesophagus with the vena portarum; and they terminate by several small trunks, either in the splenic vein, or in the trunk of the vena portarum. See Vein.

The nerves of the stomach are from the eighth pair, of which the two cords penetrate the diaphragm with the eocio-phagus, and divide into numerous branches, which form an intricate plexus along the small curvature, closely adhering to the arteries, of which they follow the ramifications. Several branches come to this plexus from the celiac ganglia, and there are also communications with the hepatic plexus. See Nerve.

The absorbing vessels of the stomach are much smaller than those of the small intestines, and have transparent contents, instead of the opaque milky fluid seen in the latter. Like them, however, they may be divided into superficial and deep seated. From both surfaces of the stomach they partly go to the glands of the smaller arch, scattered in the omentum, and partly join the absorbents and glands of the spleen. They unite and form a plexus with the lymphatic vessels of the liver and ferosus omentum, pass behind the pancreas, and uniting with those of the spleen and intestines, end in the thoracic duod. Others accompany the blood-vessels on the great arch, proceeding to glands in the omentum, and having formed various plexuses, proceed above and behind the pancreas, to glands about the celiac and superior mesenteric arteries, terminating in the thoracic duod.

Functions of the Stomach. - The masticated aliment, and the drink, are received into this bag, brought into contact with its mucous membrane, exposed to the action of the fluids poured out by the latter, and variously moved by its mucous fibres. We have to consider, therefore, the phenomena exhibited both by the muscular and the mucous parts of its structure.

The mucous surface of the stomach, as the experience of every individual must have instructed him, possesses the power of secreting warmth and cold. But it is not sensible to the properties of the substances usually received into it, as their weight, their odour, taint, &c. their temperature within certain limits, their state of solidity and fluidity, &c. &c. So far as the stomach is concerned, we could not distinguish fugar from jasolp, or wine from medicine. Spirituous and tpicy substances are, however, perceptible by a kind of warmth which they excite. The stomach is the seat, on the other hand, of feelings peculiar to itself, resulting from relations between various substances and different states of the body, and its organisation and peculiar senstibility. Hunger and thirst, satiety, squeamishness, nausea, &c. are examples of these.

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 acrid nature, as the strychnine and phenter mine, which heat the whole frame, do not affect it. The distilled 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, hyofozymus, euphorbium, and hellebore root, are poisons to man; while conium affords wholesome food to the cow and hare, hyofozymus 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 almonds, 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 aromatic, and tpirituous substances.

Although, in its natural state, the stomach possesses but slight animal senstibility, 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 process 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 too fatal. On the other hand, if they are divided on the eocio-phagus 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 shew, 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, dilated with food very little altered from the state in which it had been swallowed. Experiences for le Prinpe de la Vie, p. 214.

Mr. Brodie found, that the mucous and watery secretions, which delfend the stomach and intestines in animals poisoned by arsenic, do not 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 as certainly, as when introduced into the stomach: it has the same properties when brought in contact with any mucous or serous 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 nerves
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.


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 various 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 those 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 organ at rest? or is there a peristaltic motion, by which its contents are agitated, expelled 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 disallowed. 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 acid 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 fearlessly found the organ move; he observed further, that vomiting was stopped by opening the abdomen, and renewed when the wound was closed up. Chirac found that the stomach, by its 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 Weffer 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 inert. The refarches and observations 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 takes place, marked by the most unequivocal signs: a deep inspiration, congelation of blood in the head, and pain, redness of the face, heat of the forehead, not infrequently actual rupture of vessels, and copious sweat as from the greatest excretion. 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, Sommerring calls vomiting "motus ventriculi peristaltico inverius, cuius vis, adjuvante cum vehementissima diaphragmati et muscularum abdominis actione, contenta in ventriculo per oesophagum atque oesophagio impetu ejiciuntur." De Corp. Hum. Fab. t. vi. p. 269.

The examination of this subject has lately been resumed in France, and an interesting series of experiments, presented to the National Institute, has been published by their author, M. de Mazenod, in order to prove that it is all together 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 compressed it so as to expel its contents. 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 end. The retchings and efforts at vomiting could be renewed by placing the hand 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 full produced by the action of the diaphragm compressing the stomach against the linea alba. If the phrenic nerves were divided fo as to render the diaphragm motionless, vomiting could no longer be excited. Lastly, having tied the arteries of the stomach, Mr. Magendie removed it, subliniting in its place a pig's bladder, containing a coloured fluid, which he connected to the oesophagus by means of a cannula, then fewed up 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 passed 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 aliment as is generally believed; but determines a convulsive action of the diaphragm and abdominal muscles. Mémoire sur le Vomissement, 8vo. 1815; or Journal de Corvisart, tom. xxviii. p. 184.

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 strangled a portion of the intestines, and thus produced vomiting. When he had divided the pericolic nerves, and confirmit the intestines 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 pericolic nerves, dividing the abdominal muscles, and taking away a portion of the diaphragm, as far as the tendinous portion of the intestines was strangulated, 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. Thence and other experiments in the same effay restore the stomach to the full enjoyment of its former rights, from which it seemed on the eve of being degraded, and to prove, that the diaphragm and abdominal muscles are altogether inert in the act of vomiting. Mem. for le Vomissement, par M. Maingault, 8vo. 1815; or in Corvisart's Journal, tom. xxviii. p. 193.

As the two experimentallists, 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 disgustful 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 alimentic 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 arcanis, 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; calculi passing the ureters; pregnancy; particular motions of the body, as swaying, riding backwards in a carriage, turning round; to this head we may also refer fea-fickenes; certain impurities 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. There can only be three characters of 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 fluxes 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 dyspepsia 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 sensible to external heat and cold, to the qualities of food and drink; the senesces 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 unhealthy executed, wounds, even in the most dilatant 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 suppurations, is not unfrequently 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 affici
Mifericus elixa, simul conchylia turbidis;
Dulcia se in blem vertent, stomachoque tumultum
Lenta feret pituita. Vide, ut pallidus omnis
Cana defurgat dubia? Quin corpus omnium
Heclernis vitis, animam quoque praegravat una,
Atque affigit humo divinae particularis urae.

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. Sicknese 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 sensation and voluntary motion (see Poison): in the phenomena of feb head-ache, as it is popularly and properly called (see cephalalgia); in the fibroflatus, dilated pupil, itching of the nose, headache, palefnes, delirium and even convulsions produced by worms in the stomach: in the palsy and apoplexy produced by a full meal: in the squeamishness and even fickenes caused by seeing or thinking of a disgusting object, &c. &c.

Numerous phenomena evince the influence of the stomach upon the heart: as the hurried circulation from eating or drinkingstrong or warm substances; the intermittent pulse, palpitation of the heart, &c. caused in some individuals by particular articles of food. We fee the heart influencing the stomach, when sickness attends syncope. The cough
arising from a loaded stomach, and even called the stomach cough, or from a wound of the stomach, and the effects of emetics in distresses of breathing, together with analogous occurrences, exemplify the mutual influence of the stomach and lungs. In hiccup, the diaphragm is influenced by the stomach, ticknails 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, ticknails, heartburn, and depraved appetite attending pregnancy. The state of the skin in dyspepsia and other stomach affections, and the numerous cutaneous diseases, 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. Diseased 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, Nausea, 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 stricture, as it is technically called, under which considerable suffering is produced. A stricture of the cardia, or upper aperture of the stomach, may be distinguished, according to Dr. Pemberton, from 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 described by the patient as very different from what is generally understood by the word pain. It is a sort of tender, circumcised 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 occasions hiccup. 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 into a degree, that a tumour surrounding the cardia may be discovered by a careful investigation in the region of the stomach.

A more common situation of stricture 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 contraction 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 plum-romes, which were therefore detained in the stomach; and he supposes that the pallage may in some cases be entirely shut up. This stricture occurring in the pylorus may be distinguished from stricture of the cardia, 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 stricture of the cardia. After the stricture of the pylorus has continued some time, the body generally becomes emaciated, as but little nourishment can pass into the intestine to be taken up by the lachesis, and the tumour, as in the former case, can then be discovered by examination of the abdomen. Pemberton on Diet of Abdom. Viscerae, 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 distended 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 has 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 flow in their progress. They are attended with pain, or an uneafy 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.

Schirius 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 imperfection 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 surprising to find the very extensive mischief which the stricture 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 palage of the food. Dr. Pemberton mentions that he has seen a large schirius in the stomach, near the pylorus, with an open cancer in one part of it, which had made its way through the stomach, and through the left lobe of the liver; and an adhesion had taken place between the fides of the abscess and the peritoneum: to that had not the patient been carried off by a disease in the aorta, it was probable that this abscess would have made its way out through the integuments 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 shewn 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 most 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 flight indigestion, and, therefore, none that could lead to a fulmination of such an extensive and formidable disease. In general, however, when the schirius has ulcerated, and formed what is called open cancer, there is a constant pain, though varying in degree, and which is increased by taking
STOMACHIC, a medicine that strengthens the stomach, and promotes the office of digestion.

Of this kind are wormwood, rhubarb, mint, mallow, aloe, 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 Corrosion. See CORROSION.

STOMACHIC Elixir. See Elixir STOMACHIC.

STOMACHIC Pills. See PILLS.

STOMACHIC Water. See WATER.

STOMACHICA Fever, the stomachic fever, a name given by Heister, and some others, to a species of fever, called by others a melenetic fever, and by our Sydenham nova febris, 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 fome for all medicines used in disorders of the mouth.

STOMBLE, in Agriculture, provincially a term which signifies to trample or poach, as a wet foil by means of cattle flock, or in the time of ploughing, &c.

STOMOXYS, in Entomology, 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 tefaceous, with live articulations; the antenna are tefaceous. There are sixteen species, in two divisions.

Species.

A. Sheath convolute and geniculate at the Base, with two Brilles.

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, antenna, and femmata; abdomen black, with a blue glofa; the tips of the wings are whitish.

GRISA. The antenna of this species are feathered; hairy, grey, with tefaceous thighs. It is found in Germany. The proboscis is black, a little tefaceous at the base; the head is white, with a tefaceous line on the front; the wings are whitish; the legs black, with rufous thighs.

SIBIRIA. Antenna feathered; hairy, grey; sides of the abdomen pale diaphanous. It inhabits Germany. Orbits brown; legs black, with pale thighs.

CALCITRANS. Antenna 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 flap with the feet; and which flings our legs in autumn.

TESSELLATA. Hairy, cinereous; abdomen grey, telfelate with brown. It inhabits Kiel, and is larger than the S. irritans, next to be described.

IRITANS. 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. Antenna slightly feathered; hairy, black; abdomen paler, with deep black bands. This is found in Denmark.
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Denmark. The segments of the abdomen are black at the base; the wings are white.

PENGUINS. Cineous, with black 'thighs. It is found in divers parts of Europe, and harlees cattle, though it is of a diminutive size. The body is lightly hairy; the wings whitish.

Asiliformes. Antennae facetous; the body is dusky; wings with black marginal spots. This is found in Italy. Theucker is short and yellow; the antennae are yellow, with a long filpne hair; the legs are yellowish, hind-thighs black.

Stylata. Cineous; abdomen rufous, with a projecting style, black at the end; wings hyaline, with five brown bands, every other one abbreviated. This inhabits Barbary.

Dorsalis. Black; abdomen mowy on the back, with three pair of black dots. It inhabits France, and is small.

Longipes. Orbits white; thorax grey; abdomen grey-brown; legs ferruginous, black at the ends.

B. Sheaths covering the Mouth, with five Bristles.

Rostrata. Thorax with obscure lines; probosces, abdomen, and legs, telfaceous. It resembles the common fly, and is very troublesome to cattle.

Lineata. Thorax black, with four white lines; abdomen black, with three lateral yellow spots, and tail. It is found in Germany. The proboscis is yellow, the tip emarginate and black.

Musiformis. 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 fuscous club; the mouth is hairy; the head is brown; the tail is bluish; legs yellow, spotted with black.

STONED, 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 Argyile's gardener, and probably born in the times of Argyile, about the beginning of the last 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 almost unrivalled efforts. Before he attained the age of eighteen years, he had acquired a knowledge of the most sublime geometry and analysis without a master. When he was asked by the duke of Argyile, how he had gained this knowledge, he replied, "I first learned to read; and the masons being at work on your house, I faw that the architect used a rule and companions, and that he made calculations. Upon inquiry into the use of these things, I was informed there was a science named arithmetic; I purchased a book of arithmetic, and I learned it. I was told there was another science called geometry, and I learned that also. Finding that there were good books on these two sciences in Latin, I bought a diction, and learned Latin. I also understood there were good books of the same kind in French, and I learned French. This, my lord, is what I have done; and it seems to me, that we may learn everything when we know the twenty-four letters of the alphabet." The duke, pleased with this simple answer, drew Stone out of obscurity, and provided for him an employment which allowed of his favourite pursuits. He soon discovered that Stone polished the same genius for music, painting, architecture, and all the sciences that depend upon calculations and proportions. The works of Stone, partly original and partly translations, are as follow: viz. "A New Mathematical Dictionary," first printed in 1726, 8vo.; "A Treatise on Fluxions," 1730, 8vo.; the direct method being translated from the marquis de l'Hospital's "Analyse des Infiniment Petites," and the German method supplied by Stone himself; "The Elements of Euclid," 1741, 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 flatuary. He is principally known as the copyist of many portraits by Vandyck; 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 1673.

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 Mercia, after murdering his two sons, was induced, by the persuasion of his queen and St. Chad, to embrace the Christian faith, and founded a monastery, in 673, at this place, in expiation of his crimes. This became a college of regular canons of the order of St. Augistine. His queen, Ermehilda, next established a nunery here; but both these houses were injured, and the inmates dispersed, by the Danes. After the Norman conquest, the college and nunery were repleted with monks and nuns; at least it feems evident that Enfyan, a Norman, brought canons from Kenelworth, and made the establishment at Stone a cell to the more eminent house at Kenelworth. Robert de Stafford, about the year 1260, rendered the former independent of the latter. Several perfons of the Stafford family were interred in the church at this place, to whom some fine and curious tombs were raised; but these were removed, at the dissolution of the priory, to the church of the Augufines at Stafford-Green. A new church has been erected on the fette of the old structure.

Stone confifts mostly of one long street, in which is a newly formed market-place. In the town is a free-school, or charity-school, and an endowed alms-house. Here 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 1772, built an elegant house, called Sandon-Hall. This was formerly the property of the Erdefwick family, one of whom, Sampfon Erdefwick, was author of a topographical account of this county, and lies interred in the church of Sandon. Statues of himfelf 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 1603. See Fuller's Worthies of England. Alfo Chalmers's Biographical Dic-
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&c. vol. xiii. from Shaw’s History, &c. of Staffordshire; and Pemberton’s Journal from Chester to London, Svo, 1781.

Stone, in Natural History and the Arts, is an inerudated 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 the mineralogist: and the order in which they are arranged over each other in the great stone mausole which 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; none of the principal of these it 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 as the mineral acids would afford them. Others, as the professed 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, Browne, in 1755, divides them into such as are permanent in the fire, such as the lapsi glaris, amiantus, aëblius, and fusorii; calcinable, such as the calcareus, fissilus, morum, gyphum, iptam, flatactic, fissilis, and fpecularis; and those that are vitreous in the fire, such as the arena, arenarius, gemma, granatus, silex, quartzum, crytallus, and fluor. The other fossil bodies he ranges under the several classes of earths, faltis, fulphurs, figured stones, petrifactions, calculi, semi-metals, and metals.

Wallerius, in 1747, distributes stones into calcareous, as the calcareus, marmor, gyphum, and iptam; into the vitreous, as fivelis, cos, silex, petriform, quartzum, and crytallus; the appreus, as mica, talcum, ollaris, conormes, amiantus, and aëblius; and falsa, or rocky stones, as the silexica, mixta, grisea, and petrosa. The other bodies pertaining to the fossil kingdom, he classifies under the general heads of earths, lean, fat, mineral, and arenaceous; minerals, fulphurs, semi-metals, metals, concrete substances, such as the pori, petrifactions, figured stones, and calculi.

Wolterdof, in 1748, divides stones into the vitreous, as gemma, crytallus, quartzum, arenarius, conornes, iptam, vitrefus, fuxum, and pumex; the argillous, as the fmicetis, aëblius, talcum, mica, and schilitis; the gyphus, as gypus, alabaland, and iptam gyphum; and the alkaline, as calcareus, marmor, iptam alcalinum, topus, flatactic, and margodes. The other fossil substances he distributes under the titles of earths, argillous and alkaline; faltis, acid, alkaline, and mean; biturmus, fluid and soli; semi-metals, fluid and solid; metals, noble and ignoble; and petrifactions of fomiculous animals, of infects, of teflallaneous animals, of vegetables, and of marine bodies.

Cartheuder, in 1555, distributes stones into the lamellous, as iptam, mica, and talcum; filamentosus, as amiantus, aëblius, and inolothus; foid, as silex, quartzum, carnormal, gyphus, fissilis, and fmicetis; and granulated, as arenarius and jaspis. The other fossils he classifies under earths indifolable and indifolable; faltis, alkaline, acid, metallic, and purgious; fylpectis; inflammables, both genuine and fomulated; semi-metals, not maleable, sub-maleable, and fluid; metals, flexible, hard, and fixed; and heteromorphia, including the true and fpiritious petrifactions, and the figured subfactions. Juli, in 1757, distributes terrene bodies into the noble, as the adamas, sapphirus, sapphire, amethystus, topazius, turcois, opalus, crysolfilus, and ligeiactus; the semi noble, acryrallis, carnormal, aëblius, aëmetals, and fmicetis; malaehites, and lizali; appreus ignobil, as talcum, mica, molybdiana, vitrum mofhout, illetites, conornes, jalpis, and aëblius; calcareus, as marmor, gyphum, and iptam; and vitreus, as cos, quartzum, silex, schilus, torterinus, triplea, pumex, granites. fuxus, argilla, marga, limus, and umbra. The other fossil bodies rank under the heads of metals, noble and ignoble; semi-metals, fluid, hard, and mineralized; faltis, acid, alkaline, and mean; and petrifactions, animal, plants obscure, figured, and crytall.

Conrad, in 1758, arranges fossils under the clades of earths, calcareous, silexicus, granate, argillaceous, micceous, fluid, aëblius, veolitic, and magnesius; faltis, acid, and alkaline; phlogistic bodies; and metals, perfect and semi-metals.

Vogel, in 1762, distributes stones into the argillaceous, calcareous, margaceous, silexicus, pyromaeus, ichillious, folious, plumous, pale, metallic, fulle, petra or rocky, and new; and the other fossils under earths, argillaceous, calcareous, silexicus, margaceous, silexicus, micceous, inflammable, pale, metallic, and mould; petrifactions of animals, plants, lithophyous, lithotomous, and pors: faltis, idyptic, fulle, such as are capable of being hardened, volatile, and alkaline; combullibles, as fulminous, biturmus, levum, and belan; and metals, perfect and semi-metals.

Pott, in his "Lithogogoeufa," distributes stones into calcareous, gyphicus, aëblius, and appreus.

It has been doubted by some of the most respectable mineralogists, whether we ought to defend below what are called general definitions in the fossil kingdom, because the subjects are infinitely various, and the gradation by which they run into one another 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.

Linnæus and Wallerius have been among the first who attempted the arduous task of fixing the specific characters. For this purpose, Linnæus has formed a set of terms that express all differences in the figures of fossil bodies, in their crista or outward appearance, their superficies, their corresponding particles or fibres, in their texture, whether plated, silex, &c. in their hardness, or in their colour, and in the alterations they undergo by solution, both by acids and by fire.

The chemical fyllematies and metallurgists, in their arrangements, usually begin with the earths, considering them as the basis of stones: Linnæus begins with the latter, proceeding 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 terrene principle by cohesion: these are simple, as in their composition they are definite of simple, inflammable, and metallic principles; they are fixed, as not being entirely and intimately soluble in any mercurial; and in the time, as they confit of homogeneous component parts. Of these there are five orders; viz.

1. The brumusa, or flaty stones, which originate from vegetable earth, are combullibles, and leave gros light after. Under this order there is one genus, viz. the silex, or flate,
flate, including thirteen species, among which the most distinguished are the table-flate, black flate, blue house-flate, and black crayon.

2. The calcareous, or calcareous flones, which originate from calcareous marine animal bodies, become light and porous in the fire, and fall into an impalpable powder, and effervescence, 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 lime-stone, the flaky line-stone, &c.; argyrum, or plasters, flone, of which there are three species, such as the common plaster, alabaster, &c.; flitum, or fibrous alabaster, including four species, as the fibrous gypsum, or English talc, &c.; and psittum, or fpar, of which there are fourteen species, some soluble in aqua fortis, as the soft fpar, refracting fpar, or island crystal, subdiamagnetic compact fpar of different colours, pulvulic coloured fpar, as purpulic topaz, emerald, and taffhire, &c.; and some not soluble in aqua fortis, as the felpar, &c.

3. The argillaceous, or argillaceous flones, which originate from the viridiferous sediment of the sea, are somewhat unctuous to the touch, and hardened in the fire. To this order belong the three genera, viz. talcum, or soap-earth, including twelve species, as the reddle, smectis, or French chalk, or soap-earth, ferpent-flone, and hornblende, &c.; anitumnus, or earth-flax, of which there are ten species, as the amebole, pluofo abfolos, mountain cork, and aluta, or mountain leather, &c.; and mica, or tale, of which there are ten species, as Mucovys glafs, gold glimmer, and green tale, &c.

4. The arenaceous, or sand-flones, which originate from the precipitation of rain-water, are extremely hard, strike fire with ease, and by tribute, yield a very rough powder. This order comprehends three genera, viz. the ca, or whet-flone, of which there are sixteen species, as the grind-flone, filtering-flone, mill-flone, building-flone, &c.; the quartz, including eight species, as the pellucid rock quartz, coloured rock quartz, red, blue, yellow, &c. milky quartz, granulated quartz, pebble quartz, &c.; and the fale, or flint, of which there are sixteen species, some being vague or loose fints, as the common flint, gun-flint, Egyptian pebble or Mocoa-flone, opal, onyx, or cameo, chalcedony, cornelian, &c.; and some being rock-fints, as the agate, petro-delix or chert, jasper, &c.

5. The aggregate, or rock or compound flones, which originate from a mixture of the four preceding orders variously conglutinated; the interfaces, usually filled up with quartz, fpar, or gimmer. Of this order there is only one genus, viz. the fayum, or rock-flone, including thirty-nine species, as the porphyry of different colours; the trapezium, or trap-flone, the granite, the fusorium, or founder's-flone, the silicium, or pudding-flone, &c.

The second class of foffle bodies are the mineræ, or minerals, which Linnaus defines to be foffle bodies originating from a saline principle by crystallization; they are compound, as conglutinating 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. Saltæ, faltæ, or crystæls, which are fapid bodies soluble in water; distinguished from each other by their different effects on the organs of taste: under this order there are fix genera, viz. nitre, of which there are nine species, as the saline, or native faltpetre; the quartzofe, or mountain crystal: flvor, or coloured crystal, from the varieties of which are the true hyacinth, the fale topaz, ruby, amethyst, fapphire, beryl, and emerald; and the calcareous, as the hexagonal truncated flpar, the fulium, or fparry fwine-flone, &c.; natron, including fourteen species, as the saline, or native mineral alkali, apntronitrum, and Eption falt; the lapidofe, or ipatofe, decahedron natron, the gyppeous, pellucid, fusform natron, the selenite, or rhomic natron, the hydon, or pyramidal, or dog-tooth fpar, &c.; borax, of which there are fix 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 chrysole, the sea-green or emerald, and the deep green or emerald, the bafalties, the tourmalin, the garnet, and the mangodes, or opaqne, argillaceous, telledoltor borax; the mario, or sea-lalt, of which there are nine species, as the saline, or sea-sofil, fountain, and hot-bath falt; the lapidofe, or Bononian flone, fparry floror, or Derbyshire fpar, &c.; alumen, or alum, including six species, as the native, or native alum, plumofo, &c.; soluble, or alum-flate, flone-alum, or calcareous alum-flone, called Roman alun: and lapidofe, to which belong the ipatofe alun, or faile amethyf, the gemma, pretiof, or diamond, ruby, and fapphire, &c.; vitriolum, or vitriol, of which there are eight species, as the simple, or ftole of iron, copper, and zinc; the compound, or triple vitriol of iron, zinc, and copper; the aternation, i.e. vitriols mineralized with ftriable flone, such as red hallatus, grey flary, black melanteria, and yellow mifly, &c.; and the lapidofe or ipatofe vitriol of zinc.

2. Sulphura, or inflammable bodies, flaming and odorous while 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; fuccinum, or amber, of which there is one species, as the electric amber, and the varieties of diaphanous, opaque, yellow, brown, and that which includes infectæ; bitumen, of which there are ten species, as the naphtha, petroleum, or rock-oil, maltha, or Jew's pitch, mumia, or feum mineral, asphaltum, or folfie pitch, ampollæ, or peat, lathanthras, or common coal, or schifofe bitumen, gagas, or jet, fulinium, or calcareous fetid bitumen, of which there are the varieties of compact, granulated, squameous, and cryftalline, and the hepaticum, or liver bitumen; pyrites, or sulphurs, including seven species, as native sulphur, orpiment, cryftallized pyrites, or marcasite, figured pyrites, iron pyrites, copper pyrites, of which there are thirteen varieties, and aqueous, or liver-coloured pyrites; and arsenic, comprehending eight species, as the solid tenaceous arsenic, the fandaraca, or red arsenic mineralized with sulphur; the arfential marcaite, the arfenicum albicans, or arfenic mineralized with iron, &c.

3. Metalla, or metals, which are fiving heavy bodies, fulfure in the fire, and soluble in appropriated acid menftrua; distinguished from each other by infecption: of this order there are two subdivisions, into semi-metals not melable, and metals melable. The firt subdivision includes fix genera, viz. hydrygryrum, or mercury, of which there are five species, as virgin, or native quickfiver, cubic cryftallized quickfiver, cinnamon, with the varieties of laminated, granulated, and cryftallized, and pyrrhical, cuprous, flone mercury, &c.; molybdanum, wadd, or black-lead, of which there are three species, as plumbago, or black-lead, or wadd, or sulphur faturated with iron and tin, manganofa, or black manganofe, and ipuma lupi, or red manganofe, or wolfram; fthium, or antimony, of which there are four species, such as native regulus of antimony, cryftallized fthium, fibrous, or common antimony, and red antimony mineralized with sulphur and arsenic; zinc, or tutenac, of which there are eight species, as cryftallized zinc, that mineralized with sulphur
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flour and lead, or iron, that mineralized with sulphuretted iron, fibroite zinc, calamine, or flint zinc, or zinc mixed with marl calcareous, or mock-lead, or black jack, or semi-telluride black zinc, and red zinc, or micaeous liver-coloured zinc: bismutum, or bismuth, of which there are four species, as native bismuth, common bismuth, mineralized with sulphur and arsenic, or bismuth, and bismuth mineralized with sulphur only: and, chalcite, or chalicoch, or chalico or chalico of which there are four species, as crystallized cobalt with sulphur, arsenic, and iron, cobalt mineralized with arsenic and iron, pyrite of cobalt and flag-cobalt.

The second subdivision comprehends malleable metals, and of these there are six genera, viz. plumbum, or tin, including four species, as crystallized tin or tin-grains, tin-flake, ipatose tin, &c.; plumbeum, or lead, of which there are ten species, as native lead, cubick lead crystallized, cubick lead mineralized with sulphuretted silver, or galena, fliated lead-ore, greenish arsenical lead-ore, sparry arsenical lead-ore, &c.; ferrum, or iron, including twenty-seven species, as native iron in grains, crystallized iron, such as obey the magnet, to which denomination belong helc-grained iron-ore, fine-grained iron-ore, common iron-ore, pyritic 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-flake, blood-flake, purpere iron-ore, &c. and magnetical, or the magnet; cuprum, or copper, of which there are sixteen species, as copper precipitated upon iron, native copper, crystallized octahedral copper, pyritic yellowish-green copper-ore, pyriticfloe copper-ore, soft pyritic grey copper-ore, lootty, pyritic, arsenical copper-ore, white arctic, pyritic copper-ore, indurated ochraceous red copper-ore, which is sometimes liver-coloured; findy ochraceous copper-flake, green and blue copper-flake, lapis lazuli, lapis armenius, or blue calcareous copper-flake, malar-ches, or green gyposious copper-flake, 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, born silver-ore shining, submalleable, and somewhat diaphanous, mineralized with sulphur and arsenic, glais silver-ore, or lead-coloured malleable silver-ore mineralized with sulphur, red silver-ore mineralized with sulphur and arsenic, white silver-ore mineralized with sulphur, arsenic, silver-ore mineralized with arsenic, copper, and sulphur, grey silver-ore mineralized with sulphur, antimoniy, copper, and iron, silver-ore mineralized with arsenic and iron, silver-ore mineralized with sulphur and arsenic, 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 cinnabar, and in rivers in loofe grains and lumps, called gold-duff; and mineralized pyritical gold-ore.

The third class is fofills, which are bodies originating from different modifications of the subject comprehended in the preceding classes: of these there are three orders, viz.

1. Petrifacies, or such fofill bodies as represent in figure certain animals or vegetables, or parts of them. The true petrifactions are such as have the texture and organic parts of the bodies entirely filled up with floyy particles, either of a calcareous or flinty, and sometimes marcasitical nature: there are others in which the bodies are preferred and unaltered, as having lost only the animal gluten: others, again, are only bodies incrusted with flalice, or calcareous matter; and frequently they are only impreitions received in their soft state. Of this order there are eight genera, viz. sonoibus, or the petrifactions of mammalia, including four species, as bones of men, remains of the rein-deer, foill, ivory, and turquoise, or teeth incrustad with copper: ornitholithus, or petrifactions of birds, in whole or in part, and of their nefs, of which the firl species are fearce, and are usually, flalice or calcareous incrustations: amphibolithus, or petrifactions of amphibia, of which there are six species, as of an entire tortoise, of a toad, of the skeleton of a crocodile, of an entire serpent, of various nantes, as of the raia, ballites, &c. and glossopepra, or thark's teeth: ichtholithus, or petrafactions of fishes, including three species, as those of entire skeletons, with the fins in flate, and in marbre, and the buofines, or grinding teeth of the wolf-fish: entomolithus, or petrafactions of insects, including three species, as the cancri or petrified crab, lobster, &c. paradoxus, or unknown insect, petrified, and insects inclosed in amber, which indeed are not proper petrifactions: helmintholithus, or petrifactions of worms, including twenty-four species, as the corum ammonis, orthocerates, or straight nautilus, ane-mites, or various anomax, gypylites, or crow-flake; Jew's flake, supposed to be fipes of echnites, madrepores of various kinds, entrochas, flar-flakes, belemnites, &c.: phy-olithus, or petrifactions of plants, of which there are seven species, as of the entire plant in coal-flate, of fere in flate, of roots in marble, of wood in various flates, as of lime-flake, agate, flint, sand-flake, and flate; of leaves in flate and marbre, of flowers in flate, and of fruits in coal flate, commonly cones of the pine, nuts, acorns, &c.: graptolithus, or flones resembling pictures, including eight species, among which are Florintine marble or flate, refumbling ruins; dendrites, representing woods, landscapes, &c. arising from vitriolic fulzations interminated between the plates of fife flines, or in marble.

2. Concreta, which are slight conglutinations of different kinds of earths, whose specific differences arise principally from the nature of the component parts: of this order there are six genera, viz. calculi, or animal concrections, including eight species, as the flone in the kidney, or bladder; tartar of the teeth, of the lungs: hecoar-foles, formed in the abomasus, or fourth fomach of ruminating animals; agagropila, or hair-balls, formed in the fife fomach; bile-flones, pearls, and crab's-eyes: tartari, or vegetable concretes, of which there are two species, as yeall, and red and white tartar: zetites, or concretions within the cavity of fones, of which there are the true, having a loofe nucleus, as the geodes with an earthy nucleus, and the aquilus with a floyy nucleus; and the fipurious, as the hamachates, or fipitous zetites, with a fixed crystalline nucleus, marble zetites, including dog-tooth par, and echinated zetites, including fluor crystals: pumex, or concretions by means of fire, including eight species, such as black flate pumice, white pumice of iron-furnaces, red copper pumice, foot, ashes of volcanoes, Rheinifh mill-flate, vitreous pumice, or black and green Iceland agate, &c.: fialacities, or concretions by means of air, including twelve species, as vegetable incrustations, drop-flake, foid and branched marmorose fialacte, foid fipate fialacte, red fipate fialacte, or oxolite, &c.: and topus, or concretions in water, including twenty-two species, of which there are the metallic topus, as the mardy topus-flake, the tubular, marly, ochraceous tophi-flake, the sandy ochraceous sea top-flake, the bog iron-ore in various forms, &c.; and the fimple topus, as alum topus, concretions of teas-kettes, pea-flake of hot springs, oftocollia, or bone-binder, folid black fchilote toph, &c.

3. Tere, or earths, which are fofill substance not conglutinated, but usually in a slightly cohering or pulverized state;
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flate: of this order there are five genera, viz. ochra, or ochres, or clays, or earths of metals, of which there are fifteen species, some in the form of powder, as ochre of iron, green and blue ochre of copper, native cera, ochre of cobalt, &c.; and others plomoe, or gerninating ochres, as copper blue, or plomoe copper, flowers of antimony, plomoe silver-ore, with sulphurised antimony and arsenic, &c.: argile, or clays, including fourteen species, as sea-fand, coloured sands, sand of heaths, fulvous, or common sand, micaceous, or glittering or writing sand; gold, iron, and slitt sand, &c.; or argile, or clays, boxes, and marles, including twenty-one species, some simple, among which are porcellain clay, tobacco-pipe clay, China porcelain earth, Lemnian fuller's earth, tripoli, or rotten stone, brick-clay, potters' clay, boxes of different colours, &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, gypsumous grt, or lac lume; and others granulated, as alabaster, chalk, soluble arenaceous calx of the isle of Ascension, and lentricular granulated calx; and hamus, or mould, of which there are fourteen species, as the impalpable vegetable mould, common black mould, depauperated mould of heaths, spongy mould of marbles, alpine earth, turf, mould of lakes, or mud mould, red mould, animal mould, &c. See Linnæi Systema Naturæ, tom. iii. 1770, passim; and Pulteney's General View of the Writings of Linnæus, 1781, p. 131—166.

M. Da Costa, in his Natural History of Fossils, 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 imbedded 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 perversaria by Hill, of which there are the alkaline sand-stones, as the Portland-stone, freestone, &c.; sand-stones not acted on by acids, as the whetstone, flint, mill-stone, grind-stone, &c.; and sand-stones imperfectly described by authors; and stones hard 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 includes stones that are found forming continued strata, of a close, solid, smooth texture, or composed of no visible grit, and generally delitute 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 plane 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 flates.

The third class comprehends marbles and marmoroides. The fourth class includes the marmor-profera, the granites, and the porphyrtes. 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 buildings, appears to have been almost coeval with the establishment of civilized societies. The advantages which stone possess'd over wood, in hardness, strength, and its capability of resisting 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 Asia, 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 stone, 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 Allyrians, and the Romans, as well as by the moderns.

In the choice of different stones for public or private edifices, the contest and nature of certain stones, and the use 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 then regarded as essential qualities of building stone, and those stones which possessed these properties in a remarkable degree, were sought for with great affluency, 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 degrading 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 2000 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 foundations of which began speedily and visibly to perish in the very life-time of their founders. The same observation is applicable to Somerset-house, and many other public buildings in London; the fine sculpturing of the altrelievos figures having already disappeared by the action of the elements mouldering away the stone. The most careful observer may notice, that this effect is more rapidly taking place in stone stones than in others in each of these buildings, though they are all of Portland stone, a calcareous stone, called roo-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 hardnes, tenacity, and compactness, with the
the property of refilling the decomposing effects of water and the atmosphere. Before the strength necessary to support their own weight in such buildings, they may also have to refill the impetus of floating bodies, and particularly of large masses of ice. These stones which are the hardest, are not precisely those which have the most tenacity or toughness, of which we have a familiar illustration in common lime-stone and glass; the latter, though much harder, is far more easily fragile 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 erection, before 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 occasion the destruction or wear of rocks on the surface of the globe: they may be classed into two kinds, those of decomposition, 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 felspar, albume, or lime, (see Silex, Alumine, and Lime,) to which we may add magnesia, 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 classified as felsicous, argillaceous, calcareous, and magnetit.

Of these, the felsicous are the least liable to decomposition; felspar being insoluble in water, or any of the acids, except the fluoric, which is never found in a free state. Stones composed almost entirely of felspar, if compact, may be considered as the most durable; but they are frequently brittle, and extremely difficult to work. When the felspar is combined with a certain portion of albume, as in some horn-felspar and jasper, it constitutes a stone which may be regarded as imperishable, when compared with the duration of states and empires. Such stones frequently contain imbedded crystals of quartz and felspar, and are then denominated porphyries. Porphyry, with a compact felsicous base of horn-felspar or jasper, is far more durable than granite, and is peculiarly appropriate for columns or obelisks, designed 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 felsicous 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 portion of quartz, like the greater part of the granites of Cornwall and Devonshire, are liable to decomposition 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 establishment 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 more exposed sides, we have observed the felspar to be disintegrating, and lichen has already attached their roots to some parts of the surface.

With granite may be classed all granitic rocks containing a large portion of felsicous earth, particularly felspar. (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, preserve 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 national works, the selection of the stone should not be left to the disposition of architects, few of whom have made mineralogy any part of their studies. Many of the sand-stones, in what are called the secondary strata, are composed of grains of felspar, and where these are united by a felsicous cement, they are almost as durable as granite. In felsicous sand-stones, the coarser or fine parts 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 felsicous 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 felsicous sand-stone, which vary much in their quality; some containing a large portion of clay and iron, others being almost purely felsicous. 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 five hundred years have elapsed since the erection of this building. There is a quarry of similar stone in the neighbourhood, extensively worked at present. It may be proper to observe, that in all quarries of sand-stone, the strata vary considerably in their power of resisting the effects of the atmosphere. Some strata are marked with stripes 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 supposed 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 abundantly than the rest of the stone. From what has been stated, it may be seen that stones, which are purely felsicous, are of all others the least liable to decomposition; but where there is an admixture of felspar with different substances, great skill is required in their selection for durable architecture. Some directions for the choice of such stones will be subsequeatly given.

Argillaceous stones, or those which contain in their composition a considerable portion of clay, are generally found to contain also a large portion of iron. This metal appears

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to have a greater affinity for argil or clay than for any other earth, and is frequently combined with argillaceous stones in the proportion of one-fourth of the whole mass. The iron is frequently in the state of black oxdy, and in this state rapidly combines with a larger portion of oxygen, when exposed to the atmosphere, and thus occasions the surface of the stone to swell and shiver away. We have seen stones of this kind in their native beds, some hundred feet under the surface, so extremely hard that they resisted the point of the pick, and could only be removed by blasting; yet when the same stone 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 select. The lofts 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 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 stone: the decay having been so rapid, as to render their removal necessary.

In forming the tunnel of the Huddersfield canal, in Yorkshire, through Pule Mof, a lofty mountain three miles in breadth, the workmen, in one part, had to cut through a dark argillaceous stone, so extremely hard, that they were obliged to remove it by blasting. On account of its hardnefs and compactness, it was deemed unneeceary 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 encrustation, which penetrates deeper and deeper into the stone, till the whole is reduced to a soft pulvulent mass: this is occasioned by the rapid absorption of oxygen, the iron in the basalt being in a low state of oxygenation. On this account, basaltic stones are ill suited for durable architecture, though there are some stones of this class which appear more perfectly vitrified, and refit the action of the atmosphere for ages. This is also the case with lavas which are nearly allied to bafalt: some lavas rapidly decompose and form a fertile foil, others remain unchanged for centuries. In all stones 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 2½ times its own weight of water. It communicates, in a greater or less degree, its own properties to stones, where it is combined in the proportion of from 20 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 sand-stone; 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 stone, and the roads frequently want repair. The remains of vitrified parts in some parts of Scotland, prove that the North Britons were acquainted with the durability imparted to argillaceous stones by exposure to great heat. In situations at a great distance from durable building-stone, 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 stones include all the different kinds of lime-stone, from the most crystalline marble, to chalk and calcareous sand-stone. Of marbles, there is an almost infinite variety; indeed every variety of lime-stone that admits of a good polish is denominatned marble. (See Marble.) The lime-stones or marbles that occur in primitive mountains, among blocks of granite, gneifs, and mica-flate, are generally the most durable, as they are highly crystalline; and many of them contain a considerable portion of fibrous earth, which communicates a greater degree of hardnefs 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 less 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 polifhes the greatest degree of specific gravity and hardnefs, and which will receive the highest polish, are those which will prove the most durable. There is another test applicable to marbles, and all stones purely calcareous, which affords no bad proof of their durability.

Let a given weight of different marbles be cut into cubes, or any other regular figure, and immered in dilute muriatic acid of the fame degree of strength: that marble which dissolves most slowly, will be the least liable to decay.

Some lime-stones consist of calcareous earth, combined with a considerable portion of magnesia, the primitive lime-stones which contain this earth have a milky whiteness. All lime-stones of this kind dissolve very slowly in acids; and such of them as polifhes the other properties of hardnefs, and an uniform texture, may be considered as the most durable of all marbles. The importance of an uniform texture is evinced in the different durability of the Parian and the Pentelic 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 (Pentelic 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 whiteness, 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-stone. This is principally owing to veins of extraneous substances which intersect the Pentelic quarries, and which appear more or lefs in all the works executed in this kind of stone. The Parian marble has somewhat of 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 luster of the original polish. The Medicean Venus, the Diana Venus, the colossal Minerva (called Pallas of Veletri), and the hand, called Capitoline, are of Parian marble. The Parian tables at Oxford are also of this stone. Of 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 Jamelot,
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in the late edition of his Mineralogy, with granular lime-
tone. The Devonshire marbles have scarcely been noticed
by mineralogists, but many of them poise a degree of
beauty scarcely inferior to any of the foreign marbles, par-
ticularly those of Babibon. They are veined and spotted
with a variety of colours, from a brilliant 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
UGbrook, 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 Ply-
mouth, 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 pro-
cured 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 resist the
decomposing effects of sea-water for ages, particularly if the
western side should get a covering of time. 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-stones, there are some which
contain a considerable quantity of magnesia, particularly in
the counties of Nottingham, York, and Durham. These
lime-stones have generally a yellowish colour: they diffolv,
slowly in acids, and form a very durable flone for architec-
ture. York Minster is said to be built of this flone.
The rock-flone, particularly that of Portland and Bath,
is extensively employed in architecture: it can be worked
with great ease, and has a light and beautiful appear-
ance; but it is porous, and poises 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 inattention of former architects to the durability of the
flone.

All the beautiful ornamental work of the exterior had
moulder away in the short comparative period of three
hundred years: it has recently been cased 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. Pro-
ably 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 selection in the construc-
tion 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 Somerst-houfe.
In buildings constructed of this flone, we may frequently ob-
serv 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 the 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 Somerst-
houfe, in which black and white flones may be seen alter-
nating in the same column.

Some of the lower beds of chalk are occasionally used for
building-flone; though, from its loose texture, it cannot
poise great durability. We have seen the cloisters of Weif
minster 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.”

Alaballcr or gypsum is sometimes employed for orna-
tmental architecture. The same alaballer is also given to
Italaritical lime-flone. (See Stalactite.) This variety of
time-flone poises nearly all the properties of granular
lime-flone. The gypsum alaballer is a sulphate of lime, and
poises a considerable degree of solubility in water. Dr.
Watson, 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 Portland, which has been
fully described under that article.

The disintegrating caufe to which building-flones are
exposed are moisture, variation of temperature, and vege-
tation: the action of these is distinct from that of decom-
position. The earths which are not soluble in water are
capable of being mechanically suspended in it, when mi-
utely divided. A drop of water, conflantly running along
the harden flone, marks its path by cutting a furrow in the
surface, according to the well-known adage:

“Guttae caeae lapidem non vi sed fepe cadendo.”

This cause is, however, flow, compared with others
which are constantly operating. Water infuses itself
into the minute pores and crevices of flones, and being ex-
anded by variation of temperature, and particularly by
frost, breaks aunder the harden flone, or thivers off a
portion of the surface. Thofe flones which have a lam-
inated structure are most liable to be injured by the effects
of froll, from the facility with which water infuses itself
between the lamine.

Lichens and mosses fix their roots on the surface of flones,
particularly on those alaballer flones which yield a
earthy smell, when breathed upon. By infusingating their
roots, they accelerate the decay of fuch flones, and prepare
a vegetable mould for plants of a larger growth.

In calcarious and other land-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, thofe
flones which are the moft hard, compact, and uniform, in
their texture, and which can be brought to the smoothest
surface, are thole 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 situation, offers cer-
tain indications of the effect which atmospheric agency
produces upon it. Where this examination cannot be made,
all flones that are not calcarious may be in some degree
proved, by observing what effect is produced by immer-
ing them in water for a given time, by exposing them to a red
heat, and to froll, or by covering them with dilute nitric
acid for several days. Thofe flones which absorb the
smallest quantity of water, and which are left changed by
the
the action of heat, frost, or acids, may be fairly considered as most capable of retarding the decomposing or disintegrating 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 retort the adsorption 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 comprize 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 stonecrafs. In England, the name free-stone is given to all the softer stones, which can be cut easily with the sawl 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 last 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 mason. 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 shews 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 fcudo, which contains one hundred bajoci, is about 45. 6d. English.

**Marbles.**

<table>
<thead>
<tr>
<th>Stone</th>
<th>Sc. baji.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marmo bianco di Carrara</td>
<td>-il palma</td>
</tr>
<tr>
<td>Greco</td>
<td>-</td>
</tr>
<tr>
<td>nero di Carrara</td>
<td>-</td>
</tr>
<tr>
<td>antico, detto vulgarmente di paragone</td>
<td>-</td>
</tr>
<tr>
<td>giallo di Sienna</td>
<td>-</td>
</tr>
<tr>
<td>detto Porta Santa, antico</td>
<td>-</td>
</tr>
<tr>
<td>detto fior de perfico antico</td>
<td>-</td>
</tr>
<tr>
<td>detto Settebale semplice antico</td>
<td>-</td>
</tr>
<tr>
<td>a rofe antico</td>
<td>-</td>
</tr>
<tr>
<td>giallo antico</td>
<td>-</td>
</tr>
<tr>
<td>verde antico (of fine quality)</td>
<td>-</td>
</tr>
<tr>
<td>ditto in large massie</td>
<td>-</td>
</tr>
<tr>
<td>rolo antico</td>
<td>-</td>
</tr>
<tr>
<td>ditto in large massie, very scarce</td>
<td>-</td>
</tr>
<tr>
<td>Africano</td>
<td>-</td>
</tr>
<tr>
<td>cipollino</td>
<td>-</td>
</tr>
<tr>
<td>bianco e nero antico</td>
<td>-</td>
</tr>
<tr>
<td>delle corie di Francia</td>
<td>-</td>
</tr>
<tr>
<td>di Polevera</td>
<td>-</td>
</tr>
<tr>
<td>verde Prato</td>
<td>-</td>
</tr>
<tr>
<td>porto Venere con macchie giule</td>
<td>-</td>
</tr>
<tr>
<td>Breccia corallina antica</td>
<td>-</td>
</tr>
<tr>
<td>di Saravezza</td>
<td>-</td>
</tr>
<tr>
<td>di Francia</td>
<td>-</td>
</tr>
</tbody>
</table>

The term *antico*, like *oriental* in gems, sometimes implies only a beautiful stone.

**Alabasters.**

<table>
<thead>
<tr>
<th>Stone</th>
<th>Sc. baji.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabastro di Montalto</td>
<td>-</td>
</tr>
<tr>
<td>d'Orte bianco</td>
<td>-</td>
</tr>
<tr>
<td>biondo delle folle della Penna</td>
<td>-</td>
</tr>
</tbody>
</table>

**Granite.**

<table>
<thead>
<tr>
<th>Stone</th>
<th>Sc. baji.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granito roflo delle guglie</td>
<td>-</td>
</tr>
<tr>
<td>ditto in great massie</td>
<td>-</td>
</tr>
<tr>
<td>Eriglano nero con macchie bianche roffigne</td>
<td>-</td>
</tr>
<tr>
<td>bianco e nero antico</td>
<td>-</td>
</tr>
<tr>
<td>porificuto, detto porfido rolo</td>
<td>-</td>
</tr>
<tr>
<td>ditto in large massie</td>
<td>-</td>
</tr>
<tr>
<td>prafino, detto porfido verde</td>
<td>-</td>
</tr>
<tr>
<td>ditto in great massie, scarce</td>
<td>-</td>
</tr>
<tr>
<td>rotato</td>
<td>-</td>
</tr>
<tr>
<td>Granito bianco e verde</td>
<td>-</td>
</tr>
<tr>
<td>Graniteo</td>
<td>-</td>
</tr>
<tr>
<td>Bafale nero d'Egitto</td>
<td>-</td>
</tr>
<tr>
<td>Verde di Memphi, vulgarmente detto serpentinio</td>
<td>-</td>
</tr>
<tr>
<td>antico</td>
<td>-</td>
</tr>
<tr>
<td>Breccia d'Egitto di fondo verdino</td>
<td>-</td>
</tr>
</tbody>
</table>

The prices of the above stones are enhanced not only by their fize, but by any extraordinary beauty of colour which each specimen may posses.

**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 teems rather to be carried for them. However, nothing can excufe 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 pots, very fertile in several kinds of grain, seem to confid of nothing but stones; and instances are given of fields being rendered barren, by taking away the stones which covered them. Theophratus accounted for this in a hot country, where it happened to the Corinthians, by laying that the stones sheltered the earth from the scorching heat of the sun, and thereby preferred its moisture. The fame holds true even in our colder latitude, where the heat of the sun is less 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 fown, if they pick them off too minutely; because they thereby expel 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 loose, and prevents too fudden exhalations. But it teems highly probable that there must be some farther reafon, beyond what has been yet asigned, for the benefit arifing 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 intraining and breaking of the ploughs, and the destruction of other implements. And where the lands require under-draining, 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; as, by such means, two objects may be accomplished at once. See Clearing of Land, and Draining of Land. See also Spring and Surface Draining.

An opaque imperfectly crystallized fort of stone, probably of the quartz kind, is found very troublesome to the farmers, in many parts of Cornwall. It lies, it is said, loose on the surface, in all fizes, from that of rocks to granules.
In some places it is met with a few inches under the surface, like a clove pavement. In whatever position or size these stones infest 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 success 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 fcreening the whole mass of stony matter and earth as deep as the yellow clayey sub-stratum, 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 lead 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 be the cause of the productive veins of tillage-lands, so beget 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 Land.

Stones, 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 Cretes, 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 consisted, 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 balla-relevors.

This, he says, is a phenomenon no otherwise accountable for, than by supposing the cavities of the letters filled insensibly with a matter issuing from out of the fulbility of the rock, and which even infilled in greater abundance than was necessary for filling the cavity. Thus is 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 rife 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 barks 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: "Crepent ille; crefcent 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 consequence that are fed; that the same juice which nourisheth them, serves to rejoin their parts when broken; just as in the bones of animals, and the branches of trees, when kept up by bandages; 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 how 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, guiaucum, and ebony, 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 so, 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 inexplicable, without supposing that they come from a kind of feeds, in which the organical 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 Jaudicus, &c., those of Bologna and Florence, the several kinds of pyrites, cryflals of the rock, and an infinity of other stones, he supposes to have their several feeds: as much as mushrooms, truffles, and various kinds of mollusc, whose seeds were a long time before they were discovered.

He continues, how should the cornu Ammonis, which is conically in figure of a volute, be formed without a feed, containing that same structure 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 sorts of stones above mentioned, and finds them under the fame necessity of feed. Again, that immense quantity of pebbles, with which the Crauf of Arles is covered, he thinks a strong argument in behalf of this theory.

The country there, for twenty miles round, is full of roundish pebbles; which are still found in equal abundance, to whatever depth you dig. M. Pierre, who first proposed 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 ascertaining, 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 feeds 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, petrify, and assume the figure or impression of the body; thus, what we call petrinites, conchites, mytilites, operculites, nautilites, echinates, &c., are real stones, the liquid feeds of which have infunited into the cavities of the shells called petten, conches, mytilus, operca, nautilus, and echinus. On the contrary, if those liquid feeds fall on flints, on shells, sand, &c., they enframe those several bodies, and, fixing between them, form a 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 feeds; in like manner as the quarries full of shell, unless the rocks have enveloped these bodies in their growth.

He even supposes, that there are feeds 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 pholas,
STONE.

Poem, which are never found anywhere but in the cavities of flints, which are always found exactly fitted to receive them. Now, it is highly improbable that the fish would come and dig such a notch to spawn in; it is much more likely, that the flones 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 feed thereof.

From the whole he concludes, that the feed 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, what trifles are among plants; nor is this opinion new: Pliny affures us, that Theophratus and M. T. Plinianus believed, that flones produced flones; and Gregory Nazianzen adds, that there were authors who even believed, that flones made love, Gει και αὐτοκτόνας καὶ δίορα, κρύσταλλον. Poem. de Virgin.

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 Judaicus and cornu Ammonis; the first being only a petrifaction of the spines of an echinus marinus, and the other of a shell-fish nearly allied to the nautilus kind. See Fossil, Judaicus 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 falt, sulphurs, &c. The metallic particles contained in flints give them their colour; but these are only accidents: for proof of which, he infances the fapphires and emeralds of Auvergne, which lose all their colour by a moderate fire confuming their metallic parts; but without any damage to their transparency; they being hereby rendered mere crysals.

To view rock-cryystal, 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. Thofe of the first kind are exceedingly fine, thin lamellas, equal to each other, or nearly so. Now, when these meet together, from any caufe 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 everywhere: and this is crystal.

The parts of the second kind have all sorts of irregular figures; and must accordingly form assemblages that are much more opaque, and less hard. Now crystal is formed wholly of parts of the firit kind; and all other flones of a mixture of the two kinds of parts together: this mixture is absolutely neceffary, in order to unite and bind together the parts of the second kind, and give them a hardness and confidence, without which they would only make a sand or duff. Water now appears the fittest vehicle to carry the parts of the firit 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 diffolve 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 flony, or crysalline 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 falt, which often shoot into angular and regular figures. This, it is said, appears in the formation of crystals on the Alps; and that flones are formed by the simple attraction and accretion of falt, appears by the tartar on the insides of a claret-veil, and especially by the formation of a flone in the human body. Henkell has thrown together some very ingenious thoughts on this subject, in a treatise published in the year 1734, where he builds no opinions on any other basis than that of falt, 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 all reduced to this soft flate 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, chanced to harden. Thus may the sea-flones, found fingly in the middle of hard fllints, or lodged in vast numbers in the strata of earth, lime-flone, or marble, be accounted for.

Nur 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 poorer earths into a fort of glafs, a hard transparent body, not a little refembling the nature of flint, or the other semi-pellucid flones. 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 prefent flate, 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 foillible substances, it appears that the original matter of all flones has been earth, either of the nature of chalk, marl, or clay; and that many of them have been greatly altered by receiving metallic or other mineral matter into their earthy matter, at the time of their formation; and all seem to have owed their change into their hard flate, either to fire alone, or to saline, oily, metallic, or saline sulphurous matters, either conjunctly with the force of this agent, or alone. Henkell, Lithogena.

Thofe flones which are formed in their prefent flate, immediately out of fluids, have been produced either by congelation, a rude coalition, or crysallization; and that all the gems have been once fluid is plain, from their imperfections in certain infinities, as from their containing grains of land, or the like extraneous substances, firmly embodied in them. If thefe, the hardet 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.

STONE. Formed, among Naturalists, mineral or flony matter,
STONE.

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 no means an effect of the general deluge, and by many is thought a convincing proof of the truth of that hillory; but there have been many who have asserted, that these bodies can convey no such proof, since, as they affirm, they are not, nor ever were, marine bodies, or owed their form to fish, but mere "fossil nature," bones formed in the places where they are found, having no relation to animals of any kind, but only accidentally resembling them. But the allusions 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 endowed with all the characters and necessary parts of animal coverings, &c. for no other end but merely to exhibit such a form, without having any relation to the uses these particular parts are appropriated to in the animal. But if the origin of these 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 as 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 flinty 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 covesing of an animal, seems no way probable; and indeed, were it true, would give great strength to the atheist's opinion, that all things are exiled by mere chance, and were intended for no end or use. Nor are the shells the only instances 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 substances produced by the fishes, &c. Of this kind are the teeth of the several species of sharks, called *glissopetera;* those of the wolf-fish, called *byfoniace;* the vertebrae of several fish, 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 substances, whether of a woody, bony, or fleshy nature, by burning, are changed first into a coal, before they go into a cask of ashes; whereas the flinty substances, on the contrary, do not burn into a coal, but are reduced at once into their true coal, or elce into glasses. But these teeth, supposing by some mere productions of the earth, all burn first to a coal, while the flinty 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 flinty matter. It is also repugnant to that great maxim, that nature does nothing in vain, to supposing these teeth formed in the earth where they are now found, since they could there have no use as teeth, nor the vertebrae, 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 cell of the body they belong to: these things are not made in this separative and useless state in the element to which they naturally belong, much less in a foreign one.

Their very substance 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 to their place, they might have been lodged there either when formed, which proves our asserting, 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 substances which they resemble do. Now, if the stone, in which they lie, was formed before them, and they were formed on a fudden 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 base, but are all broken, and that in various manners; which proves very plainly, that there has been no vegetation on the earth, because in all other figured fossils they are never found mutilated or imperfect. It cannot, with any flow of reason, be supponed 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 gliosopetera alone may evince, that they belong to the animal to which they are attributed, since they are of very different kinds. See *Glossopetera, and Serpents' Tongues.*

The perfection of the figures of these bodies is a further proof of their origin from animals which they represent, since in all crystalizations there are many imperfect and mutilated figures, ray 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 they are found with injuries which could have been no way else received. The purpura, and some other shells, 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 as also found fossil, bedded in the strata of earth or stone; and surely, if half-likely could be allowed to have shot into the figures of sea-shells, they could never be supponed 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, so 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 vall flata on the tops of the highest mountains, the Alps, Appennine,
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Apennines, and others in different parts of the world. The deluge failed 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 been thrown in that time, or to have been carried so high in such prodigious numbers. It is more probable that these tops of mountains were once not firm, 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 might 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 probable, 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 over all 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 those strata, which afterwards hardened into the various kinds of earth and stone; and something of this kind seems to have been the case, much rather than, according to Dr. Woodward, that all stone matter should have been dissolved by the deluge, and afterwards have concreted again. Ray's Physico-theological Discourses.

For other hypotheses and observations relating to this subject, see Adventurous Fossils, Marine Remains, Petrifactions, Seminum, and Shells.

Stones, Solutions and Colours of. The various beauties of the form and colour of the several more precious stones, cannot but 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 Mocca stones. 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 beaux, &c. these are all artificial, 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 sublimes of agate, marble, &c. and to lodge figures in them. The stones subject to be tinged he divides into two classes, the harder and the softer. Of the harder kind, are those which reflect 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 same acids, impregnated with the solutions of metals, are capable of penetrating very deeply into them, and tinging 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 parts of matter, and therefore are lefts easily, and left 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 thefe, 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 consequently more difficultly coloured, and these remaining, therefore, paler than the rest of the mafs, 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 salt of tartar, the colour becomes grey; and if, instead of this foot and tartar, the fame quantity of plums or 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 bitum gives a colour, which appears white when the light falls directly upon it, but brown when it is held against the sun; and, or a candle; and all the metallic and mineral solutions, employed in the same manner, affect the stone more or less in the same way.

The expelling 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 agate 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 dendrites, or delineations of trees in Mocca stones, 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 supposed 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 destroy 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 restored again to its beauty; in the first, by tinging it abroad with the same liquor, and in the latter, by 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 lead-flings, and 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 flained 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 calculation, and becomes of a dullish flesh-coloured white; and the Mocoa flone, treated in the same manner, loses all its colour, and the delineations of trees disappear.

There are many flones on which the solution of silver has no effect; of this number are all the gems, rock crysral, and the like. The dcndrites of Catalonia is also of this kind; and of this flone the artificers relate an odd phenomenon, which is, that if it be fawn under there are 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 flone breaks easiest in these places.

The effects of the solution of silver are different, as to degree of colour, on different flones. The oriental agate receives from it a deeper and blacker tinge than the common chaledony. Some agates, naturally distingumed by their yellow spots, receive a purple colour from it. The jade flone, used by the Turks, takes only a faint tinge of brown. The common prime emerald, or root of the emerald, becomes blackish 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 folaceous flones, are wholly unaffected by it.

There is another method of staining flones 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 flones, marbles, pebbles, flint, &c. may be washed over with a faturated 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 veffel almost red-hot. All of them will be thus stained in the parts moistened with the solution of a black colour, durable, and pretty deep, though it penetrated only a very little way into the subsidence of the flones.

Dr. Lewis furnishes, from some experiments on the solution of silver applied to different flubstances, which he has mentioned (Phil. Com. of Arts, p. 350.) that this solution stains flones only in virtue of their containing a calcaceous 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 flones 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 polish of the marble, eating away a part of its surface. The solution of gold does not penetrate so deep into marble as that of silver, but it gives a beautiful violet colour.

Both these operations are much affisted 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 be the lefs, according as the solution is the more satured, fo as to dry or crystallize the more quickly. An easy method of obviating this inconvenience, says Dr. Lewis, is furred 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 doubtles answer the fame intention here. The surface of the flone being coated with a proper tenacious flubstance, which the acid cannot act upon, as the composition called etching-wax, which consists of refined flubstances melted with wax, or boiled with oil to a due confilence; and the drawing being made in this ground, fo that each stroke may reach down to the flone, it may be presumed that the solution of silver, afterwards applied, will 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. Befide the powerful acid muriarts, there are many other liquors which have a power of penetrating deep into marble. Of this nature are all the oily fluids; but the expressed oils have this disadvantage, that they leave a fattiness in the marble which will not suffer it afterwards to take a good polish.

All flubstances which can penetrate marble, can carry colours into it; but such are not eligible, which having lodged the colours, evaporate, and leave them there, without injuring the flone. Spirit of wine is of this number; it is excellently qualified for the extracting of beautiful tinctures, and sinks them very deep. Oil of turpentine also has for its value, but it does not take tinges so well as the spirit. Some have recommended lixiviurns of the fixt alkaline salts, 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 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.
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 the gums set alone, yet they will succeed much
better if distilled in spirit of wine, and applied with a
penetrate for by this means they sink deeper in, and the
figures traced out will keep their determinate form and out-
lines, these solutions fixing immediately, without spreading
any way. It is also remarkable, that the solution of dra-
gon'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 dif-
solvent, and its surface eaten away to some depth, the parts
which are coloured will stand out above the rest.

A tincture of Brasil wood in spirit of wine tinges marble
red; and if the heat given to the marble be greater, it be-
comes purple; but both these colours fade a little in keep-
ing; but tincturing with gold gives a purplish-red; and the
more the marble 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 tincture with spirit, to a flight depth; and in oil
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 jasperone. Alkanet boiled in white
wax gives a flesh colour, which penetrates very deep; and
the ronceau 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 fifth 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 jasperone 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 inter-
fices between the granules of the marble, those granules
themselves, being unaltered: thus, in the other colours,
the whitening of the granules is only a heightening to the
tinges, making it brighter, and a little paler; but the white-
ness can never fail to appear distinguishably 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 common ink, either by applying on the
warm marble an ink already made, or by the alternate appli-
cation 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 co-
balt in aqua regia, employed in the same manner, the most
compact pieces were flained black; though the process re-
quires too great a heat to be practised on marble without
danger of injuring the stone. The colour which solutio-
nes 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, hav-
ing found by M. Geoffroy's experiments, that oil of
thyme, by long standing with spirit of gal ammoniac,
acquired a blue colour, tried this mixture, and found it suc-
ceeded very beautifully; but this is one of those colours which
require the marble to have but a very small degree of heat,
and 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 brittle yellow, then red, then violet, and at last of
a deep blue. In six weeks' digesting it had acquired a pale
blue, and in this state gave a little colour to marble: after
staining for fix months, it was deepened almost to a black
hue, and being now applied on warm marble, gave the flain
defined.

M. Du Fay also flained marble of a blue colour with
tincture of archel. The tincture of it in water is applied
on cold marble, and renewed as it evaporates, till the
colour is sufficiently deep. He says, that he had pieces of
marble thus flained, which in two years were not feibly
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 ima-
gined, there being nothing more required to it, than the
faying of the parts which are to be left in relief, by covering
them with a varnish, and eating away the relief by means
of an acid. For this purpose, let the defined figures be
traced in chalk upon the marble, and cover them with a
bed of varnish, made by dissolving a piece of common red
fealing-wax in spirit of wine; then pour on the marble a
mixture of equal parts of spirit of salt and ditilled vinegar,
and this will eat down all the ground, and leave the figures
standing, as if engraved with intenue trouble. The add-
ing of the colours before described, to these marbles after-
wards, in a regular manner, will give them a surpining
beauty. Mem. Acad. Par. 1728 and 1732. Lewis's Phil.
Com. of Arts, p. 435. &c.

Mr. Muller, in grinding some aurum fulminans, made by
dissolving gold in aqua regia, and precipitating it with fall
of tartar, together with some red glas powdered, and a
little water added, found, that this mixture flained 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 pestle, it
had tinged them both very deeply to a fine red, leaving the
intermediate parts of a true onyx, or chalcedony colour,
wholly unaltered. The polish of the flane was not injured
in the places where it was thus flained, nor could any art
get out the colour, though it was tried with alkalies and
other sharp liquors. This colour was not given to these
parts of the flane of the mortar in simple blotches, but
formed itself into regular lines, as we see the natural colours

of
of flones 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 fame flone, but without success; on which the flones, of which they were composed, were examined with the help of gravers, 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 to wear inferior to them. It may be worth while, on this occasion, firstly to examine flones 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 would make it a very beautiful and valuable flone. 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 fame manner the texture of flones, intended for any other experiments in leavening, should be considered, and the choosing of proper ones may make this process succeed on them. Phil. Trans. No. 1799.

**STONE.**

Stone, Artificial. See Mortar and Stucco.

Stone, Beloghan. See Bononian and Phosphorus.

Stone, Butter of. See Butter of Stone.

Stone, Calamine. See Calamine.

Stone, Caulic. See Lunar Caustic.

Stone, Chalk. See Chalk.

Stone, Clith. See Cicerum Lapis.

Stone, Copperas. See Pyrites.

Stone, Corner. See Corner.

Stone, Eagle. See Alith.

Stone, Efb. See Eft-Stones.

Stone, Emery. See Emery.

Stone, Fire. See Fire-Stone.

Stone, Flyf. See Sarcites.

Stone, Free, Grind, Grit, Gyphine, and Harfiam. See Free, &c.

Stone, Gall. See Biliary, and Biliary Calculus.

Stone, Horn. See Lapis Curnicus.

Stone, Jewiff. See Judcicus Lapis.

Stone, Infernal. See Lunar Caustic.

Stone, Lime. See Lime.

Stone, Medical, a term used by some to express those particular flones, 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 flones, were very whimsical. They suppositied 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 thunder. These have been derisively 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 constituting matter. See Gem.

Stone, Meteoric, in Meteorology. Meteoric flones, or aerolites, are those flones which have been observed to fall from the atmosphere. (See Falling Stones.) In addition to the description of these flones, 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 flones 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, masses 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 flones on the surface of the earth. The matter of which these masses of ice are formed, exiled previously in a state of elastic aqueous vapour in the atmosphere; but by what procxes it was suddenly condensed, during thunder-storms, is at present almost as inexplicable as the formation of meteoric flones. 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 substances 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 railed into the atmosphere from the surface of the earth and sea, 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 appears in its dry state. The important agency 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 flones will receive much elucidation. From the examination of rain, 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 flones are formed, may be abounded 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 concrescences may be formed; or, by slow combination, they may form flowers of sulphur, or other substances, in a diffused or less compact state. In the Annales de Chimie, tom. lxxxv. p. 262, many curious instances of this kind are related, from which we selected the following, as intimately connected with the descent of meteoric flones.

We ought probably to rank with meteoric flones the ignited bodies, or fire-balls, which are only distinguished from them by their substance not being metallic. Like meteoric flones, 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 spongy, was found at Coblenz, after the explosion of a ball of fire. Journal de Physique de Gilbert, tom. vi.

Silberenschlag relates having seen the residue of an ignited globe, which presented a gelatinous appearance, of a whitish colour.

The meteors called falling stars, do not appear to differ from globes of fire; they leave behind them gelatinous mafes,
STONE.

Maltese, 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 consequently diffused before they reach the ground. We may refer to this kind of phenomenon, the globe of fire which, according to Geoffroy, burst in the Palace du Quénoy on the 4th of January, 1717; that which was observed in America in 1800, and in the county of Suffolk in 1802. With these globes of fire may be clafled 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 flower of fire made great ravages in Germany in the year 1825, and burnt up whole villages. Another flower 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 flower of fire took place, in 1678, at Sachfen-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 attacked in vain to extinguish it by means of water. The difference remarked between flowers of fire, and those of an oily substance, which have frequently occurred, appears to confit in this,—the substance of the former is in a state of pho- phorecence, which is not the case with the latter. We may place after these singular flowers, those of a medicinal 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 same phenomena, for it is difficult to consider them as excretions of plants, as fome have asserted. One of these flowers of dew took place at Ulm so recently as 1802, and in such abundance, that every thing expelled 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 flowers and fire-balls are formed, is sometimes precipitated, in a very minute rate of division, in flowers of sulphur or fand, and what have been falsely called flowers of blood.

The flower of brimstone which fell at Copenhagen in 1646, was accompanied with heavy rain, and the air was infected with the smell of sulphur. A flower of the same kind also took place at Copenhagen in 1665, after a very violent storm: the brimstone precipitated, emitted a strong smell of sulphur when thrown into the fire, and with spirit of turpentine it formed a kind of balfam of sulphur. In 1801, the rain which fell at Raffelt was so fulphurous, that it was used to prepare matches. A red mineral flower fell in Welfphalia in 1543, at Lozen in 1560, and at Embden in 1751: the latter was so extensive, that over the circumference of 10 or 12 leagues, all bodies exposed to it were dyed red. Similar flowers fell in Russia, Swabia, near the lake of Conflance, and at Lucarno, in Upper Italy, in the latter end of 1755. At Lucarno the atmosphere became quite red previously to the flower. 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 flower fell in the mountains of Piac , its first appearance was white, but after some claps 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 pervaded the colour after having been melted. There are too many testimonies in favour of flowers of sand having fallen, to allow us to deny the fact. One was observed at Bagdad in 1930. (Quatre- mère Memoires fur l'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 flower of ferruginous rain was observed in the Atlantic, lat. 45° and long. 32°, at a distance of five or fix leagues from the main land: this flower 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. Sulphured hydrogen gas is constantly emitted into the atmosphere from volcanoes and other sources; were this collected and exploded, or slowly burned, 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 flowers, but he appears to want sufficient data to establish some of his conclusions.

"First: The fall of these flowers," he observes, "is most frequent in the months of June, July, and August. Of 65 or 70 of these recorded flowers of flone, 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 influences occur of flowers 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 3 o'clock in the afternoon and sunset." We may observe, that the descent of these flowers 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 flowers of flone 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, "of no falls of flones having taken place in cloudy weather, or during a light wind, or a heavy continued rain or snow."

The weather has been noticed during forty-three falls of flowers; twenty-nine fell in warm and ferene weather, and two when the sky presented some scattered and inflamed clouds; the remaining twelve were accompanied by violent storms of rain and hail. Out of twenty-nine falls of flowers which took place in ferene weather, twenty seemed to issue from a very extensive but round cloud, black or variable in colour, according to the colour of the flowers themselves. Thus, the cloud was white in the fall which took place at Burgos, and the flowers 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 flowers, as also the flowers themselves.

It may not be improper to remark, that the great flone which fell on the wolds of Yorkshire, was unaccompanied with any meteor or light, and the sky was hazy. The progress of the great meteor in 1783, was unattended with any cloud; and though it exploded in various parts of its course, no defect of flowers was noticed. The cloud which, from various authentic accounts, appears to be generally attendant on the fall of meteoric flowers, is formed 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 flowers in the department of the Lot and Garonne,
STONE.

Gygonian, 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 stones fell; explosions, accompanied by lightning, immediately succeeded: the sky in other parts was feniace; 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 stones in their fall appeared to diverge, striking the ground obliquely in various directions. They do not differ in their composition from other meteoric stones. 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 perceive 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 stones in the atmosphere, may elucidate, in his opinion, the appearance of new stars, which have fallen for a few years and then disappeared. The simplest form of matter with which we are acquainted, is of gas or vapour.

"Let us for a moment consider the elements of which all terrestrial substances are composed as existing in this simple state, when the flat 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, preventing to the distant inhabitants of the universe the appearance of a star of great brilliancy, but of short duration. The sudden concretion of stone masses in the atmosphere, with the intense light attending their formation, may be analogous to the production of a planet." As we conceive, however, that the phenomena of the appearance and disappearance of stars are satisfactorily explained upon other principles, we shall content ourselves with referring to the publication above cited, and to the article STARS.

STONE, Moor. See Moor-Stone.

Stone, Philosopher's. See Philosopher's Stone.

Stones, Portland, Panama, Purbeck, and Roll-rich. See Portland, &c.

Stone, Rocking or Logan, in Antiquity, a name given to a mass of rocks, the uppermost of which, from relying on a small point, or pivot, was incapable of being moved, or rocked to and fro, with very little force. These stones 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 singular objects; and certain modern antiquaries have avowed themselves, and triumphed with their readers, in affixing to them different supernatural properties. Pliny says, that at Harappa, a town of Asia, there was a rock of such a wonder-ful 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 Hepheidian mentions a Gygonian stone near the ocean, which might be agitated by the fluke of an aphantin, but could not be removed by the greatest human force. Dr. Stukeley considers the word Gygonius to be purely Celtic; and says, that Gwynog signifies Motitana, the rocking-stone. Although it is very evident that most of these rocking-stones 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. Levan, Cornwall, on the coast, on a promontory called Castle Trelyn, are three groups of rocks, on the top of one of which was formerly a very large stone, so even poised, that by a very slight pressure it might be moved from one side to another. It was popularly called the Logan-stone, and has generally been visited as an object of curiosity; but it is now immovable. There are other rocking-stones, 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 Carn-bhan, in the parish of Tywidneck, Cornwall, to be. It is thirty-nine feet in circumference, and four feet thick at a medium, and stands on a single pedestal. There is also a remarkable stone of the same kind on the island of St. Agnes, in Scilly. The under rock is ten feet fix inches high, forty-feet 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 fix inches high, and forty-feet feet in circumference. On the top there is a basin hollowed out, three feet eleven inches in diameter at a medium, but wider at the rim, and three feet deep. From the globular shape of this upper stone, 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 Sittney parish, near Helston, in Cornwall, stood the famous Logan or rocking-stone, commonly called Men-Ambert, g. d. Men-an-Bar, or the top-stone. It was eleven feet in length, six feet wide, and four feet deep, and so nicely poised on another stone, that "a little child (as Mr. Scawen in his MS. lays) could instantly move it, and all travellers that came this way defined to behold it; but in the time of Cromwell, when all monumental things became defecible, one Shrubll, then governor of Pendennis, by much ado, caused 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-stone in Perthishire, near Balvaird Castle, in the Ochil hills, Scotland, on the eftate of Mr. Murray of Conland.

That these rocking-stones were employed by the Druids, to fascinate and deceive the credulous, is very probable; but tradition has not informed, us for what express purpose they were intended. Toland thinks "that the Druids made the people believe that they only could move them, and that by a miracle; and 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," 1630, thus apostrophises the Logan-stone:

"Be thou thy mother Nature's work,
Or proof of giant's might,
Worthies and raged rough thou show,
Yet art thou worth the fight.
This bigy rock one finger's force
Apparently will move;
But to remove it, many strength
Shall all like feeble prove." 1769.

Borlase, in his "Antiquities, &c. of Cornwall," folio, has devoted a chapter to this subject, and gives an excellent view of different rocking-stones.

STONE, Potter. See Tripoli.

Stone, Sanguine. See Sanguine Stone.

Stone, Serpent. See Cornu Ammonis, and Ammonite.

Stones, Shod. See Shod-Stone.

Stone, Toad. See Bufonita and Toad-Stone.

STONE.
STONE, Touch. See Touch-Stone.
STONES, Characters on Tombs. 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 flatulence was invented. They were unknown to the ancients, called by Sanchoniathon Batillia. (See Bætys.) Pananias speaks of the statues of Hercules and of 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 so 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 dressed, serve well for making of oatmeal, which is built and most relished 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, as in the stones of wheat-mills; the edges of these grooves clip the grain like scissors, and there is no interstice through which any of the grain can escape, until it is reduced to the required fineness of meal which is proper.

STONE-Dikes, in Agriculture, that fort of dike or mound which is formed with stone and earth. These 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 feet and a half high from the surface of the ground. A dike thus built, when well executed, and filled with through-bands, bids defiance, it is said, to most kinds of animals, none of which are fond of venturing over it; whereas a green feed on the top of a double-faced wall invites the sheep to attempt clearing it, which they not infrequently do with facility. These dikes are equal in durability and cheapness; 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 contrivance 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 Picker, 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 baskets, and that of having recourse to the team, the use of one horse and a light cart is advised, which attending seven or eight women, boys, and girls, may run over forty acres in about four days. It is advised by Mr. A. Young, that constantly 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 leythe. It is of the better, he adds, that the pickers, who generally like this 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 cafes where picked by authority of parliament for turnpike roads. And Mr. Macf, of Suffolk, ascertained it experimentally.

Observations have been made in other places, which clearly shew that the stones should not be wholly picked off many farts 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 post-township called Palatine, (which inc.) 51 miles from Albany, separated from the W. part in 1808. This township is well watered, and has many fine mill-feats, 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 stones, &c. and a stone church 55 miles from Albany. In 1810 the population of Palatine was 3111.

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 Almbibon river. See Assinibois.

STONE Island, a small island near the E. coast of Newfoundland, near Cape Broyle, and one of the three islands which lie off Caplin bay.

STONE Mountain, a mountain that lies between the flats 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° 57'. 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 Bloody 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 Alien.

STONE River, a river of North America, which runs into lake Athapecos.

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 1 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 Stein in Germany, varies very much in different parts of the continent: at Amsterdam, a stone or stone is eight pounds: at Berlin, the centner or quintal weighs
weights five fenns or felines, each of twenty-two pounds: at
Hamborough and Prague, a feline of flux is twenty pounds,
and a feline 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 Rauty Mummy.
Stone-Parsley, in Botany. See Buron.
Stone-Parfey, Belford. See Sizon.
Stone-Phosphorous. See Lithophosphorus.
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-Brick, in Agriculture, a term sometimes applied
to a loose stivert of soil or land. It has a surface of
greater or less depth, mostly of a loose, dry, friable sort of
fandy, lime-fonny, chalky, or loamy materials, which seem to
be formed from abraded matters of these fomy kinds, and
abounding with many fragments of them. In many dis-
tricts and places, the lands of this sort are chiefly of the lime-
flute and chalk kinds. It is a sort of land that prevails
much in some counties, as in Oxfordshire, Someretheire,
Bedforshire, and probably in some others. It is sometimes
of a springy, fnewy nature, reeplit upon deep beds of a blue
clayey, mery quality, under which is a vein of white marle,
extraordinary rich in calcareous matter, and below that rock
of the rough white lime-foone kind. The blue and white
matters have occasionally been spread out over the surfaces
of these lands, and found very beneficial. These lands, in
some eafes, form excellent soils for the turnip husbandry, and
are very productive in wheat, especially where they are of
the more calcareous kinds.

They answer well for incoying too in some instances, in-
stead of being cultivated on the common field plan, as is still
too much the case in many places, notwithstanding the im-
provements which husbandry has lately undergone.

A variety of different covenants are suppoofe syllarcey
for tenants in cultivating stone-brick farms, as may be seen
in the Corrected Report of the Agriculture of the County of

Stone-Break, the name of a perennial plant of the
weed-kind, common in pailure grounds. The root has a
sharpish and aromatic taste. The flails are round, fleshed,
and reddish towards the bottom. The leaves are smooth,
of a dark green, and divided twice, into long, narrow, firm
segments. The flower spikes are membranous at the base. The
flowers grow in loose umbels, and are of a pale yellow col-
our. The seeds are oval, fleshed and red at the top. It is
a plant of the saxifrage kind, which has been suppoofed
beneficial in meadow lands, as improving the qualities of
the cheese and butter which are made from the milk of the cows
which are paitured upon them.

Stone-Chatter, in Ornithology, the name of a small
bird of the cananthe, or fowlo-finch kind, the motacilla rubi-
cola of Linnaeus, called by some authors rubetra and mu-
sicina, and in some cafes the stone-mitch 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 tawny; the lower part of the back, jilt
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 rest 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 covenets of the wings are
adorned with another. The head of the female is ferrugine-
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
gory grounds, but in winter differ to more marlises, &c., with-
out quitting the island: they make a very loud and often
repeated noise. Pennant.


Stone-Curlew, in Ornithology, the English name for the
redicrus, a bird of the colour of the curlew. See Stone-
Curlew.

Stone-Snitch, a common English name for that spe-
ces of cananthe, which we more frequently call the stone-
chatter.

STONEHAM, in Geography, a township of Middlesex
county, Maffichufetts, incorporated in 1725, and containing
467 inhabitants; 10 miles N. of Bolithon.

STONEHAVEN, a sea-port town in the parish of
Dunottar, and county of Kincardine, Scotland, is 107 miles
N. by E. from Edinburgh. It consists of two large streets
of houses, built on fofts granted by the earls marishal,
within whose citate, before their forfeiture, it was situated.
There is a fine harbour formed by a natural bafin, defended
by a high rock upon the S.E., which extend to the sea,
and upon the N.E. by a quay, very convenient for the un-
lading of goods.

A manufacr of 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 1660, and in consequence of the gaiol for
the county, and county courts held here, the town is much
benefited. The public revenue of Stonehaven consists
chiefly of hire due, which amount to about 45 £ annu-
ally. A great deal of lime is brought to this part; and
from four annual fairs, the revenues of the town are aug-
menced.

Stonehaven is a borough of barony, of which the juridic-
tion is by the charter veiled in magistrates chosen by the
superior and feuars. In 1792 the town contained 1672 in-
habits, independent of the additional suburb.—Beauties
of Scotland, vol. iv. Carlyle's Topographical Dictionary of
Scotland, 2 vols. 4to. 1813.

STONEHENGE, in Antiquity, an affemblage of up-
right and proflrate fones on Salisbury plain, England, sup-
poofed to be the remains of an ancient Drudical temple, which
claims particular notice in this work, as being often referred
to in foreign and English books, and from having been very
accurately described in most of those publications. Next
to the wall 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 confequently
involved in the most abitrue mystery. Hence they have
also occasioned much speculation; and many volumes and
copies have been written by English and continental anti-
quaries, with a view of explaining the origin and ufe of such
structures. On the present occasion, it is intended to de-
scribe 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
shape.
and rational inference respecting this and other similar monuments. Stonehenge, situated about two miles directly west of Amesbury, and seven north of Salisbury, in Wilshire, 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 surprise and curiosity than any other relic of antiquity in Great Britain. When viewed at a distance it appears but a small and trifling object, for its bulk and character are lost in the extensive space which surrounds it; and even on a near examination, it generally fails to alluith or gratify the expectations of the stranger, who initially visits it with exaggerated prepossessions. To behold this "wonder of the world," as it has been termed, with interest and satisfaction, it should be viewed with an artist's eye, and contemplated with a mind flored with antiquarian and historical knowledge.

In various parts of the United Kingdom, and also in foreign States, several circular enclosures of upright stones are to be found, some of which consist of a single, and others of complex circles; but Stonehenge is of a distinct 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, which regular cavities in the horizontal stones, and projecting points on the perpendicular ones; whereas nearly all othcr examples, of what is generally called Druidical circles, are composed of rough, unhewn stones, and are without impoits.

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 temple, as remaining in 1816; the darker parts shew thefe that are standing, and the light tints the fallen stones, or fragments: whilst the dotted lines indicate the impoits, or stones refting on the uprights. B is a view of the structure from the south-west, showing 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 distance between the temple and the vallum C, the stone D, within the ditch, and the stone E, still farther from the temple. These two stones, one now standing, E, and the other fallen, D, is it presumed, formed part of a long avenue, similar to others at Avebury (see Avebury); F, 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 in its original state. E is a perspective elevation from the same plan. F 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 thefe (see plan D, view 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 fect of thefe 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 section, D, E, and F. (See Plate Stonehenge.)

Horizontal stones, or impoits, were laid all round, in a continued order, on the outer circle; and five similar impoits 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 stones. 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 one 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 unchilled stone, called "The Friar's Heel," which is now in a leaning position, and measures about fifteen feet in height, C, a. Immediately within the vallum is another stone, lying on the ground, three sides of which bear the same marks of tools as the large uprights, and was evidently once flanding. In length it measures twenty-one feet two inches, of which three feet six inches appear to have been formerly under ground when it stood upright. Its distance from the stone last-mentioned is one hundred feet; and it is nearly the same distance from the outside of the outermost circle of the monument. Each inch of this row has two mortises in it, to correspond with two tenons on the top of each vertical stone. The impoits 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 fizes; but their general height is about fourteen feet, and the measure of their fides seven feet by three. The space between them also varies a little; that between the entrance-stones (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 six impoits. (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 impoits; but Smith, in his "Choir 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 respecting this circle claim attention. Dr. Stukeley, in his ground plan of Stonehenge, has placed the two stones at the entrance (Plan D, b, b') a little within the range of the others, and observes, "that the two stones of the principal entrance of this circle, correspondent to thefle 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 that 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 attention of Wood, that all the stones of the smaller circles had impoits. 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
when standing, exclusive of the impolt, twenty-one feet six inches in height (Plan D, d): these next it, on each side, were about seventeen feet two inches (D, r; t): but the others were not more than fifteen feet three inches (D, j, f). Thus we perceive a progressive rise in the height of these barrows. 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 barrows are perfect. (Plan A, 2, and 3.) One of the uprights is standing at 4: but leans inwards, and rests on 10. The next barrow, 5, fell down in the year 1787, and it is remarkable, that this is the only alteration recorded of Stonehenge. At 6, one of the uprights is standing; but its corresponding stone and the impolt have fallen, and are broken into several pieces.

The interior row of stones which next claims attention, consisted, according to Stukeley, of nineteen uprights, without impolts; but their original number is differently stated by other authors. These stones "inclined 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 at an angle on the inner side." For what purpofe 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, g; and A, 10.)

The altar-stone, as it is usually called, lies flat on the ground, and occupies the core, or adytum of the temple. Two other stones belonging to this monument remain to be noticed: they are situated close to and within the vallum, 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 vallum; but the latter is not more than four feet high; and both are rude and unshaped.

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 feites of two flone vales, 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 bones.

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 impolts; the second, or inner circle, thirty; the third interior row fourteen, and seven impolts; and the fourth interior row thirteen: the remainder are the altar-stone, the three stones adjoining the agger, and the large flone in the avenue.

Natural Quality of the Stones. - Thofe of the outer circle, and third row, with the flone in the avenue, and those adjoining the vallum, are, according to Dr. Townson, in Tracts and Observations on Natural History, &c., all "of a pure, fine-grained, compact flnad-flone, 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 pyramidal flone, imperfected with black hornblende, felspar, quartz, and chlorite, excepting four in the circle; one of which is a fliceous felicitus, another an argillaceous felicitus, and the others horn-flone, with small specks of felspar and pyrite. - The flab, or altar-flone, is different from all thefe, being a kind of "grey cor, a very fine-grained calcareous flad-flone," which strikes fire with ilex, and contains one minute fragment of silver mica. Many perfons have absurdly supposed that these flones are artificial, and formed in moulds.

The mystery of Stonehenge, the legendary flories connected with it, and the natural and artificial features of the surrounding plains, are certainly calculated to make itsogn impressions on the mind of every spectator. The area of the temple, as may be readily supposing, 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 tin 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 characters engraved upon it were unintelligible to the most learned antiquaries of the age. It is much to be regretted that this relic is lost. Sir Richard Hoare and his indefatigable coadjutor, Mr. Cunningham, were found to contain, in some infancies, cills filled with burnt bones, and in others entire flcketons, with various relics of Britifh 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 vallum of Stonehenge on the north-eall, 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 lait is a very curious and interesting appendage to Stonehenge, if such it can be properly considered, and certainly ranks among the most perfect velliges 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-five 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, resembling a long barrow, which stretches entirely across it. The western extremity is defitute of any mound like that at the extremiend; 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 distinct 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

M m 2
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larger one. From the near resemblance of the above work to the cursus of the Romans, it seems reasonable to suppose, that if these 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 HIPPODROME.

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 British nobles, 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 thereupon endeavored to perpetuate the memory of this tragic event. The historical Trials of theWelsh 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 Hengist. 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 Killraus, 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 "infernall subterracel," or a wild structure. His description of it is so very erroneous and defective, that we doubt much if he ever saw it. 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 monument 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 Celsus: but unfortunately for Jones's theory, he has committed palpable errors in the form and arrangement of the stones, and has thus rendered his deductions and allusions untenable and untrue.

Jones's work was succeeded, in 1663, 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 Wilthire.

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, malversation, and profanity. 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 Chorea gigantium given to our monument) be the Phenicians; and the art of erecting these stones, amidst of the stones themselves, brought from the furthestm old parts of Africa, the known habitats of the Phenicians." 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 opinion by most 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 reasonings, 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 reeling his theory upon solid British ground, he takes up a large portion of his essay with irrelevant dilatation and speculation. Wood, an architect of Bath, devoted much time to make plans of this structure, which he published with an essay, in 1741. 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, &c." 1775, supposes Stonehenge to have been a place held sacred by the Druids, and appropriated to a meeting of great assemblies on civil or religious occasions; and adds, "the world does not afford a soberer spot. Its situation is upon a hill, in the middle of an extended plain in the southern part of the kingdom, covered with numerous herds and flocks 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 "Choix Gaufr," appeared in 1779, after giving an account of the theories of Jones and others, with copious extracts, and a minute description of the monument itself, says that he considers it to have been of Druidical origin, and erected as well for the purposes of astronomic observation as of religious ceremonies.

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 Christianity. This gentleman, however, had such strong prejudices and antipathies against every thing pagan, that he could not even mention this, or any other anti-christian temple, but in terms of repro-
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aliuded 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 mount 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 delivered, and the great veneration in which it was held by the primitive bards, those immediate descendants and avowed disciples of the British Druids. As the great sanctuary of the dominion or metropolitan temple of our heathen ancestors, so complex in its plan, and constructed upon such a multitude of astronomical calculations, we find it was 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 Ha, the deified patriarch; Elphin and Rheiddin, the Sun; Eleve, Iba; Ked, Ceres, with the cell of her sacred fire; Llywy, Proferpine; Gwyden, Hermes; Budd, Victory; and several others." As to the precise date of Stonehenge, Mr. Davies says nothing definitively, but remarks, that it was most likely of later origin than the introduction of the Helio-Arkithe 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 sanctuity influenced the selection of the spot for the place of conference between the British and Saxon princes." P. 385, &c.

Mr. Davies 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 fablance of the Grecian 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 fize to Sicily, lying towards the north, and inhabited by Hyperborei, who are so called because they live more remote from the north wind. The soil is excellent and fertile; and the harvellt is made twice in the same year. Tradition says that Latona was born here, and therefore 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 curvus-adjoining as the hippocorde on 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 impolts, constituted the old, or original work; and that the small 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, sir 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 theory, and with the practices of remote ages, to conclude, that the second circle of small, rough, unknown stones, with another circle immediately within the ditch, and some other members, now destroyed, formed the original, pristinely temple. Many arguments might be used to exemplify this opinion; and also to prove that the great circle of upright chiselled stones, with their impolts, and the third row of trihions, were posterior to the former, raised by another clafs 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 curits 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 "these circles, besides being used as places of worship, and courts of justice, evidently served the purpose of rude astronomical observatories, by which the Druids could ascertain the rising and setting of the sun, moon, and stars; the feasons of the year; and even the hours of the day: and where they are tolerably entire, a slight 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 dispursed about our dominions: we then find some attempts at architecture in the cromlech and kilwaen, in both of which we see immense stones laid incumblent upon others that are upright; whether these gave the idea of the impolts at Stonehenge, or vice versa, will be a difficult matter to determine; at all events, I consider Stonehenge of a much more modern date than Aubury, where there are no impolts, and no marks of working on the stones; but in the former we perceive a regular plan, a great deal of symmetry, and great knowledge in mathematics. We know, also, that many stone monuments exist on the continent, and in that part of it from whence our island probably received its earliest population, viz. Gallia-Celtica."

"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 "Monuments Celtiques," has given a very detailed and animated description of this interesting relic of antiquity. He tells us, that some detached stones on the hillside and banks announce the approach to this grand theatre, which consists of an immense number of rude unhewn stones (amounting to four thousand, or more), 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-five feet."
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 sand 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 perplexed 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 function of their names, we shelter ourselves whenever we are ignorant and bewildered." And Mr. Borlase, with equal judgment, remarks, "that the work of Stonehenge must have been that of a great and powerful nation, not of a limited community of priests; the grandeur of the design, the distance of the materials, the tediousness with which all such massive works are necessarily attended, all these facts, which I have stated, 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 Wiltshire, in vol. xv. of "The Beauties of England," by J. Britton, F.S.A. 1814. "The History of Ancient Wiltshire," 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 barber, who has so laudably employed his time. One of the plates in this volume is more particularly interesting, as displaying a plan of the site of the temple, the avenue, the situation, and extent of the great curfus; also a smaller cursus, with numerous ditches, barrows, and encampments, in the vicinity of Stonehenge. Comte Alexander de la Borde, in an elegant work now publishing in Paris, entitled "Les Monumens de la France clasique 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 part of land which is constituted of loofe, reduced, mixed, flomy materials, and which is of a light, dry quality, capable of being worn 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 Lepantii and Tridentini. According to Livy, they were subjugated by the consul Q. Marcius.

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 lute, settled in 1658, and containing six places of worship, and 3043 inhabitants, of whom nine are slaves.

STONING, North, a town of Connecticut, in New London county, containing 2524 inhabitants, of whom two are slaves.

STONO INLET, a channel on the coast of South 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° 3'.

STONY CREEK, a small stream of Upper Canada, which runs into Lake Erie, E. of Sangas 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 Hock's Town.

STONY ISLAND, an island near the E. coast of Labrador. N. lat. 53° 4'. W. long. 55° 30'.—Alfo, a small island in the Spanish Main. N. lat. 14° 26'. W. long. 82° 45'.

STONY MOUNTAINS, mountains in the N.W. part of North America, extending from S. to N. in a W. direction, from N. lat. 48° to 68°. The north part of this range is called the Mountains of Bright Stones.

STONY POINTS, a small peninsula in Orange county, New York, projecting from the W. bank of Hudson's river into Haverstraw bay, about 40 miles N. of New York city. The population of Haverstraw 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° 15'. See also Roche.

STONY STRATFORD. See Stratford.

STONY LANDS, in Agriculture, such as are full of flints, pebbles, or small fragments of free-stone. It is found that lands of this sort, in many places, yield good crops; and the general rule is, that in hilly and cold lands, the flones 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 flones, 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 curious and interesting to see how the vegetation flourishes and gets through such beds of stones. 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 most 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 flones are very numerous and closely befted 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 Stud, the common name of a flod or houttack or corn or grain let up in the field. See Hat-tack.

In some districts, a distinction is made in this mode of putting up corn in the field; the flod or flouk, consisting of twelve wheats, while the houttack has only ten.

STOOKING, or Stouking, the operation of setting up the wheats of grain into flocks, flouts, or houttacks, in the field, to guard them from rain. It is sometimes written flocking. It was formerly the practice to let one flout up right, with the ears uppermost; and round that to place a circle of many other wheats, in the same direction, inclining on the first flout; then to lay an horizontal circle of wheats, with all the ears in the centre, and cover those ears with a loaf.
loose sheaves or two. And thus placed, they are faid 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 flipped on the top, so as to meet at the
centre with their tails, and to flipe downwards. In this
mode the air has a free course, whether it bears against one
or other end of the flipe, or even against either side of it.
Thus, two weighty sheaves afford a good cover, and con-
tinue to, being hardly to be blown off by any wind, if care-
fully laid on: at least not to be blown away but so as soon
as to be replaced. And the flipeing position of the cap-sheaves
never 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 straw
is thickift and strongest, receive the miff rain, which can do
them little or no harm, and especially if they be thrust
clofely together. See Harvesting and Hattock.
STOOL, Alves, in Medicine. A thing is faid to be
voided by flipe, when it is discharged by the anus, or fum-
dament. In the Philosophical Transafions, we have in-
stances of fick persons voiding facitious flones, balls, &c.
by flipe. See Alves and Defecfion.
Stools, Bloody, in Medicine. The spirit of vitrif, mixed
with the patient’s drink, has often been found beneficial in
cures of bloody flipes. See Dysentery and Flux.
Stools, Retention of the fift, 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 falled.
Stools, in Ship-Building, pieces of plank bolted to the
quarters, for the purpose of forming and creafing the quar-
ter-galleries, and fometimes to the flipe’s fides abait the mafs
for the backflays. Also ornamented blocks of wood for the
poops and top-lanterns to fland on.
Stool, Cucking. See Cucking.
Stool, in Agriculture, a term used pro vincially to fignify,
to ramify or tiller, as grain.
Stools, in Gardening, fuch headed-down young trees
and shrubs in the nurfery-ground, or other places, as are
appropriated for the production of an annual fupply of
lower shoots or branches near the ground, properly fituated
for layering. See Laying.
Stools, Hop, in Rural Economy, the small contrivances
of this kind which are made ufe of in hop-gardens, in pick-
ing the produce from off the hinds, in some districts. They
are thought ufeful and improper in some hop plantations in
different districts, and of course never employed; but in
others they are still continued, and fuppoled to be of con-
fiderable utility and benefit in the execution of the above
fort of work.
Stooming of Wine, a term ufed to fignify the putting
of bags of herbs or other ingredients into it to pre-
vent fermentation.
Stoop, in Commerce, a liquid meafure in Holland and
Flanders. See Tab. XXXI. under Measures.
Stoop, in Rural Economy, a pole fixed in the earth, as a
gate-polt, &c. and many other forts.
Stooping, in Falconry, is when a hawk, being upon
her wings at the height of her pitch, bends down violently
to take the fowl.
STOOKER, in Coinage, a small Dutch filver coin, valued
at 2½ fivers.
STOP, in the Mange, is a paine, or difcontinuation of
go. In order to flop a horfe, the rider fhould, in the
fift place, quicken him a little, and at the infant when
he begins to go faifer 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 flop is made; then vigorously extend the
hams, and reit upon the ftrump to make him form the
times or motions of his flop, in falcading with his haunches
three or four times. You fhould not form the flops of
your horfe fhort and precipitate, let you spoil his hams and
mouth. After flapping, a horfe fhould be made to make
two or three corverts.
With a raw and young horfe very few flops fhould be
made; and when they are made, they fhould be performed
by degrees, very gently, and not all at once; because nothing
so much hirmains and weakens the hocks of a fliff and awkward
horfe as to be a sudden and rude flop. It is an universally agreed
point, that nothing hews to much the vigour and obedience
of a horfe, as his making a beautiful and firm flop at the
end of a fliff and violent career. The facility of flapping,
however, depends upon the natural aptnefs 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 mutt, therefore, be cparated by the strength
and temper of the horfe, by the fteadinefs of his head and neck,
and the condition of his moutb 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 flapping
he fupplies up his nofe, or forces the hand, keep your
bride-hand low and firm, and your reins quite equal; give
him no Libertv, 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 furest method to bring
him into the hand. To compel a horfe to flop upon his
haunches, nothing is fo efficacious as a little flapping ground:
nevertheless you muft examine, previously to this kind of
exerife, if his feet, reins, shoulders, and legs, are able to
bear it; for otherwise your horfe would soon be fpooled.
In this cafe the rider fhould put the fires of his aids rather
in his thighs and knees than in the ftrump. One of the
moft trying leffions to which a horfe can be put is to flop
him, and make him go backwards up hill; and therefore, on
these occasions, you muft fabe the fore-parts of the horfe as
much as poifible, and throw your whole weight upon the
hinder. As there are fome horfes which, from weaknefs in
their make, can never be brought to form a jull and beauti-
ful flop, there are others which are apt to flop too fuddently
and fhort upon their shoulders, though otherwife too much
raised before and too light. These employ all their powers
in order to flop all at once: these horfes fhould never be
made to go backwards; but, on the contrary, fhould be
fopped flowly and by degrees, that they may be embold-
ned; but they fhould never be forced or kept in too great
a degree of fubjeftion. The leffon of making a horfe to flop
upon his haunches is admirable, if it be practiced with
horfes which have been fuppled and prepared; but it fhould
never be ufed to colts or raw horfes, whose joints are fliff.
The moft certain method, fays Mr. Berenger, to unite and
affemble 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 forts of airs, depends entirely
upon the perfection and exactnefs of the flop. The qualities
above
above enumerated are essential to the top, and the top must be considered as the eff-ct, and not as the cause of the good qualities. Berenger's Hist. and Art of Horsemanship, vol. ii. chap. 5. The opposite term to top is porting. In former times, the top of a horse was called parade. See NAIL.

STOP, Half a, is a top not finished by a pesade; so that the horse, after faiding three or four times upon the haunches, returns and continues his gallop, without making pesades or corvetts; which fee.

STOP, at Sea, a word used by him that holds the half-minute gahs, in heaving the log; for immediately when the glass is out, he calls stop to them that let run the line. See STOPPING.

STOP, in the Practice of Rigging, is a temporary feizing. When used to stop warming, it is faked. This is a name given to several turns of tumps-yarn taken round the end of a rope, similar to a feizing, to faid it to another rope. Also, a projection left on the upper part of top-gallant masts, &c. to prevent the rigging from riding down. See STOPPING.

STOP, Saturday. See Saturday.

STOP is a floating beam, used to top and detain barges at the toll-houses, when neceffary, and during the night. Stop-Gates are similar to Safety-gates; but they require to be lifted up, instead of acting of themselves.

STOP-Planks are planks put into a grove, and serving the fame purpofe with top-gates.

STOPCOCKS, in Hydraulics, are appendages to pipes conftiuted for the conveyance of fluids; and thefe, as well as valves, differ in their form and construction according to their various situations and ufe. Stopcocks ufuall confift of a cylindrical or conical part, perforated in a particular dire&ion, and capable of being turned in a focket formed in the pipe, fo 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 dire&ion only, and not to return. See VALVE.

STOP, or Step, in Mining. When a funph or pit is sunk down in a lode, they break and work it away in flairs or fteps, which method of working is called topping; and the height or ftep which each man breaks, is called a ftep.

STOPIN, a term in ufe at the military laboratory, de-erived from the French word eflamm, and figurating a wad, lump, clew or hard of hemp, tow, rope-yarn, &c.

STOPPAROLA, in Ornithology, the name of a bird of the lark kind, defcribed by Aldrovanus, and supposed by Mr. Ray to be the fame with the flaptulata, or the tordino of the Venetians; but the muscipula grifola of Linnaeus. See Fly-catcher.

STOPPEL, in Geography, a town of Flandres; 5 miles N.W. of Hull.

STOPPERS, in a Ship, certain fhort pieces of rope, which are ufually knotted at one or both ends, according to the purpofe for which they are defigned. They are either ufed to fpind or any heavy body, or to retain a cable, shroud, &c. in a fixed position. Thus, the anchors, when fift hoifted up from the ground, are hung to the cat-head, by a flopper, called "anchor-slopper," attached to the latter, which falling through the anchor-ring, is afterwards falfened to the timber-head; and the fame rope ferves to fallen it on the bow at fes; or to fpind it by the ring which is to be funk from the flip to the bottom. The floppers of the cable have a large knot and a lainiard at one end, and are falfened to a ring-bolt in the deck by the other. They are attached to the cable by the lainiard, which is falfened

freely round both by feveral turns pafted behind the knot, or about the neck of the flopper; by which means, the cable is reftrained from running out of the flip, when the rides at anchor.

Thofe that are ufed to check the cable are called "bit-floppers;" and the latter are denominated "deck-floppers." "Dog-floppers" are ufed as additional fecurities when the flip is riding in heavy gales, or bringing up a flip with much fenm-way, to prevent the cable from flapping at the bits, and to fave the deck-floppers. "Wing-floppers" are ufed for the fame purpofe as dog-floppers.

The floppers of the fhrouds, called "frhood-floppers," have a knot and a lainiard at each end. They are only ufed when the fhrouds are cut afunder in battle, or difabled by tempeftuous weather; at which time they are lafed, in the fame manner as ftofe of the cables, to the separated parts of the fhroud, which are thereby reunited, fo as to be fit for immediate service. This, however, is only a temporary expedient.

"Fore-tack" and "fleet-floppers" are ufed for fecuring the tacks and fheets, till fayed. 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 chenched on iron plates beneath.

STOPPING, in Grammar. See POINT and PUNCTUA-

TION.

STOPPING, among Horfes, the practive of filling the hollow of a horfe's foot with poultice, cow-dung, or any other moit application. It has the effed of softening the fole, and, on some occasions, may be advantages, though it is frequently misapplied, and of course does injury. It is not ufually employed for the feet of team-horfes, especiffy thofe of the plough kind, as travelling too much amidst the mould renders them hard, brittle, and unceafy.

STOPPING a Leak, at Sea. See LEAK.

STOPPING a Ship. When a ship comes to an anchor, and the cable is veered out by degrees till the flip is found to ride well, and then flopped, it is called fopping the flip.

STOPPERS, up, in Ship-Building; the poppets, timber, &c. ufed to fill up the vacancy between the upper fide of the bilge-ways and the flip's bottom, for supporting her when launching.

STOPS, in Grammar. See POINT.

STOPs of an Organ. See ORGAN.

STOPs, or Stoops, in Rural Economy, a term provisionally applied to small well-buckets, and thofe of some other kinds.

STOR, in Geography, a lake of Sweden, in the province of Vefjarla; 6 miles S.W. of Gefle. —Also, a lake of Norway, in the province of Aggerbuu; 40 miles N.E. of Chrifhania. —Also, a river of Mecklenburg, which runs from lake Schwerin to the Elbe. STORA, a town of Sweden, in the government of Vafu; 20 miles S.E. of Chrifhianfand. STORA. See SGIOTA.

STORAX-Tree, in Botany. See STYRAX.

STORAX, official, in the Materia Medica, is the rufinous drug, obtained in perfection only from thofe trees that grow in Aftratic Turkey, which influes in a fluid flate from incifions made in the bark of the trunk, or branches, of the florax-tree. It is brought from Turkey, but is fo adul-
terated, that it is very difficult to meet with any that is pure. It has a moll pleasing fragrant odour, and is called fylax colatim, because it is said to be transported in hollow canes; or, according to others, because it exudated from the tender twigs and young shoots of the tree, and coated them.
them over to a reed or other hollow cylindrical body drawn over the twigs. Two kinds of this reed have been commonly distinguished in the flouses: viz. the pure and the common floras; the first, or pure, is usually obtained in irregular compact masses, free from impurities, of a yellowish or reddish-brown appearance, and intermixed 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 "flora in the lump," "red floras," and the separate tears, "flora in the tear." The common floras is found in large masses, very light, and bears no kind of external resemblance to the former floras, as it seems to be almost wholly composed of dirty saw-dust, merely caked together by the resinous matter; and though much less esteemed than the pure kinds of floras, yet when freed from the woody part, it is paid to polishes more fragrance, and to be superior to the other kind. Rectified spirit, the common menstruum of floras, readily dissolves the floras, which may be impregnated to a solid confidence in the manner directed for the "flyras purificato" in the London Pharmacopæa, without substantiating any considerable loss of its sensible qualities.

Common floras, infused in water, imports to the menstruum a good yellow colour, some trace of its smell, and a slight balsamic taste. It gives a considerable impregnation to water by distillation, and strongly diffuses its fragrance when heated, though it scarcely yields any essential oil. The spirituous solution, gently diffused off from the filtered reddish liquor, brings over with it very little of the fragrance of the floras; and the remaining infusion is more fragrant than the finest floras in the tear, which Dr. Lewis says with.

The pure resin diffused without addition yields, along with an empyreumatic oil, a portion of saline matter, similar to the flowers of benzoin; and Dr. Lewis says, that he has also sometimes extracted from it, a distillation of the same nature by coction in water.

Among some of the ancients, floras was a familiar remedy as a solvent, and particularly used in catarrhal complaints, coughs, asthma, menstrual obstructions, &c., and from its affinity to the balsams, it was also preferred in ulcerations of the lungs, and other states of pulmonary consumption. And our Pharmacopæas formerly directed the "pluâ e floras" (see Storax Pills); but this odorous soup has now no place in any of the official compounds; 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. Med. Woodville's Med. Bot.

Storan, Liquid, is a resinous juice, obtained from a large tree, with leaves like those of the maple, called by Ray "floras ascrius folio," by Linnæus "liquidambar florasiflua," 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 floras to be obtained by boiling the bark or branches in water. See Liquidambar.

Two sorts of liquid floras are distinguished by authors: one, the purer part of the resinous matter that rises to the surface in boiling, separated by a strainer, of the consistence of honey, tenacious like turpentine, of a reddish or ash-brown colour, moderately transparent, of an acrid unctuous taste, and a fragrant smell, resembling that of the solid floras, but somewhat disagreeable; the other, the more impure part, which remains on the strainer, untransparent, in smell and taste much weaker, and much more commonly confused with the substance of the bark. That which is commonly met with in the flouses under this name, Vol. XXXIV.

is of a weak smell and a grey colour, and is supposed to be an artificial composition. Liquid floras has been chiefly used in external applications. Among us, it is at present almost wholly in difuse. Lewis's Med. Med.

Storax, White. See Balsamum Peruicinum, under Balsam.

STORICA, in Geography, a town of Poland, in the pralatinate of Kiev; 24 miles S.S.W. of Bialacevick.

STORCK, Anthony, in Biography, a medical professor of considerable note at Vienna, succeeded the celebrated Van Swieten in the office of physician and director of the college 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 studious course of experiments relative to the operation of various narcotic vegetables, and to the bel mode of preparing and administering them. The vegetables of which he has treated in various tracts, are the hemlock, henbane, farronum,acenit, meadow-saffron, and pulsatilla nigrae; and although he was disposed to over-rate the efficacy of some of these substanices, and has ascribed to them virtues which sublimate 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 sublimately undergone several editions and translations in other countries. He was also author of a collection of cards which occurred under his observation in the hospital at Vienna, entitled "Annum Medicus, quo MS. luptant Obserbationes circa Morbos acutus et chronicus," 1759; of which he published another "Annum Secundum" in 1761. This work was afterwards continued by his successor, Dr. Colin. In 1775, he published a volume, entitled "Institutn Facultatis Medicæ Vindobonensis," Eley Dict. Hist. de la Méd.

STORDALEN, in Geography, a town of Norway; 28 miles N.E. of Drosthen.

STORE, a town of America, in North Carolina; 30 miles W. of Exeter.

STORE. Bill of Store. See BILL.

STORE, Naval. See NAVAL.

STORE-House. in Agriculture, that sort 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 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 fortres are constructed for the preservation of all sorts 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, in which are kept different sorts of farm articles. These rooms should be as dry as possible, and perfectly secure from vermin. An upper floor is the
belts 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 fials, anchors, cordage, & c.

Store-Magier, in Agriculture, a term applied to that kind of farmer who is, in a great measure, in the live-stock kind of farming in some way or other, as either by means of sheep, neat cattle, or some other sort of domestic animals.

Store-Ship. See Store-Ship.

STOREA, among the Romans, a kind of basked made of ropes or rushes, for gathering flowers or garden-fruits.

Storea was likewise a kind of defence, made of large cables fashioned into a fort of netting; which was so strong, that no weapon, though thrown out of an engine, could penetrate it.

STOREGE, Στοργη, a Greek term, frequently used by naturalists to signify that parental instinct, or natural affection, which animals bear toward their young.

The storege 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 acuteness do animals nurse 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 left then at greater distances, to dodge and draw them off from pursuing their young.

With what concern do others look about their young in places of safety? and some even admit them for shelter into their bodies. Thus the opossum, Dr. Tyfon observes, has a curious bag on purpose for securing and carrying about her young. The same author adds, from Oppian, that the dogfish, 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 squinna and glaucus do 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 their creatures? and still in proportion, as they grow up, and become fit to look to themselves, this storege 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 fodder awhile in her prolapse. And Clufius observes, that the old female Ethiopian 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 considerable. Pliny fays 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 flit 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 inhabituate their unplummed 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. 62° 32'. E. long. 17° 13'.

STORHOLMEN, a small island on the W. side of the gulf of Bothnia. N. lat. 62° 33'. 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 lofs in this way has been found to be from one-twelfth to one-tenth of the whole in different sorts 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 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 and 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 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 lat 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 flue. 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 forts 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 soil, with the stalks and leaves to them, the latter being carefully doubled over and lapped round the heads, instead of hanging them up in fields or other places, as is the usual practice in preparing them. In performing the work, it is begun at one end of the pits, laying the heads in with the root-stalks upermost, so as that the former may incline downward, 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 fort of ridge, and beaten quite smooth with the back of the fpade, 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 sub-fledged some feet, 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 fluffed with straw, and the surfaces of the ice covered with the fort of material, cave-boxes, dry ware, cauls, balkets, or any other such vessels, are to be placed upon it, which are then to be filled with the roots, such as turmips, carrots, beets, celery, potatoes in particular, and some others.

In cales where there are not ice-houses, vegetation may be greatly retarded, and the roots preferred 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 flored and preserved, it is said, by earthing them in small parcels, as about two holls 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 fpade. 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 flate of the weather may be. And where the pits or heaps are not in the shade, it is sometimes proper, when the seedon 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 tabile until the end of September, or till the succeeding crop becomes perfectly ripe, so as to be used without loss, as that must always be the case where the roots are largely employed before they are in a flate of mature growth. It is affited, too, that in this manner potatoes are even capable of recovering in plumpness and talt, 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 clas. See HERON.

Naturalists have been much puzzled in ascribing the winter abode of storks. Many authors have supposed that they go to the Nile at this season 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 autumn 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 controverts 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 till 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 every day into a dou-wanne (according to the phrase of the people), are said 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 favored than the ibis was among the Egyptians; and no less profane would that perfon be deemed, who attempted to kill or molest it. The regard paid to these birds, Dr. Shaw imagines, may probably have arisen, not so much from the service they perform to a moit fenny country, in clearing it of useless reptiles and insects, as from the solemn geometrical calculations they are observed to make as often as they rest upon the ground, or return to their nects. Shaw's Travels, p. 428, fol.

STORKAGAT, in Geography, a town of Sweden, in the county Bothnia; 25 miles S. of Pitea.

STORCO, a small island on the E. side of the gulf of Bothnia. N. lat. 63° 52'. E. long. 22° 39'.—Als, an island in the Baltic, near the S. coast of Sweden. N. lat. 58° 15'. 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 Wasta; 17 miles E. of Wasta.

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, storks of these kinds are very prevalent, and highly hurtful in different ways. In the sheep farms in the northern parts of the island, storks are often extremely hurtful and destructive to the sheep. They are the most fatal to these animals, it is said, when the frost is keen, the wind strong, and the snow light and mobile; as then the defecated flocks move before the blast, into some hollow part or place, where they find a little relief from the piercing storm, but are soon covered up deep with drifted snow; and when long confined beneath it, many of them perish, and those which survive are often much reduced in condition, and sometimes have lost part of their wool. And should 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
Smooth green hills, that are defluent of rocks, woods, or other shelter, are, it is thought, the most 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 consumed with the cold, and over- blown by the drifting snow. Stone boulders are also useful; but the true and effectual shelters are, it is said, plantations of forell trees, to which the sheep naturally fly on the approach of storms. See Sheep.

STORMAY, in Geography, a bay on the south coast of New Holland, between South Cape and Taffman's Head.

STORMCAPE, is the northern limit of the mouth of Bay Verte, and forms the fourth-calf corner of the province of New Brunswick.

STORM-FINK, or Storm-Finch, in Ornithology. See Procellaria Pelagica.

STORMAR, or STORMARIA, in Geography, a district of the duchy of Holllin, of which Hamburg is the capital. The Stoor, whence it derives its name, confines this district on the north, and separated it from Ditmarfia: the Sunla, Trave, and Billa, determined the rest of its extent. It was formerly almost one slimy marsh. The wet and low situation of Stormaria and Ditmarfia 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 forum, a metaphor expressive of the feditions of its inhabitants; but Stoor, the river, and Marf, the residents in marshes, seem to compose a jufter etymology. Adam distinguishes the Stormarii by the epithet "nobiliores." 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 folitudinem reducata." Stormaria was one of the three districts which anciently divided Norderland, or Eald-Saxon; Ditmarfia and Holllin being the two other districts. These were the countries in which our Saxons ascended, when the Roman geographer (Ptolemy) first noticed them; and from these 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 Osnabruck, and west by the late township of Williamshurg, 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 county lies fronting the St. Lawrence.

STORNIA, in Ancient Geography, a town of India, on the other side of the Ganges, belonging to the people called Tangani, according to Ptolemy.

STORNARA, L.A., in Geography, a town of Capitanata; 9 miles N.E. of Acoli.

STORNAWAY, a parochial town on the eastern side of the isle of Lewis, and shire of Ross, Scotland. It contains a good and well-frequented harbour. The parish is of great extent, and stretches about ten miles north-west, along the north side of an arm of the sea, called the Broad Bay. In this, ships of large burthen have good anchorage, and can ride with safety, as no heavy sea can come into it. The town of Stornaway is situated at the extremity of both 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 sails weekly with the mail and passengers. The houses of the town are generally well built, and, in 1811, amounted to 698, with 3300 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 Kintail, and lord lieutenant of the shire.—Carlilie'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. 62° 45'. E. long. 17° 58'.

STOROZEVOI, a cape on the north coast of Russia, in the fritis of Vaigatkoii. N. lat. 69° 25'. E. long. 86°.

STORSIO, a large lake of Sweden, in the province of Jamland; containing several islands, on which is the town of Profon, and on another the town of Nordter. It has a communication with many other lakes and rivers, and by means of these with the gulf of Bothnia. N. lat. 63° 16'. E. long. 14° 10'.

STORSKAR, two small islands on the east side of the gulf of Bothnia. N. lat. 63° 17'. E. long. 20° 32'.

STORT, a river of England, which falls by Bishop's Stortford, &c. and runs into the Lea, 2 miles N.E. of Hoddesdon.

STORTA, LA, a town of the Patrimon, near the ruins of the ancient Veii; 6 miles N.W. of Rome.

STORTFORD, Bishop's. See Bishop's Stortford.

STORNIA, the name of an instrument used by the ancients for drawing blood from the nofe; but we are not perfectly informed of its shape or structure.

STOSSEN, in Geography, a town of Saxony, in Thueringia; 6 miles S.E. of Naumburg.

STOT, in Rural Economy, a provincial term applied to a feer, or young growing bullock.

STOTTFIELD 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 Fuellen.

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 particularly 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 fire-places, from the fire being included within the stove, and giving out its heat through the sublance 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. Fire-places, on the contrary, have the fire as open and as much exposed as possible, conveniently 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 contruction of their fire-hearths, 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 flaves, 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 habitation. 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 still placed below. It appears, however, that this was the origin of flues for smoke, and even of flaves; the situation and proportions of which have successively undergone an infinity of changes, according to the localities, the wants of the inhabitants, and the fashion of the decorations.

The ancients had the custom of heating apartments by fire plaques under arches or vaults; but this was confined to palaces, and other edifices, where magnificence was augmented by prodigality; and the vestiges that have been discovered among ancient ruins, sufficiently point 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 chimney 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, join 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 bit-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 flave used in China, and called hang, is briefly described under that article.

Francis Keßlar of Frankfort, whose work, entitled "Épargne-bois," &c. (the Wood-saver, &c.), appeared, in French, in 1619, is the oldest writer who deprivers to be quoted, as having proposed any useful ideas on the subject of flaves. 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 aërical, to feed the fire; and there was another aperture to draw air from the apartment for the same purpose.

Savot, in his "Architecture Française des Bâtiments particuliers," i.e. Architecture of private Houses, printed in 1625, gave some advice relative to the belt method of constructing chimneys, but with scarcely any object than to prevent their smoking.

M. Daleime, in 1686, suggested the first idea of a flave without smoke, which he called furnus aequos. Here the smoke is forced to descend into the fire-place, where it is consumed. Dr. Franklin, who afterwards executed a very complete flave on that principle, still spoke of it, in 1773, as a mere-curiosity or philosophical experiment, as it required too much attention to be managed by common servants.

This machine consisted of a tube of iron-plate, such as is used for the flue of a German flave. This tube was bent at right angles, and the part which was horizontal was about two feet in length, and joined to the side 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 grating, upon which the fuel was placed; and the grate prevented the fuel falling down into the horizontal tube. To light this flave, 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, which had been thrown into flame, which, after destroying the offensive smell, comes out at the end of the longer tube, as more heated transparent gas or vapour.

Whoever would repeat this experiment with succefs, must take care that the part of the shorter 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 Transctions 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 Wurttemburg in 1723, which describes, among a great variety of other flaves for warming of rooms, one which seems to have been formed on the same principle. It was probably taken from the hint thereby given, though M. Daleime's experiment is not mentioned; for the construction is as nearly as possible the same, except in the proportions of the parts; the furnace being made in the form of a basin or vase, having the grate in the bottom of it.

Gauger, author of "La Mecanique du Feu," &c. printed at Paris in 1709, was the person to whom we are indebted for the first and most complete syllabus 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 fend off the heat in elliptic curves.
curves. We there find a description of a chimney, with
the back, the larch, and the jambs, of hollow iron, to
beat the air that is to enter the room. But it does not ap-
tear that this work produced much effect at the time; the
most important truths lie concealed in books, till some
preventing interest awakens the attention of mankind to their
utility.

Dr. Franklin, in 1745, published an account of the new
floes of Pennsylvania; the advantages of which he com-
pares with those of the floes of Germany and Holland,
and the chimney of Ganger. A description and drawing
of this floe are given in our article Fire-Place.

In 1785, Dr. Franklin published the description of an-
other floe, which has the flame reveried; that is, it
palies downwards through the fuel. The appearance of
this floe is that of a vase of cast-iron, with its pedestal;
and this is mounted upon the top or lid of an air-box, fit-
ting upon the hearth of the fire-place, and built close in
niches in the stone-work: but the vase being wholly de-
tached from the back of the niche, has a very neat ap-
pearance. 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 brass 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 ilam or foot of
the vase into a hollow iron box, forming the pedestal. At
the bottom of this pedestal is a grate in the lid or top of
the air-box, upon which the vase stands. The air-box is di-
vided by four partitions, between which the smoke palies and
repalies horizontally in a waving direction, until it escalate
into the chimney. Thus the smoke and flame, immediately
after it has defended through the grate in the top of the air-
box, palies 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 those 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 flided back, expose the spaces between the par-
titions, 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
vafe, upon which the fuel contained in the vafe 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 vafe into the hollow
pedestal, and through the grate in the top of the air-box;
it then palies 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,
each part of it turns to the right, and palies round the farther
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 furnaces 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 palies to the left, round the far end of the
middle partition, round the near end of the outside partition,
STOVE.

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 floor with soap-les and a brush, rinsing it with clean water.

The advantages of this reversed 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 flame 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 flies, 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 masts of foot that a few weeks' firing will lodge against the sides of the chimney; and yet this is formed only of those particles of the column of smoke which happen to touch the sides in its ascent. How much more must have palled off in the air? And we know now that this foot is fill fuel, for it will burn and flame as fresh; 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 extinguished. Smoke must have a certain 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 side 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 funnel; you will find it very little: and yet that smoke has in it the substance of so much flame, and will instantly produce it, 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 we 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 fires made in this stove 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; but 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 vane, a kind of inverted pyramid, like a miller's pepper; 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 means of 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 funnied of a burning candle, which, while enveloped in flame, and thereby prevented from the contact of the palling air, is long continued, and augments instead of diminishing, so that we are often obliged to remove it by the funnied, or bend it out of the flame into the air, where it pretently consumes to affection. He then supposed, that to consume a body of fire, palling air was necessary to receive and carry off the separated particles of the body: and that the air palling 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-luted crucible, which, though long kept in a strong fire, comes out unconfused.

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 floves in preference to open fires, when they burn pit-coals. Dr. Franklin completed the stove just described in 1771, and used it in London during three winters. While he was in France, he contrived another grate for burning pit-coals, which has the same property of burning the smoke, and at 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 back-plate: it is one foot (French) in diameter, and eight inches deep or long between the bars and the back: the sides and back are of plate-iron, the sides 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 sides do not meet at either the top or bottom by eight inches: and this square space is filled with grates of small bars, crossing from front to back to 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 sides, across the centre of it: the pivots are supported by a crotchet, the item 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
are fixed small upright pieces, about an inch high, which, as the whole is turned on its pivots, flop 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 giver of warmth to our fires. 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 stuck in below among the red coals, have their smoke fo heated, as that it becomes flame as fast as it is produced, which flame rises among the coals, and enlivens the appearance of the fire. Here, then, is the use of this tivel-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 preferred from consuming. This construction, though not to complete a consumer of all the smoke as the vale, is yet fitter for common use, and very advantageous; it gives also a full light 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 preferred full to one jall 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 understood 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 at all. By the hollow base with which his stove-grates 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 cloyed by the aforementioned frame and plates, and the stove stand before the fire-place, and the smoke be carried off, by the help of a circular elbow, into the chimney above the mantle-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 circumstantial 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, libraries, 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 it can be not taken to supply it continually with wood, &c. the heat it produces is hardly sufficient, because it follows the current of the air, and is carried off by the smoke. These 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 fix times the quantity. For it was not sufficient that the inhabitants of these severe climates should discover the most simple 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 fulfil 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,
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 or holes through which the smoke enters into one chamber from that beneath, are, in all cafes, made at the corner of the chamber, opposite to the passageway 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 stoves early in the morning, and with a small quantity of fuel, retains 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 diffused 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 stairs, 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 houses of private persons. To this it may perhaps be objected, that the heat produced from these stoves is unhealthy, 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 great weight, if we had not the example of the Russians, the Swedes, the Danes, the Germans, and in short of all the inhabitants of the north of Europe, to shew that those who are habituated to such stoves, do not find them unhealthy. 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 infensibly evaporate, and restore to the air that 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 memoir is translated in the Repository of Arts, 1th 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 consumed 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 fuliginous 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 in its passageway 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 absolutely 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 preserved without being too diffused from the space to be warmed, so that the heat it there deposits, 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 so far confirmed as to give no more smoke, it is advantageous to close the mouth of these chambers, 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 that comes 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 bouclés de chaleur (mouths or apertures of heat); because, instead of contemplating their principal use and intention, it is commonly imagined they are only made in order to give by their inflows a more rapid current to the heat produced. Nor is this idea absolutely devoid of foundation, since the air that inflows from them has only changed its temperature, by carrying off a portion of the heat that would have remained in the interior. Those, however, who would proscribe them, as opposing 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 flue, 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 indisputably requisite, if we could avoid being exposed to currents of cold air. Dr. Franklin very justly quotes a Chinese proverb to this effect: “Shun a current of air from a narrow passageway 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 those which are in common use in the halls and cellars of our great houses are French stoves. They differ from the others in having a very great length of small flues or windling passageways, 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 passageways are very liable to become clogged with foot; and
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 become coated with soot, do not conduct the heat so rapidly, and in consequence, a great part will chill 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 iron stove, which has a flue proceeding from the top, the fire-place and all-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 stove. Its conveniences are, that it makes a room warm all over, for the chimney being wholly closed, except the flue of the stove, very little air is required to supply that, and therefore not much rubbish in at crevices, or at the door when it is opened. Little fuel serves, the heat being nearly all saved; for it radiates almost equally from the four sides, and the bottom and top, into the room, and presently 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 stove, and is there 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 constantly passing, 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 night-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 fight of the fire), unless in some workshops, where people are obliged to fit 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 the crevices, because there is no discharge of air which it might supply, there being no passage from the flue from the room. These are its conveniences. Its inconveniences are, that people have not to much fight or ufe of the fire as in the Holland flues, and are moreover obliged to breathe the same unwarmed air continually, mixed with the breath and respiration from one another's bodies, which is very disagreeable to those who have not been 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 left in use in England than that which we have before decribed, 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 floor which is found to answer extremely well; it consists of what is called a cockle, that is, a square chest or vessel of iron-plate, riveted together in the manner of a boiler, and let in a furnace, so that a fire can be made withinside of it 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 of 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 above, 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 ceiling.

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 stove, 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 wafted by the draught of air for the support of the fire, as is usual in stoves 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 waft of which is supplied by the exterior cold air, which comes pouring into the room at the
bottoms of the doors, or by the sides of the windows, and thereby undeal 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 flues 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 joints, (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 palling 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, lardar, or stair-case, and the flame end will be gained, with this farther advantage, that such cellar, or other apartment, will be always well ventilated, and prevented from acquiring or retaining any unhealthy or disagreeable smells.

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 hurried up the chimney, while, at the same time, all the advantages of open grates may be enjoyed.

The form of Mr. Burns' flue is that of a vase 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 vase are made close, to prevent the entrance of air to the fire, except that which palls up from the air-tube through the hollow pedestal; and within this pedestal is an air-valve, which opens and shuts by a regitler, to regulate the entrance of the current from the open air. In the pedestal of the vase is a drawer, to receive the ashes. The niche or chimney in which the vase is placed, has the usual opening at top to carry off the smoke. The air for the support of the fire enters from the external air, through the tube or air-pipe before described, and palls into the hollow pedestal of the vase; and having passed through the hollow neck or stem of the vase, it finds no difficulty in palling 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 glas taic or iron-work fence or fencce, to prevent those dreadful accidents which frequently occur of ladies' or children's clothes being set on fire by sparks from the grate. Where this safe-guard fence or fencce is wished to be applied, the inside 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 flue 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 fresh fuel, or when the drawer with the ashes is to be removed. The fence is a framework 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 leaves 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 purpofe of guiding the upper part of the frame of the guard. The glas with which the frame of the guard is lined may be flamed or painted; complete safety is thus 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 a 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 purpose. But whichever of these ways be followed, or whatever other method of construction (for it may easily be varied to answer circumstances), rollers or catthers 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 liang above-mentioned. Where either the glas or the wire-work frame, or both of them, are meant to be applied to square 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 jams, of such chimneys; or the fence may be made to ride, by means of pulleys, into the wall above the opening, or be slid sideways into the walls at the fides of the openings.

Besides the advantages already pointed out as connected with them, these flues posses all 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, as in close flues, for these grates have slide 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 smalleft apartment; for when their full effect is wanted to be procured, it is only necessary to keep the fence in its receds, that even that portion of heat which would be kept back by the interposed glas or wire-work, may be thrown out into the room, and perform its office.

In 1804, Mr. Joshua Jowett of London obtained a patent for a very similar contrivance, which he called a fire-guard flue, which is intended to prevent accidents from sparks of fire flying out. The flue 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 flue or grate is supported upon a vertical iron bar, which is in the centre, or axis of the cylinder, which forms the flue, 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 include the
STOVE.

the fire, or it can be turned round behind the flue out of sight.

The fire-guard may be fixed to any flue which will admit of two centres or pivots being placed in a perpendicular line in the back of the flue, to support the fire-guard, and guide its motion; and the flue 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 flue by means of two lever-cranes, one end of which is fixed to the guard, and the other end of each to the centres or pivots, by which the guard sways in a rotary motion, passing through a groove formed in the flue on either side, to swing from the fire when required, and is brought into use by means of a handle or nob, 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 check or back of the flue, 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 flue, or by means of the combined force of the spring and balance.

Mr. Allan Pollock took out a patent, in 1807, for a flue which is very similar to the Swedifh flues, having chambers through which the smoke is facel'v conveyed, and gives out its heat to the air of the apartment in which it is placed: in addition to this, the flue is made to give a constant current of warmed air; for this purpose, the cold air is made to enter and circulate through winding passages, situated in the back of the fire-plate, or space in which the fire burns, and the fume 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 flues are made of cast-iron; but, to prevent the air receiving any taint from passing in contact with the hot iron, Mr. Pollock proposed to apply a composition to the cores of the moulds in which the pipes are to be cast, which composition will become vitrified by the heat of the melted iron, when the fume is poured into the mould, and will form a glassy or vitrified lining to the tube, and prevent the actual contact of the air with the iron. These flues answer very well.

A very important improvement in those flues-places for burning coal, which are generally called bell-stove flues, has been lately made by Mr. John Cutler of London, for which he had a patent in 1815. The flues constructed by him are nearly such as are known by the name of register-flues, 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 regiler, at the upper part of theinclined space. Mr. Cutler's improvement consists in applying to such grates or flues a chamber, or magazine, situated beneath the grate (or the space inclined 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 axle, 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 burning fuel, and be thereby 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 foamy atmosphere in which it is hidden would be so 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 smoke contained in the flue is avoided; also chimneys which throw out smoke into the room will, in almost all cafes, 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 coals, 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 doublets occasioned by fires left unextinguished.

The machinery for raising the moveable bottom of Mr. Cutler's flue is very simple. The magazine-chamber is composed of iron plates screwed 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 plate 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 pass over the top of the flue, 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 flue; 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 rises from the coal rifies through the fire, and is thereby consumed.

Mr. Cutler has made a great number of these flues, 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,
rooms, &c. by a continual introduction and exchange of dry fresh air. These flues are called American, because the first patterns in call-iron upon this principle were the invention of Dr. Franklin, who then resided in Philadelphia.

See Fire-Places.

STOVES, Dutch and German. See Fire-Places.

STOVE, in Gardening, a sort of garden-building or erection, constructed with brick-work behind and on the north, as well as partly in front, and roofed wholly with glais fashes to the south; being furnished internally with a pit, or long, wide, deep cavity, for a bark hot-bed 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 also enabled to forward many hardy plants to early perfection, such as various sorts of curious flowers, fruits, fidal-g-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.

There are different sorts of flues used occasionally for different purposes: as the bark-flue, for common use, which has both a bark-bed and flues; the dry-flue, for particular succulent plants, &c. which is furnished only with flues for fire-heat, having no bark-bed; the forcing-flue, 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 sort of flue, 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 succeed best when placed 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 stationet mollly 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 desigued 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 glasses the better, particularly strawberries, but good early kidney-beans may be raised in almost any part of the flue. 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 flue is sometimes called the moist flue.

The second sort of flue, from its affording a dry heat, is intended principally for the culture of very succulent tender exotics of pachet foils, that require to be kept always dry. Where there are large collections of this sort of plants, it is very useful to deposit the moist succulent of them in separate flues, for fear of the others, which perhaps more freely, occasioning a damp air in winter, which may be imbied by the succulents, and injure them, as being impatient of much moisture, particularly in that

feason. In this kind of flue, movable frames or shelves are erected above one another, on which to place the pots of plants, such as the tenderer sorts of aloes, cereales, euphorbias, melon-thistle, and other very tender succulent plants, &c.; but most of them may be cultivated in a common flue, with proper care.

The third sort of flue is sometimes used principally for flowers, as is common about London, to force large quantities of early roses, pinks, and numerous other flowers for market, at an early season; others are intended principally for fruit-trees; and some serve both for forcing flowers and fruits, and several sorts of small plants, such as strawberries, kidney-beans, &c. so that they confit of two kinds, which are a bark forcing flue, furnished with a bark-bed and flues; and a fire forcing flue, having only flues for fire, without any bark-bed: the former of which is constructed like a common bark-flue, 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 early as 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 roses, pinks, dwarf tulips, hyacinths, narcissi, honey-fuckles, 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 balfamines, &c. may be forwarded in it: likewise pots of strawberries, dwarf cherries, and other small fruits, plunged either in the bark-bed, or placed any where towards the glasses; also pots or boxes of kidney-beans, falling, &c.

But besides these large flues, it is necessary to have what are called fuchsia flues, and small pits for striking, forwarding, and nursing the plants in, while they are in their infant state of growth, especially when the collections of them are large, in order to prevent the large flues from being uselessly filled with improper or unproductive plants, and for the purpose of greater convenience. The pits serving to strike the plants in, and the fuchsia flues for placing and continuing them in afterwards, until they become ready and fit for fruiting or setting into the large flues.

Stoves are constructed in various ways, and of many different sizes and forms, so as to suit the sorts 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 suitable length, and eight, ten, twelve, or more in width, having from two or three to six feet of height in the front. Very lofty or capacious flues are but rarely wanted.

The most economical form of flue, Mr. London supposes, is that of a parallelogram, placed from east to west, of glass fashes on the south side, roof, and ends; and facing 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, glasses on all sides is precarious, especially in the northern parts of the island. Stoves of the dry kind are kept of a temperature, in general, between fifty-five and seventy degrees Fahrenheit's scale, and moist flues 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 those materials, as in the usual culture of the pine; but pits filled with earth, and managed in the manner prescribed 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 several plants which are raised or managed in them, and under some other heads. Befide, most of the late improvements in the flowers of them, which are the most material parts, will be seen below.

The succelion flowers 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 flinging glass in different ways, according to circumstances, but moley in the manner of the principal flowers, especially in the former.

The striking and nurting pits seldom need be of any large dimensions, but have flinges somewhat proportionate to those of the succelion flowers, having flus and glass in the most part, only upon the top parts of them.

The season 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 shrub and tree kinds in particular, as if planted or potted the preceding year, or before, and they are well rooted and finely establisht 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 fame time trained in the requisite order: thofe 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-side, have the flumes trained in through small holes, and conducted up under the floping glass: but such plants as are to be raised from seed, shold not generally be bown till the time the pots are placed in the floue for forcing. When the plants, feeds, &c. have been properly arranged in these flowers, they are then set in motion by the bark-bed heat, and afterwards by making moderate fires on cold nights, and on days occasionally, in very fever weather, to support a confluent 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 seafon in the open air.

But thofe of the latter kind, or fuch flowers as are worked by fire-heat only, are moley used for forcing fruit-trees, having the whole or moft 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, allotting a raised border along the back part for the reception of the choicer fruits to be trained as wall-trees; and the main middle space for small standards of moderate growth: in thefe, the belt forts of apricots, peaches, nectarines, cherries, plumbs, vines, and figs: like-with any small fruit-plants, as gooseberries, currants, raspberries; also tufta of strawberries, which should all be fernt trained in the open ground to a bearing flate: 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 loweft forward; with pots of strawberries and low flowers upon shelves near the glashes; and the vines either within, towards the front, or wholly without, close against the front wall; and the flumes, or a ftrong fhoot of each plant, drawn in through a small hole made for each, either in the wall, or in the tumber of the front creafions; and the branches within trained up to the inside of the flopen glafs upon trellis-work: in the vines planted on the outside, it is necessary to guard the flumes in winter, especially some time previous to and during the forcing weather, with lay-bands wrapped clofly round them, also to lay some dry mulch over the roots, to protect the whole as well as possible, that the progres of the sap may not be much retarded by the external cold, and to promote its flowing more freely for the advantage of the internal growth of the vines, &c.

The feafon to begin forcing or making the fires in these flowers is in 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 utes fouged. In a communication from C. Lorimer, esq. to the Caledonian Horticultural Society, can-flues are strongly advised in the construction of such forts of houses. The flues 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 inserted 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 flame 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 slabs were made of a cylindrical or drum shape, all the length of the fame diameter, so that the ends would exactly fit one another, with about the half of the thickness of them taken off on the outside, for three-fourths of an inch each, in order to hold the plater. This would make the flue, it is supposed, look much neater and better on the outside, as the swelling at the joinings from the plater 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 must not have too much flame from the can-flues as from those of the old construction, but this, it is allerted, will not be found to be the case. As full as much flume has been railed by sprinkling the cans by means of a fine-rosed water-
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ing-pan or pot, after they have been sufficiently heated, as could ever be done by the flues of the former conduction.

In one instance, though the cans had been made of common clay, they stood 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 leaf injured them.

In consequence of the cans not being half an inch thick, it is evident, it is said, that they must 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 let 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, 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 at most three degrees of success, as he has since had the largest crops of grapes that have been there known upon vines of such an age: 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 every where 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 of 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 astonishingly fast.

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 the 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-heat fix 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 are capable of being beneficially employed for different other sorts 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 forced by flues, brick, or tile, is, it is said, very great indeed. On the bell authority, they are fluted to have been attended with remarkable success. Great crops, not only on those forts of vines which are considered the bell bearers, but on those which are less productive, such as the Frontiniac, have been afforded by means of them in many different cases and situations; in all of which, the grapes were not only fine, but as well-tasted 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 suppos'd, 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 fame 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 forxing culture in houses of this kind, may be considered 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 flues, has also lately been suggested, and communicated to the same society, by Mr. G. S. Mackenzie, as the result of careful experiment. Sir George having often been surprised at the cobt 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 vast number of plans for the purpose which are in use, in which have been proposed at different times, may be suppos'd difficult, or probably 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 poffefling 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 price, 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 cost of furnaces being constructed with glafs. He cou'd fee no reason or necessity for this; and it appeared plain, that a fold 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 glafs end and a glafs door. The next object which he had in view in this intention, and for which he defired a remedy, was the frequent occurrence of breakage, during the movement of the lathes in giving air; and he conceived it poiffible to have them always fixed, and yet to have ample means of ventilating the house. It was likewise confidered, that much expence 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.
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This and some other purposes are effected in the following methods. The training is done by means of a frame-work, which is set up at the distances of five 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 that may be required. In the front, there are fah-frames made to slide past 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 father 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 five feet on the back wall, which in such houses is fifteen feet high in that part, and two feet in height in the front one. Each vine in the division is trained to its respective trellis, and on half of the front fah, so that this method does not supercede, but is merely an addition to the common mode of training in such cases. The house that the inventor built some years ago on this plan, is, it is said, forty-two feet long inside; and part of it is separated for peaches and nectarines. The plan is twenty-four feet, which, by the ordinary mode, would, it is said, give a surface for training of about 1000 square feet. The addition which is proposed nearly doubles this, by adding about 950 square feet. It also allows of a great variety of vines being planted, so that there may be a sufficient number to choose from when they come to the bearing state. In large houses of this fort already built, by raising vertical trellises across them, many kinds of fruit, it is said, may be forced, for which, if we deem at present, there is no room, and many fine exotics be cultivated.

The flue on such a plan may, it is suggested, be conducted so as to have spaces for passing into the divisions, which, by contrariety at different places, retard the heated air in the higher parts, the advantages of which are quite obvious. The rest of the flue is low, but which can be managed in different ways.

It is affected from experience, that as good fruit has been had on the vertical crofs trellises, as under the glass, or on the back wall; and that it is this which only that could have induced the ingenious inventor to bring the plan into public notice. He has the intention, some time hence, to construct a house of this fort with partitions of brick instead of trellises; which last, however, look the best. But when utility and not appearance is studied, he should be inclined to give brick a decided preference, for many reasons; and among others, on account of the facility with which the temperature could be regulated. There is to houfes of this fort a small porch, the outer door of which is always shut before that of the house is opened, to prevent, when necessary, the rushing in of the external air.

It has also been suggested by R. Stevenson, esq. an able engineer, that the same principle which is employed in constructing the flues for heating drying-houses for different manufacturing purposes, may be usefully applied and employed in heating flues, vineries, and other forts of forcing-houses in gardens. From experiments and trials made in different houfes of the drying-house kind, with flues built and constructed in different manners, as with the fire-place at one end, and the flue six inches by ten, conducted under the floor, and made with tile-brick, the flues being made to cross several times under the floor, before reaching the chimney at the other end of the room; by which the smoke and heat were detained longer in their passage to it, and from traversing the whole of the floor, was confidently expected to raise the heat of the place to 1050 of Fahrenheit's scale; but it was found to be different, and with difficulty a temperature of from 60° to 70 could be raised and kept up; but that on the flues being removed, and crofs-walls of open brick-work made for supporting the floor, so that the whole space under it formed one large flue for the smoke and heated air, the same quantity of fuel put into the same fire-place as before, speedily raised the temperature to 150°, at which it could be maintained for any length of time, with the ordinary expenditure of fuel; and with the fire-place opened at one end of the house, and the flue carried to the other end, then turned and brought down the middle of the floor, and after being conducted a second time to the end of the house opposite the fire-place, communicated with a chimney which took off the smoke, the flue mesuring three feet in height, and two feet in breadth, made its evolutions in a space equal to the area of the building, and four feet in depth under the sole 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 thereby converted into one large flue, or chamber for heated air, which being made to influx from the joints left in the flone-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 14 in height from the floor on which the flues rest, is speedily raised to, and easily kept at, from 70° to 90° of the above scale, while the wet materials are hanging in it, and the shutters in the upper part let 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 as large flues as the circumstances of flues and other houses of that kind will admit, would not only be attended with great advantage in point of economy, as a very small fire would be sufficient to maintain the temperature usually required in such houses; but what is perhaps, it is thought, of more consequence, 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 that it is said, that the flues in general ufe 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 piffles 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 vineries, 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 houfes, and even the inclosing of gardens, where they are of the wall kind, to make the walls hollow, as well on account of such a mode of construction inclosing 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 anwering its purpose in the
STOUPEE, in Geography, a town of Lithuania; 33 miles E. of Novogrodek.

STOUR, a river of England, which rises near Haverill, in Suffolk, and passes by Clare, Sudbury, Nayland, Dedham, Manningtree, &c. forming a boundary between the counties of Essex and Suffolk, and runs into the German sea at Harwich.—Also, a river of England, which rises near Wincanton, in Somersetshire, and runs into the English Channel at Chittlechurch, in Hampshire.—Also, a river of England, in the county of Kent, which runs into the sea at Sandwich.—Also, a river of England, which runs into the Trent, 4 miles S. of Kidderminster, in the county of Worcesters.

STOUR HEAD, a cape of Denmark, on the N.W. coast of the island of Funen. N. lat. 55° 37'. E. long. 9° 48'.

STOURBRIDGE, a town, the name of which is derived from a bridge built over the river Stour, in the county of Worcestershire, England. Being for a considerable period a hamlet belonging to Swinford, it had, until the time of Henry VIII., a chapel dependent on the church of that place: but having now increased to a large and populous town, a chapel was erected of brick, in 1742, on the western side of the town; which, by act of parliament, has been made parochial, and independent of the mother-church. The various classes of Protestant Dissenters have also meeting-houses in this town. A free-school was founded by Edward VI.; but anterior to that reign, there appears to have been an establishment for a similar purpose: the present one is handsomely endowed, and is under the inspection of eight governors.

The manufactures of Stourbridge, which are aided by the vicinity of the Staffordshire canal, are various: the principal is that of glass, both in making and cutting of which, a great degree of elegance and ingenuity is shewn. This art, in which the English now excel, was not introduced into England till 1557, at which period the Venetians parfayed all other nations in the production of crystal looking-glasses. The other branches of manufacture here practised, are the procises of making leather from sheep-kins, iron articles and nails, and fine cloth from British wools. There are also mines of crucible clay, which afford ample employment to the town and neighbourhood. Stourbridge has a weekly market on Friday; two annual fairs, celebrated for cattle; and contained, according to the report of 1811, 866 houses and 4074 inhabitants.—Beautiful of England and Wales, vol. xx. Worcestershire, by Mr. Laird.

STOURHOLM, one of the smaller Shetland islands, between Yell and Shetland. N. lat. 60° 54'. W. long. 1° 35'.

STOURPORT, a town about four miles from Kidderminster, on the banks of the river Severn, and in the county of Worcestershire, England. Its origin is chiefly owing to the Staffordshire and Worcestershire canal, which entering this county at Wolverley, continues parallel with the river Stour for a distance of nine miles, and is terminated by a bascule at Stourport, where it joins the Severn. The houses of this place are commodious and neat, amounting to upwards of 250, with about 3000 inhabitants; and is also established a weekly market, which in the winter months greatly abounds in hops, with two annual fairs. Over the river Stour, there was erected a stone bridge at Stourport in 1773; but which having been destroyed by a violent flood, was replaced by the present one, of iron, consisting of a single arch of 150 feet span.

About two miles east is Hartlebury castle, once defended by fortificatious and a moat, and for many centuries past

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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 held by the parliament, but after the restoration, it was re-occupied by the succeeding bishops: it is a brick structure, with battlements, turrets, &c.—Beauties of England and Wales, vol. xv. Wor-
casterbiurn, 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 formed the design of composing 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 made a large collection. But wanting patrons, and pressed by necessity, he was obliged to intermit his favourite pur-
uits, and to renew his application to business with a pro-
erty 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, an information against him was laid before the council, in 1568, as a dangerous person, and as having pollu-
tion of many pernicious books of superstition. His study was searched by order of Dr. Grindal, bishop of London, and many popish books 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 desirous of taking away his life, preferred against him above 140 articles before the ecclesiastical commissary. But the infamous character of the wretches who were engaged to prove the charges, caused him to be acquitted. His first work, undertaken at the re-
quittal of the powerful favourite, Robert Dudley, earl of Leiceste, had been already published: and as it had been dedicated to the said nobleman, his countenance was of service to him in his present circumstances. This was "A Summarie of English Chronicles," first printed in 1565, and several times reprinted. This book contained an ac-
count of the reign of every English king from the era of the fabulous Britoe, down to his own time, with a list of 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 lost his best patron, archbishop Parker; but his mind was so ardently engaged in his antiquarian studies, that he prosecuted them with uninterriting diligence and zeal, amidst all the inconveniences and difficulties of penury. In 1585 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 fumaries, recording the memorable acts of famous citizens, and that he contemplated the publication of a larger fomary, and soliciting en-
couragement and assistance; and four years after he pre-
fented another petition, requesting a pension, or some other benefaction; but it does not appear whether or not he suc-
cceeded in his solicitations.

To the improvement of the second edition of the Chroni-
cles published by Hollingshed in 1587, Stow largely con-
tributed; 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 presented 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 Eng-
land he had been for 40 years collecting materials; but he only lived to print an abstract of it in 1600, entitled "Flores Historiarum, 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," men-
tioned by Stow, and which he left in his study fairly written out for the press. It is said to have come into the posses-
sion of Sir Symonds Dewes, but is not found among his MSS. in the British Museum. Stow having spent his patri-
mony, and acquired no certain income, sunk into wretched poverty 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 75th year, "to repair to churches, or other places, to receive the gratuities and charitable benevolence of well-disposed people." Of 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 71. 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 libe-
rality towards its own historian. Stow, oppressed by poverty and painful diseases, obtained a release in the year 1655, at the age of 80 years. His aspect is said to have been cheer-
ful, 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 in-
vestigating 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 clafs 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 885 inhabitants; 26 miles N.W. of Boston.—Alfo, a township of Vermont, in Chittenden county, about 25 or 30 miles E. of Burlington, containing 650 inhabit-
ants.

STOW CREEK, one of the eight townships into which Cumber-
land county, in New Jersey, is divided, containing 1039 inhabitants.—Alfo, a river of New Jersey, which runs into the Delaware, N. lat. 39° 58'. 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.

In the stowage of different articles, as ballast, cafks, boxes, cafks, and bales, there are several general rules to be observed, according to the circumstances or qualities of those materials. The iron ballast, which is mostly used in king's ships, should not be flowed too near the keelfon, but winged up from two to four feet from the sides of the keelfon, according to the make of the ships. Cafks which contain any liquid, are, according to the sea-phrase, to be hung-up and bilge-free, i.e. closely wedged up in a horizontal position, and reeling on their quarters; so that the bilges, where they are thickest, being entirely free all round, cannot rub against each other by the motion of the vessel. Dry goods, or such as may be damaged by the water, are to be carefully inclosed in cafks, cafks, bales, or wrappers; and wedged off from the bottom and sides of the ship, masts, and pum-pell.

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 laden so deep that the line of floatation 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 unskillfully flowed too near the bottom, it will place the centre of gravity too low; and although this will enable her to carry a great press of sail, she will nevertheles roll heavily, and consequently rule the handling 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, she would be cramped, that is, 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 overfetting.

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 amidships as possible, and the lighter part of it as near the masts as possible, also at the fore-part of the vessel, and likewise at the stern: hence, if the vessel be judiciously flowed, the will 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 mouths of the bags, which are securely fixed all round it, for the convenience of flowing the hops into them. See Hop.

STOWE, in Geography, a parish in the county of Buckingham, England, nine miles N.W. of the county-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 mansion on the estate; but this was taken down and rebuilt by Sir Richard Temple, K. B., who died in 1667. His son, Lord Cobham, enlarged the mansion by building a new front, and 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 pannels, cornice, and dome, are all adorned with sculpture and other ornaments, to produce a splendid effect. A large drawing-room, 50 feet by 32; a large gallery, 70 feet by 25; a library; and several drawing rooms, eating-rooms, &c, constitute the principal floor. A library, fitted up to receive Saxon MSS. and old literature, has recently been formed here from the deigns 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 450 acres, and present a great variety of surface, fenery, and objects. In some places they display bold swells, 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 these gardens are several ornamental buildings, consisting of temples, columns, arches, &c. The beauties and characteristic features of this jolly noted seat have been extolled in the poetry of Weel, Pope, and Hammond; and are fully described 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 taste ful style by T. Midland. An account of it is also given in the first volume of the Beauties of England and Wales.

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STOWEY, a small market-town in the hundred of Williton and Freemasons, in the country of Somerset, England, is situated eight miles W.N.W. from Bridgewater, and 149 miles W. from London, at the foot of Quaintock hills, on the banks of a rivulet, which paffing through Fiddington, falls into the Bridgewater river at Combe. The town consists of three streets, and was returned to parliament, in the year 1811, as containing 119 houses, occupied by 620 persons. A weekly market is held on Tuesdays, and an annual fair for cattle. Here is a small market-croft, of an octagonal form, standing on eight small round pillars, with a clock, and a bell, which is usually rung to proclaim the opening of the market-service, as the church stands a quarter of a mile from the town. "STOWEY is a reputed borough, the inhabitants whereof anciently held their houses 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 none vestiges remain of either but the castle-ditch; the site of the castle being pature-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. Col- linson's History of Somersetshire, vol. iii. 470.

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 1761 inhabitants; and by the report of 1811, these appear to have increased to 2006 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 steeple 120 feet high, which, though of wood, has a light and neat appearance. In this church are interred several of the Tyrrel family, of Gipping-Hall, in this hundred. Here is also the monument of Dr. Young, once vicar of this place, and tutor to the immortal Milton. The contiguous parish of Stow-Upland, which has neither church nor chapel, is now consolidated with Stow-Market; but they have still different officers for each parish.

The county meetings for Suffolk are chiefly held in this town; and here is a manufacture of facking, ropes, twine, and hempen, which has succeeded that of stuffs and bombeazes. Being well situated for the barley trade, the market of this town is much frequented by the farmer, and much busines is done in the melting 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 whole expense of this undertaking was 26,380l. Independently of its utility, this canal is an ornament to the town. There are about 150 acres of hop-plantations in this neighbourhood.
An old manor-house, called Abbots' Hall, together with the manor of Stow-Market, were given by king Henry II. to the abbey of St. Olyth, in Elfrith; but was granted, 38 Henry VIII., as part of the poffeilion of that monaftery, to Thomas Darce. 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 expense of more than 12,000l., and was opened in 1781.

Finshull, near Stow-Market, was the birth-place of Sir William Coppinger, 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.

Finborough-Hall, in the parish of Great Finborough, was built in 1705, by the present proprietor and lord of the manor, Roger Petteward, 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 refided and is interred here. He was born in 1659, at Coton Clanford, 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 Tyrrel, whose residence, Gipping-Hall, is now held by Sir John Shelly, bart. Haughley 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, conjectured to have been built by the Saxons. The figure of the building approaches to a square, fortified with a deep ditch, or moat; and, except on the north side, a proportionable rampart, still entire. Towards the north, upon a high artificial hill, of 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 Haughley 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 formerly professed a power of trying all causes in his own court of oyer and terminer. Beauties of England and Wales, vol. iv. Suffolk, by F. Shoberl.

STOW-ON-THE-WOLD, a market-town and parish in the hundred of Wiltshire, 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 wind-mill 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 abbey of Ewelham, by which establishment some 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 Mangersbury, 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, 81 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 end 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 Hatlings Keyt, of Edington, 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 school; both situated on the south side of the church-yard. The former was founded under the will of William Chaftre, dated as early as the sixteenth of Edward IV. Althorne, or Ethalmore, earl of Cornwall and Devon, in the tenth century, is the reputed founder of the original church in this town, and it is also said to have erected an hospital here, which Rudder mentions as being yet charged in the Fitch-fruits office with the annual sum of 13l. 4s.

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 shoes.

At Adelotrop, 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 Ewelham, 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 Income-camp.—Beauties of England and Wales, vol. v. by J. Britton and E. W. Brayley.

STOWRE, in Rural Economy, a term signifying a round of a ladder; a hedge-stake; alfo the flaves of the sides of a waggon, in which the caue-rings are faffened. It alfo signifies a iaff or round fick, fuch as a tuck or rack iaff.

STOWS, in Mining, are seven pieces of wood, fet upon the surface of the earth, faftened together with pins of wood. See Spindie.

STRABANE, in Geography, a poll-town of the county of Tyrone, Ireland, situated on the river Moune. 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 2395 inhabitants.

STABISMIUS, in Medicine. See Squinting.

STRABO, in Biography, a celebrated geographer, was born at Amasia, a city of Pontus, but in what year we cannot ascertain. From his acquaintance with C. Gallus, prefect
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 Bishop 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 great 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 interperses many philosophical remarks, which indicate a cultivated mind, and many short narratives, which serve to extend our 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 I. Caffaron, fol. Genev. 1587, and Paris, 1626. That of Janfon ab Almecevo, cum notis variorum, 4to. 2 vols. fol. 1727, is much esteemed, though not very correct. An Oxford edition has lately appeared, under the inspection of Mr. Falconer. Fabr. Bibl. Græc. Gen. Biog.

Strabo frequently mentions music, and the illustrious musicians of antiquity, with great respect. He places Zeno at the head of all sciences; and says, that the principal invention of the poet does not consist in teaching, but in delighting mankind. Whereas, according to the more ancient fuges, poetry was a first philosophy, which conducted youth through a pleasant path to prudence, morality, manners, human affections, and focial laws; while the moderns of our times (adds Strabo) say, that wisdom is only to be found amongst 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 fame 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 Arisoxenus; 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 Athenæus, l. i. c. 17.

But though a grave and solid writer, and a Stoic, Strabo has related a story in his fourth 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 Bargilia, 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 palling that way, wished 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 haffened 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, but finithed 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-market bell rang. What do you say? Why, has it rang?" demands the deaf gentleman; and the performer answering in the affirmative—'Oh, then, I wish you a good day, sir!'—and haffened 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.

STRACAIOA, a town of Wahachia; 18 miles N.W. of Krajowa.

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, comprising the events from the death of Charles V. to the year 1573, and published in 1632; and the second, as far as 1592, 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 Latins. It was attacked with virulence by Gaspar Scipiosus, in his "In Praise Famiano Strada," which injured his own reputation more than that of the historian.

The "Prolusiores Academicae" 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. Addison 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.


STRADA, or STRADANUS, an eminent painter of a good family, was born at Bruges in the year 1536; and after studying in his own country, visited Italy for further improvement. 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. Salvati. In compliance with the invitation of Don John of Austria, he visited Naples, and accompanied his patron to Vienna, where his pencil was employed in commemorating that great officer's military exploits. He afterward fixed his residence at Florence, where he became the head of the Florentine academy of painting; and he died in 1624. Besides history-pieces, he painted animals, hunting pieces, 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 divide himself wholly of the Flemish taste which he had imbibed in his youth. Many of his pieces are engraved. Parkington.

STRADA, Anna Maria del Po, an opera-singer, selected and brought into England from Italy by Handel himself, who went thither in 1728, after the dissolution of the Royal Academy, to engage a new company of singers, in order to let up for himself against the nobility and gentry, his opponents, who had likewise formed a separate company. The Strads, we find, was at Bergamo in the Venetian state, who had worked her way to Naples, where, in 1725, she performed the part of first woman in the serious opera; and in the autumn of 1729 arrived in England, where the
was announced in Handel's advertisement among the other fingers of his troop in the following manner: "Signora Strada, who hath a very fine voice, a performer of singular merit." 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 entertainment 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 assuage 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 sang 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 donai!" seems chiefly calculated to display her fine and brilliant flage, for which there are more than thirty occasions given in the course of the song.

The Strada performed for Handel at Oxford, in the oratorio 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, we believe, well-merited fame, for the accuracy and spirit of her performance.

STRADAUN, in Geography, a town of Prufia, in the province of Oberland, 3 miles N.W. of Eylau.

STRADAN, a town of Prufia; 6 miles N. of Lick.

STRADAUNNEN, a town of Prufia; 9 miles S.W. of Margravobowa.

STRADBALLY, a poll-town of Ireland, in the Queen's county, on the mail-coach road to Cork, by way of Cashel. There is a charter-school here for 30 boys, and the town is neat, and tolerably flourishing. It is 39 miles S.S.W. from Dublin.

STRADELLA, Alessandro, of Naples, in Biography, 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 superior 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 Bourdnot, 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 list of the musical dramas performed at Venice from the year 1637 to 1750, 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 musick, faced 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 employed by a noble Venetian to teach a young lady of a noble Roman family, named Hortensia, to sing. This lady, on whom nature had bestowed a beautiful person and an exquisite voice, notwithstanding her illibust birth, having been reduced from her friends, had submitted to live with this Venetian in a criminal manner.

Hortensia's love for music, and admiration of the talents of her instructress, by frequent accunts, soon gave birth to a passion of a different kind; and, like Helena, she found, that though at first

Guileless the gaz'ld, and luid'n while he sung,
While science flow'd sarcastic from his tongue;
From lips like his the precepts too much move,
They muic taught—but more, alas! to love!

and accordingly she and her murther became mutually enamoured 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 Abbeard'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 suitor, on discovering their flight, determined to gratify his revenge by having them assassinated in whatever part of the world they could be found; and having engaged two desperate 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, supposing that he would naturally return thereto 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 employer, affuring 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 so soon as the deed should be perpetrated.

After waiting at Naples for the necessary letters and instructions, they proceeded to Rome, where, such was the passion of Stradella, they were not long before they discovered his residence. But hearing that he was soon to conduct 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 avail themselves of the darkens of the night when he and his mistreis should return home.

On their arrival at the church, the oratorio was begun, and the excellence of the muic, and its performance, joined to the rapture that was expressed by the whole congregation, made an impression and softened the rocky hearts even of the sanguine Scotch; to such a degree, as to incline them to relent; 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 infinse of the miraculous powers of modern music, superior, perhaps, to any that could be well authenticated of the ancient.

Both these assassins being equally affected by the performance, alike inclined to mercy, and availing them in the street when he quitted the church, after complimenting him upon his oratorio, confided to him the business on which they had been sent by the Venetian nobleman, whom milites he had folen; adding, that charmed by his muic, 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 Emperor that Stradella and his mistresses had quitted Rome the night before their arrival in that city.

After this wonderful escape, the lovers did not wait for new council 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 affianced returning to Venice, told the enraged Venetian that they had traced the fugitives to Turin, a place where the laws being not so severe, but the difficulty of escaping is much greater than in any other part of Italy, on account of the garrison, they should decline any further concern in the business. This intelligence did not, however, incline the offended nobleman to relinquish his purpose, but rather stimulate him to new attempts: he therefore engaged two other affianced in his service, procuring for them letters of recommendation from the abbé d'Élréade, at that time the French ambasador at Venice, addressed to the marquis de Villars, ambasador from France to Turin. The abbé d'Élréade requiring, at the desire of the Venetian ambasador, protection for two merchants, who intended to reside some time in that city, which being delivered by the new affianced, they paid their court regularly to the ambasador, while they waited for a favourable opportunity to accomplish their undertaking with safety.

The duchess of Savoy, at this time regent, having been informed of the sudden flight of Stradella and Hertsenia 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 her palace, as her maeftra di cappella. In a situation apparently too secure, Stradella's fears for his safety began to abate; till one day, at fix 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 ambasador, as to a sanctuary.

The affianced 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 duchess, who ordered the gates to be shut, and the affianced to be demanded of the French ambasador; but he insisting on the privileges granted to men of his function by the law of nations, refused to give them up. This transaction, however, made a great noise all over Italy, and M. de Villars wrote immediately to the abbé d'Élréade, to know the reason of the attack upon Stradella by the two men whom he had recommended; and was informed by the abbé, that he had been surprised into a recommendation of these affianced by one of the most powerful of the Venetian nobility. In the mean time, Stradella's wounds, though extremely dangerous, proved not to be mortal, 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 affianced 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 regent, interregning herself in the happiness of two princes, who had suffered so much, and who appeared 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 affianced after them, who watching for a favourable opportunity, rushed into their chamber early one morning, and robbed them both to the heart. The murderers having secured a bark, which lay in the port, by infantly 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 assigned to it by all the musical 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 Terela 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: "Bailando il dirit, che il concerto di perfeeta melodia sia valore d'un Alleandro, cioè del signor Stradella riconosciuto senza contraffato 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, 45, con intro-menti," which is generally believed to have faved 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 fyle of composition. Purcell was extremely fond of writing upon a ground-bafe, a pec-ies of chaconne, which the Italians call biffa efferette, and the French baffe-contrainte; and in Stradella's oratorio, it appears that more than half the airs in that admirable pro-duction are built upon a few bars or notes of bafe perpetu-ally repeated. Purcell may have been imitated to exer-cise his powers in such confined 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-bases 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 Pavia.

STRAFFORD, a township in 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.

STRAHER, a town of Scotland, in the county of Ar- chet, situated on Loch Fumlie, in Inverclyde.

STRAHISTEIN, in Mineralogy, Aliminole, Jemeton; Amphibole Actinae, Hauy. This mineral is clasbed by Hauy with hornblende, on account of the identity which he supposes to exist in the forms of the primitive crysals of both:
both: this identity is, however, denied by the count de Bourdon. Werner makes a distinct species of shale-flints, which he divides into four sub-species: common actinolite, glassy actinolite, granular actinolite, and fapholus actinolite. The three former appear to differ only in their structure; the latter more nearly resembles afehite.

The colour of actinolite is principally leek-green or grafs-green, but sometimes olive-green and greenish-white.

Common actinolite, Gemeiner flahlbfein, is never regularly crystallized; it occurs in beds of gneifs, mica-flate, and talcose flate, 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 lustrue is fining; it is more or less translucent or transparent; it scratches glass, and melts before the blow-pipe into a greyish-green or blackish glass. The specific gravity of this mineral is about 3.4.

Glaspy actinolite, Glasfartiger flahlbfein, 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 refuting on each other. In the fibrous varieties, the fibres are sometimes parallel. The lustrue 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:

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<th>Component</th>
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<td>Silex</td>
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<td>Magnesia</td>
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<td>Alumine</td>
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<td>Oxide of chrome</td>
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<td>Carbonic acid and water</td>
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<td>Lofs</td>
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Granular actinolite, Korniger flahlbfein, occurs massive, in large, coarse, and small granular distinct concretions, along with precious garnet and quartz, in the Sanalpe and Tainach, in Stria. The lustrue 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, and faintly translucent.

Fapholus actinolite, Afterflarter frahlbfein, Werner. Actinolite aciculari. Haity. 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 translucent on the edges. Internally the lustrue is glittering and pearly. It is soft, rather brittle, and breaks with difficulty. The specific gravity of acicular actinolite is 2.8, Karlen; according to Kirwan, 2.579. It melts with difficulty into a black, or dark green-coloured glass. The constituent parts, according to Vauquelin, are:

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<th>Component</th>
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<tr>
<td>Silex</td>
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<td>Magnesia</td>
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<td>Oxide of iron</td>
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<td>Oxide of manganese</td>
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<td>Lofs</td>
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The variety of which the analysis is given, is composed of thin, elastic and flexible crystals, and is called by Sauture byssolite. It occurs in Norway, Sweden, in the Hartz, and various alpine districts, in rocks of gneifs, mica-flate, and granular lime-flint; it occurs also near Maraffon, in Cornwall. The colouring matter of crystallized actinolite appears, from the analysis of Langier, to be chrome; this is also, in all probability, the colouring matter of the other varieties. The hexahedral prisms of actinolite are commonly of a beautiful green, imbedded in white talc. Actinolite occurs at Glenelg, in Inverness-shire, and in the isle of Sky, and disseminated in trap, in Shropshire. The mineral with which actinolite or flahlbfein is most likely to be confounded, is thellite or epidote. For the distinctive characters of each, see Thellite.

STRAIGHT, STREIGHT, or Straight, 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 straight. 1. Such as join one ocean to another. Of this kind are the straight of Magellan and Le Maire. 2. Those which join the ocean to a gulf: the straights of Gibraltar and Babelmandel are of this kind, the Mediterranean and Red sea being but large gulf. 3. Those which join one gulf to another; as the straight of Caffa, which joins the Palus Mesotis to the Euxine, or Black sea.

The paffeage of straights is commonly dangerous, on account of the rapidity and opposite motion of currents.

The most celebrated straight 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 straights 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 straights of Le Maire have 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 straights at the entrance of the Baltic is called the Sound; which fee: that between England and France, Le pas de Calais, or the Channel. There are also the straights of Babelmandel, of Weights, of Jello, of Anian, of Darien, and Hudfon, &c.

STRAIGHT is also used, in Geography, for an inlinsus or neck of land between two seas; preventing the communication thereof.

STRAIGHT, in the Manege. To part, or go straight, or right out, is to go upon a tread traced in a straight line. When you would push your horse forwards, make him part straight, without traversing, or bearing sideways.

STRAIGHT Arches and Stairs. See the Subtangents.

STRAIGHT-Membered, called in French droit les jambes. See Legs.

STRAIGHT of Breath, in Ship-Building, that space before and about dead-flat, in which the ship is of the same uniform breadth, or of the same breath as at dead-flat.

STRAIGHT Creek, in Geography, a river of America, which runs into the Ohio, N. lat. 38° 38'. W. long. 84° 21'.

STRAIKS, in the Military Art, are strong plats of iron, fix in number, fixed with large nails, called strait-nails, on the circumference of a cannon-wheel, over the joints of the fellows, both to strengthen the wheel, and to evade the fellows from wearing on hard ways or streets.

STRAIN, or STRAIN, a violent extention of the line or tendons of some muscle. See SPRAIN.
STRAIN, among horses and other animals, an over-distention 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 opinion may have been entertained of bathing and anointing with favourite remedies, which often succeed in light cases, where perhaps bondage alone would have answered; the latter, with properly rolling 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 former, 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 roll, 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, lets the found foot hardly on the ground, to face the other, even though he be turned short on the lame side, which motion tries him the most of all. 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, the 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 shouder be well bathed, three times a day, with verjuice, or vinegar; but if the lamens continues without swelling or inflammation, after rolling 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 spirit of vitriol. Where inflammation and swelling are present, the use of camplorated farinose washes may frequently be beneficially employed two or three times in the day, cloths wet with them being applied to the parts.

Strain, in Muffe, is a section or portion of an air or time 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."

Strained Sugar. See Sugar.

Straining is the clarification of a liquor, by passing it through a sieve, or filter.

The word is derived from the French, effeüider; which is formed from ex, out of, and flinger, to throw.

Straining, in Physiology. See Lungs.

Straining, in Geography, a town of Austria; 7 miles N.W. of Pirrwarth.

Strait. See Straight.

Strait of Corf, one of the twelve departments of the second or northern region of France, composed of Arcos, Calais, and Boulogne, lying in N. lat. 50° 37', between the departments of Du Nord and the British Channel, containing in territorial extent, 704½ kilometres, or 328 square leagues; Vol. XXXIV.

or 37 French leagues in length and 15 in breadth, or about 70 English miles in length from N.W. to S.E. and 30 in breadth, and 566,061 inhabitants. It is divided into six circles or districts, 43 cantons, and 953 communes.

The circles are Boulogne, containing 71,934 inhabitants; St. Omer, with 29,675; St. Denis, having 114,665; Abbeville, with 115,580; and Montreuil, including 50,822 inhabitants. According to a census taken in 1740, the number of circles is 8, of cantons 85, and of inhabitants 522,789. 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 these on the bottom, called the garboard-strake, is let in to the keel of the keel, and into the stem and stern-post. The lowest strake beside is called the timber-strake, which is wrought about eleven inches from the side of the keelson, and has a rabat in the upper edge to receive the ends of the timber-boards.

They say also, a ship hefts a strake, that is, when the inclines to one side the quantity of all that plank's breadth.

Strakes, or Strakes, in Mining, are frames of boards fixed on or in the ground, where they wash and drefs the small one in a little stream of water, hence called strake'd 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'.

Stralech, a town of the duchy of Styria; 5 miles N. of Pettau.

Straleck, a town of the duchy of Styria; 9 miles W. of Hardeberg.

Straleun, a town of France, in the department of the Rer; 6 miles S.W. of Gueudres.

Straelenburg, Philip John, in Biography, born at Stralun in 1765, entered at an early age into the Swedish army, and in 1769 was appointed a captain in the regiment of Sudderan. Having often distinguished himself in the Polish war, and more especially at the siege of Posen, and the battle of Fueblat, and having been present, in 1759, at the unfortunate and bloody battle of Pultaw, he was taken prisoner, after he had made his escape, by returning in order to save his brother, and carried first to Moscow, and afterwards to Siberia. Here he remained 13 years, employing himself in travelling through the country, and making a geometrical survey of it, which he transmitted to a merchant at Moscow. Upon the death of this merchant, the map was found, and presented to the czar, who ordered that when the owner enquired for it, he should be brought before his imperial majesty. Having completed his travels, he was presented to the emperor at Petersburg, but declining to accept the office and salary which were offered to him, he returned to Sweden with an impaired constitution, and in low circumstances; and was promoted, in 1723, to the rank of lieutenant-colonel; but with the same pay which he received as captain eighteen years before. He afterwards obtained permission to go to Lubec, where he published, at his own expense, in 410. "Hiltorifh, Sec." i.e. "Historical Geographical Description of the North-East Part of Europe and Asia." In 1740 he was appointed commandant of the fortres of Carlham, where he remained till his death, in 1747. He was, says his biographer, a brave as well as a skilful officer; and besides his knowledge of mathematics, and parti-
particularly geometry and fortification, he was well versed in various other branches of science. Gen. Biog.

STRALSUND, in Geography, a city of Germany, and capital of Swedish Pomerania, situated in a strait which passes between the continent of Pomerania and the island of Rügen, founded in 1299, by Jarl Mar, the first prince of Rügen, 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 magnificence 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. 15° 9'.

STRAMBERG, a town of Moravia, in the circle of Prerou; 30 miles E. of Prerou. N. lat. 49° 32'. 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 Στραμωνιον, or mad-nightshade. See Datura.

STRAMONIUM, in the Materia Medica. See Datura.

Stramonium. Under the article now referred to, it has been observed that this plant has been known as a powerful narcotic poison; its common, the D. metel, is thought to be Strychnos lanata (Strychnus manicus) of Theophrastus and Dioscorides, and is therefore the species received by Linnaeus into the materia medica. In its recent state, the stramonium has a bitterish taste, and a smell somewhat resembling that of poppies, or, as Bergius says, narcotic, especially if the leaves be rubbed betwixt the fingers. By holding the plant to the nose for some time, or sleeping in a bed where the leaves are strewn, giddiness of the head and furred are said to have been produced. The deleterious effects of this 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 fuperiorior effcacy has been blamefully 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 Warmland; 36 miles N. W. of Carlstato.—Alto, a town of Norway, in the province of Bergen; 20 miles S. W. of Rosdal.—Alto, a town of Sweden, in Warmland; 20 miles N. W. of Carlstado.—Alto, a lake of Norway, in the province of Aggerhus; 75 miles N. W. of Christiania.

Stránd, North, a strait of the North sea, between the island of Benbecula and North Uist.

Strámd, South, a strait of the North sea, between the island of Benbecula and South Uist.
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 Nordrland only the small parish of Felworm, which owes its safety to the height of its situation. See NoRDTHRAND.

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 sailed 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 1766, and by his admirable drawings of the capital pictures 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 blanks of his early political errors and misconduct having been effaced, he was patronised 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. Selecting, as he was accustomed to do, eighty copies of the best impressions of each 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. BAPT. Greule; together with an introduction on the progress of engraving, and critical remarks on the pictures from which the engravings were taken. The force and clearance of his hammers 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 applause. His property, acquired by honourable industry, was considerable, and bequeathed to his family. Mem. of Sir Robert Strange.

STRANGER, in Law, denotes 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 is directly opposed to party or privy.

STRANGERS head, in Geography, a small island among the Bahamas. N. lat. 26° 43'. W. long. 78° 40'.
Strangford Lough, formerly called Lough-Conn, in the county of Down, Ireland, is the largest salt-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 flait, through which the tide rushes with great rapidity; and in it are several rocks, especially that flaoal 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 horses, and upon which immense quantities of fowl are raised. The towns of Newtown-Ardes, Killdeargh, and Cumber, on its shores, have linen markets. There is a hering-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 ca. 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 flones from the fields and spread them on the shores, in order to make the wrack grow; a good crop being obtained from rocks and flones. The name Strangford, or Strangford, 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 Manger, is a collection of the 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 crowded with impurities. The false strangles happen in old horses that have not well called the strangles. See Glanders.

Strangulated Hernia, in Surgery, a rupture, or hernia, in which the protruded viscera 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 straighting the intelleves in hernia.

Strangulatoria, in the Materia Medica, a name by which Avicenna, and some other authors, have called the dorumium, or leopard's bone.

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 Wodany.

Stranraer, a royal borough in the district of the Rhyns, and finest of Wigtown, Scotland, is situated at the eastern extremity of the bay of Loch-Ryan, and has an excellent natural harbour, called the Road, where ships of large burthens 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-house, 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 1783. In the town are ruins of a castle, now uninhabited, but which has been of considerable height and substance. The employment of the maritime inhabitants of Stranraer is chiefly the coaling-trade; but several 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 same persons have engaged in the linen manufacture. Coal is imported hither 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, Whitehorn, and Wigton, 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 councillors. The population of this place, in the report of 1811, was estimated at 1923 inhabitants, who occupied 387 houses.—Carlisle's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, vol. ii.

Strap, among Surgeons, a sort of band used to stretch out limbs in the setting of broken or disjuncted bones. See Bandage.

Strap, or Strap, in Rigging, a wrapp 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 platted together with an eye at one end, to put a fack through: it is bound round the end of the tail, to twist them tight when the rope is to be laid hard. Sometimes a hook at the other end, to hook the strands in laying: others are made of the same fixed rope as the pendants, with an eye spliced in each end.

Straps, in the Manger. The straps of a faddle are small leather straps, nailed to the bows of the faddle, with which we make the girths fall to the faddle.

Strapado, or Strappado, a kind of military punishment, in which the criminal's hands being tied behind him, he is hoisted up with a rope to the top of a long piece of wood, and let fall again almost to the ground: he that, by the weight of his body in the flock, his arms are dislocated. Sometimes he is to undergo three strapados, or more.

The word is formed from the French sfrappado, which signifies the same, and which is supposed to come from the old verb efferer, to break, extirpate; or from the Italian frappare, of the verb frappare, to wrest by force.

Strapazino, in Ornithology, the name of a bird of the wheat-eat kind, with a white rump and tail, and of a brownish-yellow on the head and back; its wings are variegated with black and yellow, and its beak is longer, and of a brownish-yellow colour; 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 Posts, are posts placed near the locks, round which the boatmen wind their rope, and check the velocity of the boat's motion before it enters the lock, and thus prevent damage.

Strasalo, in Geography, a town of Italy, in Friul; 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 the 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 Bruch, about a mile from the left bank of the Rhine. Before the revolution it was the capital of Alsace, and the see of a bishop, who was a prince of the empire. Its name, which it received about the sixteenth century, denotes the
the "town of the street," because it lay on the high road from France to Germany. It was fortified with a citadel by Vauban, the outworks of which reach almost to the Rhine. It has fix gates, and 200 streets, mostly narrow; eight bridges across the Ill, and one of wood, 3500 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 fleuple, 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 Daffyimus, 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 1682, 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, among which, one was that they were to pay nothing 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 Cath. 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 murmurs 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 1567, a plan was formed to embellish the city, correct the irregularities of streets, and build the 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 marshal Saxe, in the year 1777. The chapter of the cathedral was founded in the year 1019, to be composed of 24 nobles of the rank of counts. The episcopal territory beyond the Rhine was, in 1801, given to the margrave of Baden; 75 palms E. of Paris. Lat. 48° 35'. E. long. 7° 47'.

Strasburg, a town of Polish Prussia, in the territory of Culm, on the right side of the Drabina; 30 miles N.E. of Thorn.—Allo, a town of the duchy of Carnuthia, on the Gurck; 12 miles N. of Clagenfurt.—Allo, a town of the Ucker Mark of Brandenburg; 12 miles N. of Prenzlow. Lat. 53° 32'. E. long. 13° 44'.—Allo, a town of Bohemia, in the circle of Bolellau; 12 miles N.N.W. of Jung-Benzel. —Allo, a town of Westphalia, in the county of Stolberg; 4 miles E.N.E. of Stolberg.

Strasbourg, a post-town of Virgina, 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 Bullitt Lick. STRASCHNITZ, a town of Bohemia, in the circle of Boklau; 2 miles N. of Melnik.

Straseburg, a town of the duchy of Stiria; 11 miles N. of Marburg.

Strasites, Statnies, or Statutes, a tome described by the writers of the middle ages, and famed for its imaginary virtue of promoting venery, afflicting digestion, and the like, and that whether taken inwardly, or outwardly applied. 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.

Strasnit, a town of Moravia, in the circle of Heidelberg; 14 miles S.S.E. of Hadrich.

Strass, a town of Austria; 2 miles N.E. of Meilhau.

Strasswald, a town of the archbishopric of Salzburg; 19 miles N.N.E. of Salzburg.

Strata, in Ancient Geography, a country of Afra, 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 designating the structure of a rock or mountain: if it be formed of very thick masses of different kinds of stone, as lime-stone, flint, &c., it is said to be composed of beds; and if any of these beds be 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 deﬁnition is merely made for the convenience of description, as we could not, with propriety, lay 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 latter 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 interferences made by rivers, by the action of the sea upon the coast, and by mixing 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 pulled through the upper strata, forming lofty mountains and chains of mountains, on the declivities of which the upper strata lie in an inclined position. And even at a consid-erable distance from large ranges of mountains, the strata rise in the direction towards them. On the eastern side of England the strata rise toward the mountains on the south-west, as we shall again have occasion to notice in describing the strata of England.
STRATA.

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 rise in one direction, the lower strata will come to the surface somewherie 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 strata, f, forming the most elevated part of the series at f.

Stratification, in its simplest form, may be easily conceived, by placing a clodden 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 the line called the bearing of, 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 of each stratum, if unbroken, will come to the surface somewherie, and will be visible, if not hid by foil 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 bafel; and this bafel or edge of a stratum, may not unfortimately 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 failures, filled with mineral matter of a different nature from the rocks which they interfecl. These failures, called dykes or faults, throw down the strata on one fide several hundred feet, or, what is the fame thing, elevate them on the other fide; and in such inlines, a whole series of strata that may exit on one fide of the fault, will be entirely wanting on the other fide, and yet no trace of this disturbance may be visible on the surface. When a district is thus broken by faults, and interfecl by vallisies cutting the strata in different direclions, 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 fection to be made by a water-courfe, or any other caufe, in a stratified mountain (Plate II. Geology, fig. 2.), if the fection run parallel with the line of bearing of the strata, and no other part of the series be expecl to view at the ilation a, the strata will appear to be perfectly horizontal, and would be described as fuch by a superficial observer. Another fection, made at right angles with the line of bearing, would fhow to the fpeculator placed at b, the true dip or angle of inclination which the strata make with the horizontal level. Any intermediate fection 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 fection is in the exact line of the dip, all descriptions of the inclination of strata, which have not been corrected by a feries of obfervations, 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 bafel edges, the fame stratum may be brought to the surface in various parts of its course, and with various apparent angles of inclination. Mr. Farey, in the 11th vol. of his Report of Derbyshire, has given a series of diagrams, representing a great variety of forms in which the strata may prefent themfelves to the surface when interfecl by faults. These the fludent 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 unfortimately mistake their true position. See Plate II. fig. 6, which represents the bafel edges or out-crops of the lower strata, rising from under the upper strata at cee, and forming elevated ridges. If the surface is covered with foil or vegetation, and the rock be only visible in a few places, as at the quarry a below, and at the fummit of the hill near f; if the stratum at a be of fand-ftone, for inance, and the rock at f granite, he may mistake the true position, and defcribe the granite as being incumbent on the fand-ftone. This is one of the errors which young geologists, as Saffure observes, molt frequently commit.

The inclination of strata is seldom perfectly conformable to the curvature of the surface formed by hills and vallisies, but is often in an opposite direclion. (See Plate II. fig. 5.) In this fection, it may be observed that the stratum a forms the bottom of the hill on one fide of the valley, and forms also the fummit of the hill on the oppofite fide. Inlines of this kind not unfortimately occur.

The strata sometimes take a waving courfe, rising with the surface of the hills on one fide, and declining with them on the other. See Plate II. fig. 3.

Befide the regular rise of the strata in one particular direclion, 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 prefent an undulating surface when viewed on a large scale.

Sometimes, instead of rising towards the fummit of a hill, the strata are defcended towards the centre, forming a feries of basin-shaped concavities, placed one within the other, as reprefecl 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 fifty-one beds of coal, alternating with other strata. The coal strata in various parts of England take a fimilar form.

In some situations, we find a feries 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 reprefecl 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 reprefecl at b. Where a feries of strata rest horizontally on other strata that are more 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 feries of strata are nearly horizontal, and extend over a considerable district interfecl by deep vallisies, the fame stratum will make its appearance at nearly the fame level in distant moutains. There is a striking infance 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 a a represent the position of the coal strata; in this illustration, 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 so 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 can be 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 dislocation has in all probability opened a passage for the water, and asilled in the original formation of valleys.

In situations where regular parallel strata rise at a considerable angle of elevation, resting on stratiﬁed 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 dislocations occasioned by faults 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 crumpled, 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 show the extent of the elevation or depression. Where the angle of inclination of the strata is greatly changed by a fault (as represented at fig. 9.), either 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. Instances occur of strata being raised, thrown out of position, and declining to opposite parts of the horizon, their position nearly resembling that of the ﬂicks of a fan spread open. A remarkable instance of this kind, in the Isle of Wight, will be subsequently noticed. Similar appearances have been noticed in the ﬂench mountain 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 compelled by a force acting in a horizontal direction, or laterally. In some of our coal mines, this zigzag position of the strata occasionally occurs; and at Anzin, near Valenciennes, there is a remarkable instance of this derangement of the coal strata, nearly similar to fig. 9, in which the same letters represent the same strata as bent upwards or downwards. The whole are covered with horizontal strata of chalk, marl, and clay, deposited at a subfrequent 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 apparent by the horizontal displacement of metallic and mineral veins. (See Veins, Metallic and Mineral.) Fig. 10. represents the ground plan of a vein, a, running from west to east, until its continuity is broken by a bend, or cross course, which has thrown the vein several fathoms northward. Now it is obvious that the ground on one or both sides of the cross course must have been carried north or south along with the vein. Nor are instances of such a lateral motion of the earth frequent during violent earthquakes.

The Extent of Strata.—That many of the strata extend over large tracts of country, is a fact in its own self-established, though it appears to have been known but very recently. Among the miners in the coal districts it has indeed been observed, that the same beds of coal might frequently be traced to a considerable distance, until they came to the surface, or, in the miners' language, cropped out: but with respect to other strata of sand-ﬂone and lime-ﬂone, &c., though a considerable similarity might be observed between the ﬂone of distant 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 preferred 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, after its disappearance, 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 distant 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 a stratum of argillaceous limestone called lias, which rises from the level of the sea, near Bridport, in Dorsetshire, and extends to Lyme on the river Ax, where it terminates: a represents this bed rising from the sea, covered with a bed of green and yellow sand b. From the angle which it makes where it ﬁrst rises, it would form very lofty mountains, and terminate before it reaches the town of Lyme; but it is thrown down on the western side by a great number of small faults or interfections of the strata, and is thus continued in a direction well outward several miles beyond Lyme. The same bed, the most remarkable and best characterized of any in England, extends in its line of bearing, with little interruption, through Dorsetshire, Somersetshire, and Gloucestershire. It may often be traced into Yorkshire and Durham. It is said, that a similar bed may be traced through France to the Pyrenees; but though the composition and external character be 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 decline in the line of their dip or inclination, to what extent they may ﬂeet under the surface is 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
rise to the opposite point of the horizon, forming basin-like 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 resemblance and connection, which implies a natural relation; hence such strata are chaffed together, and are described as one formation. "We may conceive one flab of Rome to be composed of different laminae, which, though not exactly of the same nature, either with respect to colour, confidence, or substance, yet all contribute to the formation of the same Rome; 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 limestone, flint, slate, &c.

The German geologists assert, that the principal rock formations are universal, meaning that they were spread over the whole of the earth's surface, encircling it like the coats 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 similarity in different countries, yet there is often a 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 distant parts of the world which have yet been examined, do the same series regularly occur. According to the observations of Humboldt, chalk and roe-flint, 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 our 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 no 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, N° 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 which the strata that terminate on one side of the valley may be discovered again in the hills 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 basins or lakes of limited extent, though these basins, in some instances perhaps, may not be less than the basin of the present Mediterranean sea.

The substances of which the strata are principally composed, are argillaceous, calcareous, or siliceous earth, which are generally more or less incermined 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. Carbonaceous or bituminous matter is more frequently combined with alumine or clay than with the other earths. Morf of the soft argillaceous strata contain iron pyrites, from the decomposition of which, the water sprangling from them are generally considered more or less impure. 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 fource. (See Volcano.) 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 Charmouth, in Dorsetshire, composed of beds of pyritous clay, took fire spontaneously August 1751, after a very heavy rain in a hot dry season; the strata continued to emit flame at intervals for several years. Watfon's Chemical Essays, vol. i. p. 197.

A pyritous clay or shale near Whitby, of a similar composition, sometimes takes fire spontaneously, when matted 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 occurs in 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 safest 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 sterile. Thus, a knowledge of the strata might frequently be of great use to the
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 sites for architecture, a knowledge of the composition of the 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 referable them the most; and 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 explored, no traces of organic existence have been found. Hence such beds of rock are supposed to have been formed prior to the existence of organized 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 interposed, in which no such remains occur: hence we may infer, with some probability, that the processes, by which some of the strata were consolidated, has obliterated all traces of organic existence; and the mere absence of vegetable or animal remains in a stratum is not sufficient to prove, that they did not exist 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 shells, fish, and zoophytes; and it is only in the upper strata that we meet with the remains of animals populating a more complex organization; 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 distant 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 distinct 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 is the only proof we have that the strata were formed 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-flute called marl, 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, distinct from those in the upper strata; and also with a few vegetable remains. Under this stratum a series of strata occur, composed of sand, lime, 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-flute, 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-flute are no longer divisible. 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 sublunates, 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 loofe 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 tranquility; 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 sublunates of these shells and the shells which still exist in the sea: they have, therefore, once lived in the sea, and been deposited by it. Hence it is evident that the basin, or reservoiv, 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 greater 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."
STRA. \\

trata. The lower trata, 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 trata of the hills at their base, but, on the contrary, dip underneath them. When we dig through the horizontal trata, in the neighbourhood of the inclined trata, the latter are invariably found below. Sometimes, when the inclined trata are not too much elevated, they are surmounted by horizontal trata: the inclined trata are, therefore, more ancient than the horizontal, and, in many instances, appear to have been raised into their inclined position before the horizontal trata were placed upon them. If we institute a more detailed comparison between the various trata, and these remains of animals which they contain, we shall soon discover still more numerous differences among them, indicating a proportional number of changes in their condition. The sea has not always deposited mineral trata of the same kind. It has observed a regular succession as to the nature of its deposits: the more ancient trata 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 subslates which it held in solution; and when the surface of the trata came to be divided by islands and projecting ridges, 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 trata; and although the same species occasionally recur at small distances, the shells in the lower trata have forms peculiar to themselves: they gradually disappear, and are not seen at all in the upper trata, full less 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 upper or more recent trata resemble, as it were, the genus, the fossil which will exist in the sea, and in the last formed and lowest of these trata, there are 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 trata, 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 caused 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 subfrequentl 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 trata, have not, therefore, been entirely owing to a gradual and general retreat of the waters; but to sudden irruptions and retreats, the final result of which however has been an universal depression of the level of the sea. These 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 last of them, the traces of which are most conspicuous. In the northern regions it has left the carcases of some large quadrupeds, which the ice had attacked, and which had perished in 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 trata, which happened in former catastrophes, flew plainly that they were sudden and violent, like the loll and the heaps of debris which are found in various places among fold trata, demonstrating the vast agitation excited in the mass 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 acted less 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 trata in every part of the globe bear the imprints 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 water," as being found "in the midst of the most ancient and ancient trata." 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 trata," though they are sometimes found in caverns. The remains of amphibious animals occur in trata below the chalk, as the lias, which may be considered as very ancient, compared with the trata covering chalk; but we have never heard of remains of land animals in the trata subjacent to the lias, either in the sandstone of the coal formation, or in the alpine lime-stone. Animal remains in the caverns of the alpine lime-stone may be of very recent date, as these caverns are sometimes closed by the deposition of stalactites. See Stalactite.

It is a fact particularly deserving of notice, that no human bones or works of art have been discovered in any of the trata, 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 order of creation described by Moses in the book of Genesis. Public curiosity was recently excited by a fossil human skeleton brought from Guadaloupe. It is imbedded in a block of calcareous stone, 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 Souffrière. The bones contain a part of their animal matter, and all their phosphat of lime. On the shores of the Mediterraean, and particularly in the gulf of Messina, heaps of loose sand become consolidated in a few years. We are not to be surprised, therefore, that in a volcanic island like Guadaloupe,
Strata.

Guadaloupe, subject to violent convulsions from earthquakes and impetuous hurricanes, that human bodies should occasionally be discovered which have been covered by sand, that has subseguently become indurated.

It is not a little remarkable, that a recent formation of minute flinty sand-flote, 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 consisting of comminuted shells: in many places it is drifted into hills of 60 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 houfes may be occasionally seen. This loose sand, on various parts of the coast, is becoming indurated, and passing into a compact rock. At New Have its hardness is so considerablc, 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 subjedt, 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 flote through which it flows.

"Where a stream of water passes through the sand-flote, there the process of induration is more rapid. Although the iron forms but a small portion of the different foreign substances which analysis detects in the composition of the sand-flote, it is probably the principal cause of its induration, a very small quantity being sufficient for the purpose."

The Cornish sand-flote contains fragments of flote; but where there are wanting, it bears striking similarity to the sand-flote 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 those 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 averred, that granite, limestone, porphyry, &c. are 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 interossed 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 undisputed volcanic origin are sometimes interossed by such seams.

Globular balls of granite and basalt are also interossed 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.preasure, 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-flote, are distinctly stratified, and that the flaty 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 flaty laminae of true roof-flote were parallel with the direction of the bed of flate itself, but generally make with it an angle of 50 or 60 degrees. We have seen flate-rocks, which for several miles presented the appearance of flata; tabular masses of considerable thickness, rising at an angle of 89°, which might have been described as regular flata: but on pursuing these farther, we observed the vertical tables resting upon a bed of lime-flote not more than 20 yards in thickness, and inclined at an angle of about 30° upon a lower bed of horn-flote. The lime-flote was distinctly stratified, and contained the remains of encrinites in the middle flatum. See Plate III. Geology, fig. 4.

What were supposed to be flata, were here evidently the vertical seams in a very thick bed of flate, resting upon the lime-flote at a moderate angle of elevation. It not unfrequently happens, that vertical laminae of roof-flote rest upon a flab of flate nearly horizontal; and under the horizontal flab, the laminae of the flate will be nearly vertical, the same as in the upper flate: but in all flattified 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 flata seams, or regular partings of the flaters, but rents or fissures, either the result of crystallization or of mechanical separation. The remarkable convolutions which some of the flate-rocks in Devonshire and in Scotland present, are not the bendings of regular flata; 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 flature in rocks may be owing, whether to a crystalline arrangement, or to preasure during the original formation, or whether produced by the action of moisture and change of temperature, is uncertain. We know that rocks and flates, 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 flate, that we have seen a piece of the Devonshire flate, which as a fragment had no appearance of any flature whatever; but after it had been submitted to intense heat in a furnace, it acquired a regular chertolose flature, and the laminae assumed the waved form so commonly seen in the flate-rocks of Devonshire.

The German geologists have denominated the parallel flattified rocks flate-rocks (see Rocks); and though in nature there may frequently be observed a gradation from regularly stratified to unstratified rocks, yet the flature of the upper rocks differs so much from that of the lower, that we conceive it would be better to restrict the term flatterification to the former, or the flate 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 flata were formed and consolidated is a subject of inquiry involved in much uncertainty, as we can observe no process precisely analogous at the present time. The data which we may safely assume to guide us in our researches are but few. The flata are not arranged over each other according to the specific gravity of the substances of which they are composed, a flatum of heavy flone being frequently placed above one that is much lighter. Hence we may infer, that the materials of the flata were not

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not
not mechanically fusible in the same fluid, if so, the heavy 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 over both 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 assume. The principles of Werner 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 fusible, and thus the upper strata were principally mechanical depositions. Against this hypothesis, the objections which may be urged appear unanswerable. 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 retired 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 sea, where they subsided, forming different beds and strata. These have been subsequently consolidated by the operation of a central fire, which they suppose to exist constantly in the earth, and to have periods of greater or lesser activity, determined by causes with which we are unacquainted. By the operation of this fire, the lower beds were fused under great compresion, 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 most elevated mountains of our present continent. 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 hardest rocks are constantly wearing down, though their diminution be less perceptible than that of soft 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 sea, forming the materials of future strata, to replenish the continent, which are supposed to be in a state of constant 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 denuded 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 stratified 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 affirms that a process of assimilation is carried on in it, the same as in animal bodies. It poiffsles 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 lakes its organs of secretion.

By the latter, it decomposes the water of the sea to produce volcanic eruptions. The veins in strata are cavities or abceles in the mineral kingdom.

M. Patrin has supported this singular theory with much ingenuity, in various articles in the "Nouveau Dictionnaire d'Histoire Naturelle." That part which relates to the vitality of the earth will probably gain but few profeyeses, 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. Baxwell, in the second edition of his Introduction to Geology, supposes that the materials which form most of the strata, were originally dissolved or fusible 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 instances we have of actual rock formations, are volcanoes; beds and strata more than thirty miles in length, and of considerable breadth and thickness, have been spread over the face of the globe. It is impossible to doubt, according to M. Humboldt, the farther back we trace these eruptions, the greater is the similarity between the masses of lava, and the others.
STRATA.

Those rocks which are considered by geologists as the most ancient.

"The enormous ancient volcanoes whose centers are many leagues in extent, had doubtless an important office to perform in nature; and it is unreasonable to believe, that the earth itself is the great laboratory and storehouse, where the materials that form its surface were prepared, and from whence they are thrown out in an igneous, aqueous, or gaseous 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 sand. The largest active volcanoes in South America, throw out earth intermixed with water in the state of mud, which hardens and forms strata. The vall fires or rents that intersect the different rocks, may also have served for the passage of subterranean matter rising to the surface. These are generally filled with silex, which earth constitutes two-thirds of the crust of the globe. Calcareous or cementaceous 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 pausage was once opened, they may have rifen slowly, and been diffused in a tranquil state; and by gradual condensation, 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 succedance 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 sink 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 confluence 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 succedanea of varnish, whose aggregate thickness was less than that of a wafer, this would be a greater change with respect to the natural globe, than the formation of all the rocks and strata with respect to the earth; and the numerous dilatations and fractures, by sublivence 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. Professors 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 state of consolidation may, according to the theory of Dr. Hutton, have been produced by the agency of central fire at a subaqueous period, previously to which, they might form beds of land, marks, or mud. The consolidation, both of the upper and lower strata, may thus have been contemporaneous. See Systen 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 mineral kingdom may be effected by the electro-chemical action of the different strata themselves forming an immense natural volcanic 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 possessor. So early as the year 1684, an ingenious attempt was made by Mr. Liller 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 character of the soils. "I am of opinion," he says, "that certain upper soils, if natural, infallibly produce certain under minerals, and for the most part in a certain order." Phil. Trans. 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. Trans. 1722, in describing the sand-beds near Woburn, in Bedfordshire, in which the Fuller's-earth is dug, expresses his belief that the fame 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 valleys, and from whence I make a question, whether Fuller's-earth may not probably be found in other parts of the fame ridge of sand-hills, among other like matter." Here we have the suggestion of a valuable fact, once fully confirmed, —that certain minerals are peculiar to certain strata, and where we discover the same stratum in a distant 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 Thornton, near Wakefield in Yorkshire, published a valuable paper on earthquakes in the Phil. Trans. 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.
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 lime-stone, illustrated by numerous sections. Whatever may be thought of his speculative opinions, the work will remain 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 Mr. 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 the 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. Farey, and that of Cheshire, by Dr. Holland. The latter gives an excellent description of the felt district.

Mr. Farey 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 perfeclony, 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-well 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, sandstone, calcareous sandstone, and argillaceous or limonaceous 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 classified 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-marble.
3. Green and red sand-beds, with sandstone or oolite.
4. An argillaceous lime-stone, called lias. In the northern counties, magnesian lime-stone 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-stone. 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 agates 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 mafles of gravel are found aggregated congeries of siliceous nodules in a siliceous paste, forming a pudding-stone of fo compact a 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 the flint pebbles in the gravel are marked with imprints of marine animals, and are supposed to be cals. Petrified bones and large shells are sometimes found in the gravel, but generally in a triturated state; they belong principally to the chalk and under-strata, out of which they have probably been washed. Thin beds of gravel, intermixed with sandy loam and calcareous marls, form the upper covering in some parts of this district, particularly in 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 soil consists of sandy loam, in which were no fossils; fossil, sandy gravel, containing fossil-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; fourthly, patches of peat earth, which contained the bones and teeth of elephants, resembling those both of the African and Atlantic 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
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-stone, 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 land 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 foils in the London clay have been examined with more attention, and are found to resemble those of the lower marine strata round Paris. The bays 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 flinty sand-stone, called grey weather-stone, frequently occurs in this sand. The beds here described have but lately attracted the attention of geologists; being classed with alluvial foils, they were supposed to be of very recent origin. In the Wernener system, chalk is described as the most recent formation of lime-stone, and every thing over it was fancied deemed deserving of notice. Even of the chalk strata, and the various beds which occur between chalk and the sand-stone 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 Mitcham, 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 deficients of 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 flinty chalk is a thick stratum of soft or free chalk, with numerous layers of flint nodules, and great variety of echini and other organized 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 hardnec until near the bottom, where a white flint-stone, as at Trotton in Bedfirdshire, and numerous other places: that brought from near Ryegate, and elsewhere on this stratum south of London, is used as a fire-stone."

"The chalk-marls next succede, which varies much in its appearance, sometimes resembling chalk when first exposed, in other places appearing as a blue clay."

"The Sussex lime-stone strata, with green sand-beds, are remarkable for their large corals ammonite, numerous hor fie-head muscles, trilobites, and other shells, glossopteris, &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-stone, almost entirely composed of small turbinated shells, called Sufle marble, of which the lead pillars in Wictelmiller Abbey, and most of our cathedrals, are made."

"The next characteristic stratum, owing to its forming a ridge through the country, is the Woburn flint, a thick ferruginous stratum, which below its middle contains a stratum of fuller's-earth; this is the thickest and most pure in Apley, and at Hogcliffe End, ten miles north-west of Woburn. The upper parts of this flint are frequently cemented by the oxidated iron into car-stone, and the lower parts contain fragments of fossilized wood. The clunch-clay succeeds. It is generally blue, inclining to black, and is of great thickness. It has towards its top several beds of clunch, a soft chalk-like stone in appearance, whence the name. Numerous large gryphites, and small pointed belemnites, cornua ammonite, &c. are found above the clunch. The lower part frequently contains beds of bituminous flake or clay. The vale of Bedford, the beds of Cambridgeshire, Lincolnshire, and Yorkshire, are almost entirely situated upon the great plains formed by the gradual endings or feathering-out of this stratum. The Bedfordshire lime-stone 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-stone of Barnack, composed almost entirely of minute shells. It is so called, because stones were dug from thence for many of the most ancient and bel Prefered churches and buildings in the eastern counties."

"The lime-stone and grey slate strata of Stonesthield, Colly-Wellton, and numerous other places, next succeed; they abound with glossopteris, and other organic remains. Below is a stratum of sand."

"The Bath free-stone 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-stone; then the oviformed lime-stone, or oolite of Bath, Ketton, &c. succeed, below which is a great thickness of light yellow free-stone, which abounds with curious shells and foils. Below this, sand with beds of clay occurs; and then the fine-stone 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-stone. This bed is of considerable thickness, forming generally a light-yellow tenacious surface; cold, and much dispoled to ant-hills, when laid down in
in pafture. Thin flrata of lime-flone, called blue lias, occur with the clay; some of these make a lime which is superior to any other that is known for fluces, locks, and other water-works, on account of its property of fettling almof immediately, even under tea-water, and continuing to harden.

"Watchet and Aberthaw, on oppofite fides of the Britofl channel, Southam in Warwickshire, and Barrow on Scar in Leiciefhife, are particularly famed for this lime. The blue lias is remarkable, owing to the pentacrinus, the bones, fealy fll, and other floffle remains it produces throughout its whole extent. It has perhaps the belt marked and moft important geoflogical characters of any flratum in the British feries.

"In the lower part of the lias, a fucceffion of other lime-flone flrata 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 in many of the southern counties rets upon red marble or fand-flone.

We are not to conclude that all the different beds decribed by Mr. Parey, connitantly occur under each other on the eifern fide of England. In fome places, many of the beds are entirely wanting; thus, in fome parts of Dorflaghe, the green fand which forms the under flratum to chalk, rets immediately upon the lias, as in the vicinity of Lyme; and all the different beds of roe-flone and the minor flrata, are wanting. Further weft in Devonfhir, the fame fand, with its various fliffs, may be feen relling on the red marble.

This will be better understood by referring to Plate II. Geology, fig. 1, and Plate III. fig. 2. In Plate II. fig. 1., a isuppeffed to reprefent the chalk, b the green fand, c the olifite, d the lias, and e the red marle, arranged in the order in which they occur over each other, where all these formations exit; but in fome situations, the flratum, b, of green fand extends beyond the flratum e, and covers a part of d and e. In Plate III. fig. 2. we have reprefented the arrangement of the flrata, as they occur from the eift of Bridport in Dorflaghe, to near Sidmouth in Devonfhir.

The green fand, b, may be feen rifting from the fcl ; eift of Bridport it isfoon fucceded by the dark clay, and lias d d d, on which it rets. This flratum extends beyond Lyme to the mouth of the river Ax, where it terminates at M. A little to the weft of Lyme, L, the green fand is covered by chalk rocks of limited extent, e, at Penhay. The lias which riies to the fouth-weft is broken by numerous small faults, and is thus continued along the couft for feveral miles. Beyond the river Ax, at M, the flrata appear to have been thrown down coniferably, and another mafs of chalk is brought to the level of the fcl at Beer, a a, where it forms fantatlic cliffs, perforated with caverns. Weft of the village of Beer, the green fand covers the hills of red marble, without the intervention of the lias. Patches of the fame bed of fand are feen relling upon the fummits of fome of the hills weft of Exeter, covering the fame red marble, particularly on the fummit of Haldon-hill; thus a formaation nearly allied to the chalk is brought almof in contact with the gruife of Dartmoor.

The thicknes of the different formations varies coniferably in different parts of their extent.

The Rev. J. Townfeild, in a work entitled "The Character of Moifes vindicated as an Hifiorian," has given the refult of his inquiries refpeeting the thicknes of the flrata from the chalk on the fouth coaft to the coal districts of Somerfetfhir. The difficulty of meeting with good fecfions of the flrata uncovered, and the varying thicknes of each, make fuch calculations uncertain. They may, however, deferve notice as approximations to truth.

The following is a condeffed fatement of his admeasurements.

**Soil and AlICIAL GROUNDS of various thicknesses.**

<table>
<thead>
<tr>
<th>Feet.</th>
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<tbody>
<tr>
<td>Chalk more than</td>
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<td>Three beds of green, grey, and red fand, with fland</td>
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<tr>
<td>flone</td>
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<tr>
<td>Clay in one situation</td>
</tr>
<tr>
<td>Upper, middle, and lower oolites, with interpofed beds of other calcareous flrata, fand, and clay</td>
</tr>
<tr>
<td>Blue clay</td>
</tr>
<tr>
<td>Lias</td>
</tr>
<tr>
<td>Red marle</td>
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On this fatement, Mr. Backwell, in his Introdufion to Geology, obferves, that "the chalk in fome situations is nearly one thousand feet in thicknes, and the flrata which cover it in the Isle of Wight more than fourteen hundred feet. If, therefore, we add one thousand feet to the above effimate for the London clay-chalk, and minor flrata which have been omitted, this would make the depth of the flrata in the vale of Thames to the flrata containing coal, about one thousand yards. If we fuppofe the lower flrata accompanying coal to extend regularly under calcareous fand-flone and chalk-rocks, it would be an interefling inquiry to determin the accuracy of this fatement; and when the coal fields in the north are exhausted, it may become an objed of public concern. Nor would the expence for various complete trials in different situations exceed that of the prefent national expenditure for one week."**

In the fucceffion of flrata, the lower formations rifle weft of each other, and it is only where they are uncovered by the upper formations that they are visible.

The flrata of the low district appear to have been formed fubfequently to molt of the great convulfions that have broken the lower flrata, and we no where meet with those dykes or veins of basalt which interfeft and disturb the flrata of the coal formation. There is, however, one inftance of a disturbance of the flrata above and below the chalk, as remarkable as any which occur in the lower ftratified rocks. It may be feen at Alum bay, in the Isle of Wight, and has been described by Mr. Webler in the fefcond volume of "Tranfactions of the Geological Society of London." The chalk and the clay incumbent upon it pafs under the channel, called the Solent, from Hampshire, and rife in the middle of the isand, forming a range of hills, which extends from Culver Cliffs on the eift, to the Needles on the weft. The chalk flrata are here nine hundred and eighty-feven feet in thicknes, the flrata above the chalk fourteen hundred and eighty-one feet; thofe, with about fix hundred feet of lower flrata, are all thrown out of their original position, which was nearly horizontal, and are now almoft vertical. That they were once nearly horizontal, may be proved by their occurring in that position a little further south, but till more fatisfactorily by the flints found in one of the vertical beds of ftoke fand, of which there are feveral 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. Webler) that thefe flints could have been originally deposed in their prefeht position; they definitely point out the former horizontal direction of the feries; there are no figns of particular disturbance in these beds: the whole feries appears, therefore, to have been moved together." The enormous force required to upheave fuch a mafs of flrata not only through the Isle of Wight, but in Dorflaghe, must have been
### STRATA.

A similar admeasurement had been taken of the coal strata of Northumberland and Durham, from the magnesian lime-flone on the eastern side of the latter county, to the mountain lime-flone on the west, by Mr. Well-earth-Poynter. This admeasurement comprehends the beds of mountain lime-flone, which are there intermixed with beds of quartz-ose sand-flone and argillaceous shale, to the red sand-flone 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-flone, argillaceous sand-flone, and shale. The latter is provisionally called *plate*, and the sand-flones are called *pits*. We shall give from this admeasurement the thicknesses of each bed of coal, and its depth from the upper stratum, supposing them to lie horizontally.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Volume</th>
<th>Foot</th>
<th>Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soil and Flate</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Coal and Flate</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>3. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
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<tr>
<td>4. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>5. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>6. Shale and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>7. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>8. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>9. Coal, or High main coal</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>10. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>11. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>12. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>13. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>14. Coal and Flate</td>
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<td>0</td>
</tr>
<tr>
<td>15. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>16. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>17. Coal and Flate</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>18. Low main coal on Tyne</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note:** The strata 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, sinter, and porphyry, extend for about ten miles in a south-east and north-west direction, and is bounded on the eastern side by the bary formation at Barrow on Soar, and on the west and north-west by coal strata, and beds of breccia and gravel. 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 fearfully appear above the surface. In rocks of this formation near Atherstone, beds of manganite have recently been discovered.

The mountain lime-flone 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-flone. 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 lapis or magnesian lime-flone to the alpine district. An estimate of their total thickness has been taken in Derbyshire, from the magnesian lime-flone on the east, to the fourth bed of mountain lime-flone, from which it appears, that the total depth taken on a level line is 1310 yards. In the neighbourhood 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 26 yards.

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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. Bakeless, and copied from the second edition of his Introduction to Geology. It commences from the German ocean, where the magnesian limestone 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 near to Wairalinga, rising in succession to the well or fault-well, but are much broken by faults. Here various beds of coarse sand-stone or grit, finer crydalline sand-stone, and indurated shale, succeed in the same direction; they contain a few seams of coal. Metalliferous lime-stone form 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 Westmoreland. The whole of the strata, C C, is interfaced by veins of lead and zinc, which are very productive in the great lime-stone, but produce less as they pass through the sand-stone strata, and rarely produce any ore in the shale.

The highest point of the metalliferous lime-stone district is Crofs 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 lime-stone, alternating with sand-stone and shale, and is covered near the summit with the lower series of strata of the coal formation. It is interfaced by a great vein of lead-ore running east and west. A great fault, called the Buttruford Dyke, filled with white-stone or bafalt, runs north and south, and throws down the strata on 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 Crofs Fell, we come to the red sand-stone rock, the lowest of the beds in Mr. Forster’s admeasurement, 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 Westmoreland are not stratified; they are composed of slate, horn-stone, porphyry, greywacke, green-stone, silettic, and granite. Beyond these mountains, on the west, we meet with stratified hills containing coal, extending to the Irirh 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 rose above the shaft, and buried the workmen and the works.

The alpine district of England is composed of those rocks, which by the German geologists are called primary and transition rocks. (See Rock.) 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 greywacke, lime-stone, flate or clay-flate, granite, porphyry, silettic, and green-stone. Many of them appear to be composed of an intermixture of the above rocks, and have no well-defined character.
from thence to the northern extremity of Scotland. It is broken into three parts by the intervention of the Brifol Channel, and the low grounds of Lancashire and Cheifhe. They are denominated by Mr. Bakewell the Northern, the Cambrian, and the Devonian range.

The northern range enters Cumberland from Scotland, and paffing through that county and Weftmoreland, extends its branches into Northumberland and Durham. It continues along the western fide of Yorkshire and Derby-shire, and into Staffordshire.

The loftiſt mountains of the Cambrian range extend through Caerarvonshire and Merionethshire; they decline in height as they pafs through South Wales, and on the borders of the Brifol Channel are covered with regular flat-tifted rocks of the coal formation, comprifing an exentive coal field one hundred miles in length, and from five to twenty in breadth, ranging from Pembrokefhire into Monmouthshire.

The Devonian range commences in Somerfettshire, and paffes through Devonshire into Cornwall. The haighest point of this range is formed by the granitic rocks of Dartmoor. Granitic rocks of lefs elevation range through Cornwall to the Land's-End, but they are covered in many parts with flate, provifionally called "fliſſa in Cornwaſh, and "fliſſa in Devonshire. The flate, or fliffe, in Devonshire, is covered on its eafther fide by red fandfstone; in many parts a red basaltic anygdaloid is interpoled between the red fandfstone and the flate, and may be feen rifting through the former in the vicinity of Exeter. From tradition, and from prefent appearances, it is rendered probable, that a large extent of country on the western fide of Cornwall has been wafted 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 flrate fimilar to thofe on the eafther fide of England, they were too foft to refift the ravages of the ocean. The granite of Cornwall forms a barrier which protects the fouthen thores of England from the rapid encofmaments of the sea, by breaking the violence of the western tides; yet the land is gradually and confantly diminifhing along the line of coaſt from Cornwall to Kent. In the fhort period of a fingle life, this diminution is feerely noticed, except by thofe whose eftates adjoin the sea; but in the lapse of centuries, the outline of the country is changed, and its furface feffibly reduced. Of this, we might cite nu-merous inftances, both on the fouthen and eafther coaſts.

Whitby aby, in Yorkshire, offers a ftringing proof: it was built, on an elevated plain, in the year 656, at which time it was more than a mile from the sea; at prefent it is very near the edge of a perpendicular cliff, which is continually falling down as the fea excavates the bafe.

Frifh-water Strata.—We have before mentioned, that a feries of flrate occur in the Ife of Wight, refembling the flrate in the vicinity of Paris, but which do not occur in any of the English counties. These flrate lie in a horizontal position on the northern fide of the ifland, and are dif-tinctly visible in a hill called Headon, adjoining the vertical flrate of chalk before decribed. The hill is about four hun-dred feet in height. The lower bed I (fee Plate III. Geology, fig. 3) is of beautiful white fand, about thirty feet in thick-ness, over which is laid a bed of dark-clay, K, and upon this a feries of beds of landy calcareous and argillaceous marles, L. Some of them, according to Mr. Weſbler, confift almoft wholly of the fragments of frifh-water shells, as the limneous, planorbis, cyflolitha, and others refembling helices and my-tulis. This he denominates the lower frifh-water formation. In this formation in the Paris basin, the gyfsum beds are fiftuated. Over the lower frifh-water occurs a flrate con-fiing 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. Moft of them appear to have undergone but little change; and fonme of the species can fearcely be diftinguifhed from recent shells. Some of the shells are very delicate, but in a high flate of prefervation, thus fhewing that they muſt have lived near to the tops where they are now found.

In other parts of this flrate are banks of large fofible 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 diftance to their prefent situation. The fofiles are nearly allied to thoſe in the upper marine formation in the Paris flrate.

The upper frifh-water formation reſts immediately on the latter, and is the moſt remarkable one in the feries. It oc-curs 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 frifh-water shells in great abun-dance, without any admixture of marine exuviae. Many of the shells are in high prefervation, and the animals appear to have lived near the places where they are found, as the shells are fo friable, that they could not have been removed from their marine libitation without being broken.

This flrate appears to have extended over the whole northern part of the Ife of Wight, but it has not yet been discovered on this fide the water. The shells, like thoſe in the lower frifh-water formation, confift of fonse kinds of limneus, helices, and planorbis.

Part of the fide of this formation is exremely hard, and has long been uſed for building-stone. It may be confi-derived as the uppermoft or latet formation of rock we are acquainted with in Englad, and has a near reſemblance, in many of its mineralogical characters, with the frifh-water lime-stone, in the fame formation, in the Paris basin, called calcaire d'eau douce. The external characters of the fide in both countries are sufficiently different from any known rock, to render them diftinguifhable even without the shells. Over this flrate is another bed of clay, eleven feet in thickneſs, containing numerous fragments of a small nonedefcript bivalve shell. Other calcareous flrate, containing a few frifh-water shells, fucceed. The whole is furmounted by a bed of alluvium, O, forming the fummit of the hill.

There is one remarkable difference between the frifh-water flrate over chalk, in the vicinity of Paris and in the Ife of Wight. In the latter, there is a total abfence of fificious formations, fo abundant in the former. The lime-stone impregnated with filex, and containing a turnifer, covers half the bottom of the Paris basin. (Taf& of the Geological Society, vol. ii.) Though the shells in these flrate are confidered by Mr. Weſbler and other naturalifs as undoubted frifh-water shells, yet as they differ more or lefs from thoſe of exifing species, it may be asked, are we certain that animals which bear a close reſemblance to frifh-water shells, might not formerly have been inhabitants of the ocean? Or might not these animals have been brought in a living flate to their prefent situations by rivers or inundations which emptied themselves into bays of salt-water.

If we admit that they are really frifh-water shells, and the beds which cover them contain exclusively marine shells, we must alfo admit that the places where they are found have been succesively covered with seas or lakes of salt and frifh water, after the formation of the London clay. To explain this, it is not neceffary to fuppofe a general rifing of the ocean, or an alternate fubfidence and elevation of the land. Lakes in the vicinity of the fea might have their bar-
barriers broken down by earthquakes, and closed again by de-
positions of sand and gravel, by which the nature of the waters
would be changed. If the strata in the hill of Headon
were once the bottom of a lake, one great revolution, at
least in the rate of this part of the globe, must since have
taken place, by which the 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 inhabi-
tants of each as children of the same foil; and it was
surely more wise to urge this as a plea for mutual amity,
than to make the geographical position of the two counties
a motive for eternal hatred, and exclaim with a late British
senator

"Littora litteribus contrarias, fluibus undas,
Impeor arma armis pugnent iprique nepotes."

Aen. 4.

"Our cliffs, our coasts, our waves opposed to theirs,
May the fame hate descend to all their heirs."

Dryden.

The basin in which the upper strata round Paris are de-
posited is of considerable extent. The total thickness of the
beds over chalk is about 500 feet. A very interesting ac-
count of these beds, and the extraordinary fossils they con-
tain, 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 suc-
cession of different beds, and from the extraordinary orga-
nic remains they contain; millions of marine shells, that alter-
nately with fresh-water shells, compose the principal
mats. Bones of land animals, of which the genera are en-
tirely unknown, are found in certain parts; other bones, re-
markable 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
revisions that terminated the formation of the present con-
tenents. Though chalk is the foundation, it rises to the sur-
face, only a few situations being covered with other beds, in
the following order:

1. Chalk with flint.
2. Plafic clay and lower sand.
3. Coarse marine lime-flint, or calcaire greffier. The
   place of this is sometimes occupied with the lower sand-
   flint, No. 4.
4. Lower marine sand-flint.
5. & 6. Lower fresh-water strata, gypsum clay and gyp-
   sum, 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. Aluvial soil, ancient and modern, including gravel,
padding-flint, black earth (les marne argileuses noires)
   and peat.
12. Chalk.—This chalk agrees in external characteristics
   that found in other countries. It occurs in indistinct hori-
   zontal strata; in which we observe either interrupted layers,
or tuberose-shaped masses of flint, which pafs into the chalk
at their line of junction, or kidness of hard chalk, having
the same fhape and position with the flint. This formation is
well characterized by the petrifications 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
belemnites occur in the chalk, and these appear to be
different from those found in the lime-flint, and are con-
didered 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
fection of a similar arrangement of the strata, a representing
the chalk, b, b, b, the newer strata.

2. Plafic Clay.—All around Paris we find the chalk co-
vered with a deposit of plastic 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 cynthia,
turritella, and bituminous wood; they sometimes occur in
the purer clays; 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 separate 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 slate-clay, occur in it.
These are arranged in a determinate order, and the strata of
lime-flint are well characterized by the petrifications
they contain; the same system of strata always polisphing
the same species of petrifications.

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 nearly lustre, and differ more from the
present existing species than those in the upper strata of this
formation.

The following are the petrifications enumerated by Cuvier
and Brongniart, as occurring in it.

Nummulites levigata, scabia, and nummulis. These are
always found in the lowest part of the bed. Madrepora,
at least three species. Aulaga, three species. Carophylla,
three simple and one branched species. Fungiata. Ceri-
Voluta ethara. Caffectia lamellosa. Turritella multilfi-
cata. Otlaea flavella. Otlaea cymbula. The second series of strata is still very rich in shells;
nearly all the bivalves found by M. Defrance at Grignon be-
long to it. It also contains a few impressions of leaves and
flowers. The most characteristic petrifications of this series
of strata are the following. Cardita avicularia. Orbito-
lites plana. Turritella imbricata. Terebellum convolutum.
Calyptrae trochiiformis. Pectunculus pulvinaris. Cith-
area nitida. Citharea elegans. Milolites, very abundant.
Cerithium; probably several species; but neither the lapi-

dum and petricolum, nor cinclum and plicatum, which latter
belong to the second marine formation that covers the
gyptium.

The third series of strata is less abundant in petrifications,
and contains fewer species than the two preceding. The
following have been observed. Milolites, very rare. 8
Cardium.

The lirata of the second and third series sometimes contains beds of sand-flinte or marles of horn-flinte, filled with marine shells. In some cases the sand-flinte takes the place of the lime-flinte. Land-flinte and fresh-water shells (limnea et cyclolomae) have been observed in this sand-flinte, but only where it lies immediately under the fresh-water lime-flinte. The sand-flinte and horn-flinte containing marine shells, red either immediately on the marine lime-flinte, or are contained in it. The following list contains the names of those species of petrifications which occur most frequently in the sand-flinte. Calyptraea trochoformis. Oliva laumontiana. Ancilla canadensis. Voluta harpula. Fucus bulbiformis. Cerithium ferratum. Cerithium tuberculofum. Cerithium coronatum. Cerithium lapidum. Cerithium mutabile. Ampullaria acuta or spilata. Ampullaria patula. Nucula deltoidea. Cardium lata. Venerocardia imbricata. Cytherea nitidula. Cytherea elegans. Cytherea tellinina. Venus callosa. Lucina cyrchna. Lucina laxorum. Two species of oyster, still undetermined; the one appears allied to ophiura deltoidea, the other to ophiura cynbula.

The fourth series of strata consists of hard calcareous marls, soft calcarceous marle, clayey marle, and calcarceous sand, which is sometimes agglutinated, and contains horizontal layers of horn-flinte, crystals of quartz, and rhomboidal crystals of calcarceous spar, and small cubical crystals of fluor spar. Petrifications occur very rarely.

4. Silicious Limn-flinte, without Shells. — This formation occurs with the coarse marine lime-flinte, on the same level with it, and in no instance is either above or below it. It rests immediately on the plake clay. It consists of lirata, not only of a white lime-flinte, but also of a grey, compact, or fine granular lime-flinte, which is penetrated in all directions with flexes, and its numerous cavities are lined with silicious flake-flutes, or quartz crystals. A characteristic mark of this rock is its wanting petrifications of every kind, both of fresh water and salt water. A species of mill-flinte sometimes occurs in it, which appears to be silicious lime-flinte, deprived of its calcarceous ingredient by some agent unknown to us. This mill-flinte must not be confounded with that which occurs in the upper beds.

5 & 6. Gypsum of the first fresh-water Formation. The fresh-water formation is not entirely of gypsum, but contains also beds of clay-marle and calcarceous marls. There are arranged in a determinate order, when they all occur together, which is not always the case. They lie over the coarse marine lime-flinte; and the gypsum, which is the principal mass of the formation, does not occur in wide extended tables, like the lime-flinte, but in single conical, or long marles, which are sometimes of considerable extent, but always sharply bounded. Montmartre 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, solid calcarceous marle, and of thin flaty argillaceous marle, or adhesive flate. The layers of gypsum are thin, and full of crystals of felinite; and in the clay-marle, or adhesive flate, imbedded menilite occurs. Wherever this bed rests immediately on the sand of the marine sand-flinte 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 angular kidnies of celelde, or sulphate of frontian. The third or upper bed of gypsum is by far the greatest; in several places it is more than sixty feet thick. It contains few beds of marle, and in some places, as at Montmorency, it lies almost immediately under the foil. The lower lirata of this upper gypsum contains lim, which appears to be intermixed with it, and to pass into it by imperceptible gradations, facts which shew their contemporaneous formation. The middle lirata of this bed split naturally into prismatic concretions, with many fides. The uppermost lirata, 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 a friable state, are met with in the marle which separates the beds of gypsum. Bones of tortoises and skeletons of fish are found in the same bed, and some fresh-water shells. The occurrence of skeletons of quadrupeds particularly characterises the upper bed of gypsum, remains of the same nature not having been found in the middle or lower beds of gypsum.

Beds of calcarceous and clayey marle rest immediately over the gypsum. Wood-flinte, or petrified wood of a kind of palm-tree, occurs in a white friable marle; and in some quarries which are worked in these beds, remains of fishes and of shells, of the genera limniona and planorbiis, are met with. The two latter do not differ very much from those found in the marlens 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 calcarceous 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 characterise this formation, are found. The first fresh-water formation neither contains mill-flinte nor flint, only menilite and wood-flinte. Over the beds of clayey and calcarceous marle there rests a bed of yellowish flaty marle, three feet three inches thick. Kidnies of earthly celelde, or frontian, occur in the lower part of it; higher up are meet with a bed of small bivalve shells, which are referred to the genus citherea; and between the uppermost layers of the marle, other species of citherea, with ceroses, spirobes, 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 calcarceous marle, and also celelde. Immediately above these follows a bed of yellow clay-
clay-marle, which abounds in fragments of marine bivalve shells, cerites, trochites, machetes, cardiites, 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 undermost contains large and thick oysters, and the upper (which is sometimes separated from the under by a thin bed of white marle without shell), 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 gypseum.

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 gypseum formation. In the following tables are enumerated the petrifications that belong to the gypseum, and to the marine marle which rests upon it.

**Fossil Quadrupeds in Gypseum.**

**Genus 1.** Palaeotherium, or ancient wild beast. This animal is arranged, according to Cuvier,

*Clafs Mammalia.*

*Ordo Pachydermata.*

_Pone tapirum et ante rhinocerontem et equum ponendum._—To be placed in the natural system after the tapir, and before the rhinoceros and horse.

The five species discovered in the gypseum quarries are,

1. _Magnum_, the size of a horse.
2. _Medium_, the size of a hog.
3. _Curtum_, the size of a hog.
4. _Minutum_, 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 rhinocerontem aut equum ab una et hippopotamum, sueum, et camelum, ab altera parte ponendium.—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. _Minutum_, size of a hare.
5. _Minimum_, very small, the jaw only discovered. A pachydermatous animal, allied to the hog.

_Canis Parisionis._

_Diadelphus Parisionis._

_Viverra Parisionis._

_Birds, three or four species._

_Reptiles. Trionix Parisionis, and another tortoise, with a species of f suburb, which appears to be a crocodile._

_Three or four species of fish._

_Molluscan animals. Cyclotheta mummia._

_In the upper white marle are palms, fragments of fishes, limnes, and planorbes._

**Marine Formation.**

<table>
<thead>
<tr>
<th>Slaty yellow marle</th>
<th>Green marle</th>
<th>Yellow marle, mixed with brown slaty marle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cytheré bombee.</td>
<td>No fish.</td>
<td>Parts of the ray.</td>
</tr>
<tr>
<td>Spirobos.</td>
<td></td>
<td>Ampullaria patula?</td>
</tr>
<tr>
<td>Bones of fishes.</td>
<td></td>
<td>Cerithium plicatum.</td>
</tr>
<tr>
<td>Cytheré plans.</td>
<td></td>
<td>Cerithium cirrum.</td>
</tr>
<tr>
<td>Bones of fish.</td>
<td></td>
<td>Cytherea elegans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cytherea semisulata.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cardium obliquum.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Nacula marginata.</em></td>
</tr>
</tbody>
</table>

_A bed of oysters._

<table>
<thead>
<tr>
<th>Calcareous marle, containing large oysters</th>
<th>Calcareous marle, containing small oysters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oltreia hippopous.</td>
<td>Shells of crabs.</td>
</tr>
<tr>
<td>Oltreia pleonochama.</td>
<td></td>
</tr>
<tr>
<td>Oltreia longirostris.</td>
<td></td>
</tr>
<tr>
<td>Oltreia canalis.</td>
<td></td>
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<tr>
<td>Oltreia cochlearia.</td>
<td></td>
</tr>
<tr>
<td>Oltreia cyathula.</td>
<td></td>
</tr>
<tr>
<td>Oltreia frapitula.</td>
<td></td>
</tr>
<tr>
<td>Oltreia linguatula.</td>
<td></td>
</tr>
<tr>
<td>Ballanites.</td>
<td></td>
</tr>
</tbody>
</table>

_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 gypseum, do not appear to occur any where 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 coarce 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**
7. Sand and Sand-flone without Shells.—The strata 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-flone and Sand.—This varies in colour, compactness, and even in composition, being sometimes a pure friable sand-flone, sometimes intermixed with clay, and its place is occasionally occupied by a thin bed of calcareous sand filled with shells. This sand-flone contains marine shells, which approach most nearly to those species met with in the calcareous marl over the gypsum.

9. Mill-flone without Shells and argillaceous Sand.—This formation consists of iron-shot, clayey sand, with greenish, reddish, and whitish clay, marl, and mill-flone.

This mill-flone is quartz, containing a multitude of irregular cavities, which are traversed by siliceous 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-flones found near Paris have a red or yellowish tint, but the rare and most esteemed varieties have a blue-blush of colour. The blue-tinted variety is most highly prized, because it affords the whitest flour; and a mill-flone of this kind, six feet and a half in diameter, fetched 1200 francs. We never observe in it cavities any siliceous flabellae or crystallized quartz, and this character enables us to distinguish in hard specimens of this mill-flone from that found in the siliceous lime-flone. It is sometimes compact. It has been analyzed by Hecht, (see the Journal des Mines, No. 22, p. 333,) and appears to be almost entirely composed of silica. Another character of the mill-flone, properly so called, is the absence of all fosile, animal, and vegetable productions, whether of fresh or salt-water origin. Mill-flones are formed by cutting pieces of these flones, and joining them together; and confining the whole with an iron hoop. They are called burr-flones. All the mill-flones used in England are formed of the French limestones.

10. The upper fresh-water formation is composed of silex and lime-flone. These flounces sometimes occur independently of each other; in other instances, they are intimately mixed together. The nearly pure fresh-water lime-flone is the most common; the next in frequency is the mixtures of silex and lime-flone; the large masses of fresh-water silex are the rarest. The silex is sometimes a nearly pure flint; sometimes approaches to pitch-flone, or to Jasper; and, lastly, it has a corroded state, when it has all the characters of true mill-flone, but is in general more compact than the mill-flones without shells. The lime-flone 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-flone near Paris; for at a considerable distance, the lime-flone occurs very compact, of a greyish-brown colour, which readily cuts and polishes. The lime-flone of Mont Abufar, near Orleans, which contains bones of the paleotherium, belongs to this formation. Even the hardest varieties of this lime-flone, after exposure to the air for a time, soften; and hence it is used as a marl for mavouring 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 siliceous minerals and the lime-flone are intermixed, the latter is always corrodcd, 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 potamides, helicites, and limneous corneus, are the petrifications that most frequently characterize this second fresh-water formation: the cyclothiana mummia has never been found in it. There are also the following vegetable and other remains: dicotyledonous wood petrified with silica, items of arundo or tifa, articulated items resembling the thorn, pediculated ovoidal grains, canaliculated cylindrical grains, olive-shaped bodies with an irregular frayed surface. The first or lowest fresh-water formation, on the contrary, has its characteristic petrifications, but never contains potamides 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, Niévre, Cantal, Puy-de-Dôme, Tarascon, and Garonne, in the south-east of France; and, more lately, the same interesting formation has been discovered in the Roman flats 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 intermixtures of the three, coloured brown and black, with carbonaceous matter; also of rolled mafles 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 other large mammalia. 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 flounces 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-course. It is difficult to distinguish the alluvial mud, situated at a distance from the vallis, from the fresh-water formation; and it even, in some cases, seems to pass into it. It appears, however, to be older than that of the vallis.

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, rhinoceroses, hippopotami, whales, chelates, and dolphins.

A calcareous breccia occurs in many of the stratified lime-flone rocks that border the Mediterranean sea; it is not stratified, but fills up fissures and chasms. The breccia consists of fragments of lime-flone (not water-worn or rounded), intermixed with the bones of ruminating animals and land-shells, cemented together by an ochre calcareous subfluence. Moll, 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 (party 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 breeches are formed at the present day; and those of Corinica contain also remains of unknown animals. In selecting fossil remains to characterize 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 subfrequently closed or filled up, as the latter may sometimes be of very recent date.

Strata Stra. 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 flinet; and the cross rents, cutters.

Stratagem, στραταγημα, formed from στρατος, I lead, or command an army, a military wile, or a device in war, surprizing or deceiving an enemy.

Stratagems, or delusions practiced towards an enemy, free from perfidy either in words or actions, or snares laid for him confentent with the rights of war, have always been acknowledged lawful, and have had often a great influence in the glory of celebrated commanders; though artifices of this kind have in various instances proved un SUCCESSFUL. In the use of stratagems, however, we should regard not only the faith due to an enemy, but also the rights of humanity, and avoid doing things, the introduction of which would be pernicious to mankind. Some nations, even the Romans, for a long time professed to delieve every kind of artifice, surprife, 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.

"Ile non incinusquo, Minerve
Sacra mentito, mali feriatis
Troas, et laetam Priami choreis
Fellerat Aulam;
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 buffoons 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 true means are also the most commendable, provided they be not unlawful and odious. (Virg. Xan. ii. v. 396.) The contempt of artifice, stratagem, and surprife, proceeds often, as in the case of Achilles, from a noble confidence in personal valor 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 surprife; as Livy (lib. xlii. cap. 47.) makes those generous senators say, who did not approve of the manner of proceeding against Perseus, as not altogether sincere. 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 stratagems; the moderns wage war more openly, and on the square. Frontinus has made a collection of the ancient stratagems of war.

Stratarithmetry, formed from στρατος, army, γραφασ, number, and μετρον, 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 at hand, or at any distance assigned.

Strategus, στρατηγος in Antiquity, an officer among the Athenians, of which there were two chosen yearly, to command the troops of the state.

Plutarch says, there was one chosen from out of each tribe; but Pollux seems to say, they were chosen indifferently 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 strategi did not command together, but took their turns day by day: as we find from Herodotus and Cornelius Nepos. Sometimes, indeed, as when a perfon was found of merit vailly 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 some be hostages and securities for his conduct and fidelity.

Confront the Great, besides many other privileges granted to the city of Athens, he bestowed his chief magistrate with the title of Νικων Στρατηγος, Μαγνα Δρυς.

Stratford, in Geography, a township of America, in Coos county, New Hampshire, on the E. bank of Connecticut river, incorporated in 1773, and containing 339 inhabitants; 58 miles above Hanover.—Alfo, a pleasant poft-town of Connecticut, in Fairfield county, on the W. side of Stratford river, containing two places for public worship, and 2895 inhabitants; 14 miles S.W. of New Haven. This township, the "Cuphead" of the Indians, was settled in 1638, principally from Malachusettts.—Alfo, 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 Shakspere; and is also pofted of considerable interest, from its local history and situation. It is a large, populous, and respectable town; but though in a manufacturing district, is by no means nor benefited by manufactures 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 frize of the town; other turnpike-roads branch off towards Warwick, Coventry, and Alcester; and to different parts of Northamptonshire, Oxfordshire, Worcestershire, and Gloucestershire.—In 1841, according to the population report, the town and parifh of Stratford contained 652 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 exifted here in the poffeffion of Etheleard, a viceroy of the Wiccans; 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 confluence, 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 Thursday, 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 reign, 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 1642-3, 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 is divided by 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 Shakspere. Several large monuments of the families of Combe, Clopton, &c. are also prefixed 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 Griffiths, 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 1629 and 1636. The chantry contains a monumental effigy of Mr. John Combe, who is traditionally said to have been fattized by Shakspere, in an epitaph written upon him in his life-time. From the situation of this church, on the margin of the Avon, it is 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, a fraternity partly civil, and partly religious, was established here as a public institution in the year 1269, by Giffard, bishop of Worceter, under the name of "The Hospital of the Holy Cross in Stratford." This fraternity had also particular municipal privileges granted them. The chapel of these brethren, excepting the chantry, was rebuilt in the latter part of the reign of Henry VII. by sir Hugh Clopton; it is a handsome structure, in the ornamented 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 Vol. XXXIV.

Underhill, was, in 1597, bought by Shakspere, who first gave 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 at Garrick's jubilee, in 1769, to the memory of Shakspere, was then denominated Shakspere Hall. The building is of the Tuscan order, containing a room of 60 feet in length, decorated with large paintings, particularly two, by Wilson and Gainsborough, of the immortal poet, and of Garrick, by whom they were prefent 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-street. It is now converted into two, although originally but one tenement; and otherwise altered by modern repairs. Stratford-upon-Avon is in the parish and division of Old Stratford, and hundred of Barlichaw, having separate jurisdiction, and is governed by a mayor, recorder, high bailiff, 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 Worceter 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 Shakspere, and others of not 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, which he held twenty-five years; and Ralph de Stratford, nephew of the above prelates, and bishop of London in the fame memorable reign; men who severally 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 Shakspere in the year 1769, a performance which very much abridged 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.
tend about a mile on each side of the road. Till of late years, the east side of the town was in the parish of Wolverton, and the west side in that of Calverton. They are now two distant parishes, denominated St. Mary Magdalene, or the east side of Stony Stratford, and St. Giles, or the west side. A market was originally granted for this town to the Vere 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 sustained much injury by fire: first in the year 1756, when 53 houses were burnt down; second in 1742, which consumed 113 houses, and the body of the church of St. Mary Magdalene, which has never been rebuilt. The tower, which escaped the flames, is yet standing. The damage was estimated at 10,000l., towards which, 4,293l. were collected by a brief, and nearly 3000l. by subscription. The church of St. Giles was originally built as a chantry chapel in 1451, and was endowed in 1482. This church (except the tower) was rebuilt in 1776, by Mr. Hioms of Warwick. Near this structure is a neat market-place. According to the returns under the population act of 1811, the Exit side parish contained 113 houses, 520 inhabitants; the West side parish 211 houses, 568 inhabitants; making a total of 1348 persons, occupying 324 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 denominations: the greater number are Baptists, who have a meeting-house in the town: the Independents have a place of worship at Potter's Perry, a neighbouring village. A guild was founded in the town, in 1481, by John Edy and others. Here are several charitable establishments, particularly one of 7c. per annum for apprenticing poor children. In 1786, two Sunday-schools were opened, in which upwards of 300 children receive the rudiments of education, under the superintendence of the minister, churchwardens, and a committee of subscribers. At the lower end of the town formerly stood a crof, 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 possession of the peron of the unfortunate young monarch Edward V., who was then with his attendants at an inn. An act for paving and lighting Stony Stratford palt in 1801. —Lyon's Magna Britannia, vol. i. Beauties of England and Wales, vol. i. by John Britton and E. W. Brayley.

Stratford-le-Bow, a parish in the hundred of Osullivan, 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 course 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 bower," which was built across the river Lea at a remote period. This parish extends along the eastern banks of the above river, whilst Hackney, Bethnal-Green, Stepney, 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 Nurseries. The soil consists almost entirely of loam, sand, and gravel. The principal manufacture of the parish is calico-printing; which, like that of dyeing scarlet for the East India company, was once in a very flourishing state. Stratford was also at one period celebrated for its number of bakers, and for a manufactory of china, which was on the eastern side of the river. The parish church, dedicated to St. Mary, was built, as a chapel of ease to Stepney, in the early part of the 14th century, by king Edward III., on a piece of ground formerly belonging to the highway. The original structure of flint and stones, yet remaining, consists of a nave, chancel, and two aisles, separated from the nave by octagonal pinnacles and pointed arches: there is also a plain square tower of stone. This church was consecrated as a parish-church in March 1719. The parish of Stratford-le-Bow, in 1811, contained 384 houses, and 2259 inhabitants. Within its precincts, at a place denominated Oldford, are the remains of an ancient manor, usually called king John's palace, of which only one gateway, of brick, is now standing, with the bages of the arches under the gate, adorned with figures of angels holding shields. At Oldford are now erected the grand and extensive buildings belonging to the East London water-works, for the purpose of better supplying the inhabitants of the adjacent parishes and hamlets. —Lyons's Environ of London, vol. ii. 1795, and Supplement, 4to. 1811.

STRATH, a term used in Scotland, and generally signifying a valley broader than a dale or glen, and receiving this appellation from a river passing through it, as Strathbogie, &c. or some distinguishing characteristic, as Strathmore, the great valley, &c.

STRATH, in Geography, a town on the E. coast of the island of Skye; 10 miles S. of Torridmore Head. N. lat. 57° 14'. W. long. 5° 54'.

STRATHAM, a township of America, in Rockingham county, New Hampshire, incorporated in 1693, and containing 874 inhabitants: situated on the road from Portsmouth to Exeter; 10 miles W. of the former, and 4 miles E. of the latter.

STRATH-AVON, a town in the middle ward and shire of Lanark, Scotland, was formerly denominated Evandale and Avendale. It is situated on the banks of a rivulet called Pomilion, which falls into the Avon about a mile below the town. In the year 1450 it was created a burgh of barony, with the usual privileges, and endowed with an extensive common, all of which have for a considerable period become private property. Here are a general post-office and a parochial school; but having no public funds, Strath-Avon has no other government than a bailiwick, appointed by the duke of Hamilton; here are also a weekly market, and five annual fairs. The number of the inhabitants of the town of Strath-Avon, in 1811, was computed to be 2439, who were principally employed in the manufacture of cotton. The church was rebuilt in 1772. At one end of the town was formerly a castle, reared on a rocky eminence, and surrounded by a strong wall, with turrets at certain distances. Its entrance was secured by a bridge. This, and the castle of Arran, were alternately the residences of Anne, duchess of Hamilton, during the protectorship of Oliver Cromwell. After her decease, which took place in 1716, the castle of Evandale being neglected, is now become a mass of ruins.

The parish and barony of Avendale is about twelve miles in length, and from five to fix in breadth: the soil consists chiefly of clay and loam, withf mois, 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 London-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. —Carlile's Topographical Dictionary of Scotland, vol. ii. 4to. 1813. Beauties of Scotland, vol. iii.

STRATHBEG, a river of Scotland, in the county of Sutherland, which runs into loch Eribol.
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.S.E. of Strathy Head.

Strathy Head. A cape of Scotland, on the N. coast of the county of Sutherland; 31 miles E. of Cape Wrath.

N. lat. 58° 37'. 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, their stratum super stratum, as is practised 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, tubular at the base; its limb in three deep, equal, erect segments, deciduous. Cor. Petals three, roundish, rather spreading, twice as long as the perianth. Stam. Filaments from six to twenty, inserted into the receptacle of the flower, short, awl-shaped; anthers vertical, linear, simple. Pity. Germen inferior; elliptic-oblong; ilakes fix, deeply closed, as long as the filaments; Rigimus fimple. Peric. Berry coated, oval, of from six to ten cells, and as many angles, tapering at each end. Stedd numerous, obovate, in two rows. Eff. Ch. Sheath closed. Perianth superior, in three deep segments. Petals three. Berry with five, or more, cells.

Obs. The anthers are occasionally imperfect in some flowers, the filigms in others. The parts of the flower differ widely, with respect to number, in different species. Damasofium of Schreb., Willdenow, &c. has a leafy, though more numerous, divided sheath, with a correspondingly number of angles and segments, its filaments moreover being but six 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 class where Linnæus, after repeatedly considering the subject, had determined to let it remain. This genus is very nearly allied to Hydrocharis. See that article.

1. S. albioides. Water Aloe, or Common Water Soldier. Linn. Sp. Pl. 754. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 379. Mill. Illust. t. 50. Fl. Dan. t. 337. (Militari aizoides; Ger. Emb. 285. Lob. ic. v. 1. 375.)—Leaves sword-shaped, channelled, with a prominent rib, and fringed with sharp prickers.—Native of ditches, ponds, and flow streams in the north of Europe. Abundant in the fenny 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, at the ends of long runners. These rise to the surface, form long fibrous dependent roots, blooming, and then link 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 flat-like tuft, as in Alce, Sedum, Saxifraga, &c.

2. S. acrosides. Indian Water Soldier. Linn. Suppl. 268. Willd. n. 2. (Acuros marinus; Rumph. Ambin. v. 4. 161. t. 75. f. 2.)—Leaves sword-shaped, flat; slightly serrated 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 serrated thereabouts. Stalk simple, fingle-flowered, smooth, three or four feet high. Sheath of two leaves; their keels bearded with fibres towards the top. Petals falcate, 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 five cells. Seeds fourteen or more. There appears no reason to think, with Willdenow, that the anthers above described are nectaries.

3. S. symphonides. Shield-bearing Water Soldier "Humboldt and Bonpland MSS." Willd. n. 3. —"Leaves roundish, peltate, floating as well as the stem."—Found in waters at the Caracas. Root perennial. Serr round, floating. Leaves entire. Sheaths axillary, of two leaves, with one or two flowers, which are twice the size of S. albioides.

4. S. albioides. Broad-leaved Water Soldier. Linn. Sp. Pl. 754. Mart. 425. Sm. Exot. Bot. v. t. 27. t. 15. (Damasofium indicum; Willd. Sp. Pl. v. 2. 276. Alt. v. 2. 331. Roxb. Coromand. v. 2. 45. t. 185. Curt. Mag. t. 1201. Ottel. ämbel; Rheede 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-flakes, almost heart-shaped, blunter, entire, many-ribbed, smooth. Flower-flakes simple, angular, almost as long as the leaves, each bearing a solitary white flower, of very short duration, not unlike a Trillium in base and general aspect. The sheath, an inch or more in length, is closely attached to the germen, cloven at the top into two or three larger segments, with some small intermediate ones. Its fides are dilated into two or three longitudinal wings: we could scarcely find more, though colonel Hardwicke's Indian drawings represent from five to seven or eight. Stamens eight, with vertical, linear, orange anthers. Styles eight.
eight, with cloven, linear, yellow figment. Berry cylindrical, 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 differing so much from each other in that particular, prove the characters derived from hence, in this genus, to be of no value. S. abidos moreover, in itself, overthrows whatever depends on sexual distinctions. The only mark by which _Dimorphium_ could be kept separate, is the sheath being of one leaf, very thinly divided. The number of its lobes and angles is too uncertain to be depended upon.

STRATO, in Biography, a philosopher of Lampacus, who succeeded Theophratus in the Periatico school, and took charge of it in the 33d year of the 12th Olympiad, B.C. 276, and prefixed in it 18 years, with a high degree of reputation for learning and eloquence; and from his attachment to natural philosophy, he obtained the appellation of "Phyficus." Ptolemy Philadelphe chose him for his preceptor, and recommended 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 system both of Plato and Arieftle, and he is said to have nearly approached that system of atheism, which excludes the Deity from the formation of the world. From Cicero (De Nat. Deor. i. 1. c 13) we learn, that he conceived all divine power to be seated in nature, which polishes the caues of production, increase, and diminution, but is wholly delibit of senfation and figure: and the fame author, in his Tufcul. 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 opinions: that there is inherent in nature a principle of motion, or force, without intelligence, which is the only caufe of the production and dissolution of bodies: that the world has neither been formed by the agency of a deity, distinct 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 affected 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 indirecitly excluded from his system the doctrine of the existence of a Supreme Being. Strato also taught, that the seat of the soul is in the middle of the brain, and that it only acts by means of the senses. Brucker by Enfold, vol. i.

STRATONICA, or Stratonica, a town of Asia Minor, near Mount Taurus; called Stratonica ad Taurum by Strabo, in order to distinguish it from the Stratonica of Caria.

STRATONICUS, in Ancient Music and Biography, a famous musician in the service of Ptolemy Aeuleus, the twelfth king of Egypt, who, in a dispute with this monarch on the subject of music, had the courage to tell his majesty, who consented all playing but his own, that "to wield the fopre and perform well on the flute, were very different things."

It is said that he gave lessons to Telephane, and that Niccolo, king of Cyprus, had him put to death by poison, in punishment for the numerous epigrams which he had written against him.

Phanes, the Peripatetic, in his account of the poets, speaks of Stratonicus as the greatest performer on the lyre of his time.

In Athenaeus, l. viii. c. 11, from Phainias the Peripatetic, we are assured, that Stratonicus the Athenian had considerably increased the number of strings on the lyre, and invented new sounds, (not chords, as M. Laborde tells us,) as well as their notation. This must have been a different musician from the disputant with Ptolemy. Athenaeus does not inform us when he lived; but it was probably subfsequent to the great musicians of antiquity, as he is mentioned no where else.

STRATONIS ISTRAEA, in Ancient Geography, an island situated near the entrance of the Arabic gulf. Strabo.

STRATONISI, in Geography, three small islands in the Grecian Archipelago; 10 miles S. of Specia. N. lat. 37° 16'. E. long. 23° 25'.

STRATOR, among the Romans, an officer who took care of the horrea furnished by the provinces for the public service.

Strator is also used for an officer in the army, whose business it was to take care there was nothing in the roads to hinder or inconvenience the army in its march. For which purpose, he ordered banks and steep eminences to be levelled; laid bridges, cut down woods, and assisted the quarter-master to find out places proper for transporting the army over rivers.

Strator is also used for an equestrian, who held the bridle of the prince's horse, and assisted him in mounting. This officer was by the Greeks called _anabolos_.

Strator likewise denotes a surveyor of the highways.

STRATOS, in Ancient Geography, a town of Greece, in the higher part of Acanania, on the river Acheulon. Thucydides.—Allo, a river of Asia, in Hyrcania, which had its source in mount Caucasus.—Allo, a town of Peloponnesus, in Achaia.

STRATTI, or Agno-Stratti, in Geography, a small island in the Grecian Archipelago. N. lat. 39° 35'. E. long. 25° 12'.

STRATTON, a small market-town in the hundred of the same name, and deanery of Trigg-Major, in the county of Cornwall, England, is situated 18 miles from Launceston, and 223 miles west from London. The road into the county, by way of Stratton, was much frequented before the making the Camelford turnpike-road, about the year 1760. A weekly market, which appears to have been held by prescription, is kept on Tuesdays for corn and provisions, and here are three cattle-fairs. The population return in 1811 was 215 houses, occupied by 1094 persons. Camden mentions this parish as being celebrated for gardens and garlick: there are now no gardens but such as are cultivated for private use; nor is it remarkable for the culture of garlick, though that article is occasionally offered for sale in the market. The principal village in the parish is the small sea-port of Bude, containing a few cottages, where families who visit the coast in summer for fes-air and bathing
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 oaks; the
imports, coal and lime-wood from Wales, and grocery, &c.
from Bristol. The harbour, on account of its lands, is well
suited to vessels 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 mackerel, not only into the neighbouring
parishes, 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 parl-
ament, under the earl of Stamford. The latter was en-
camped on a steep hill, with thirteen pieces of cannon, and
3400 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 1775. In 1797, Lord De Dunstanville was created
baron Balcot of Stratton, with remainder to his daughter
and his issue male. Lysons'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 Azud.
STRAVADUM, in Botany, a most barbarous name, taken
from the Samfriedwal. 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
rarefied inflorescence and angular drupis. It consists of
Eugenia racemosa and acutangula, with Butonias alba
of Rumph. Amböin. v. 5, which, though quoted for the
former by Linnaeus, appears in Jullien's opinion to be
different.
STRAVAGANZA, It. 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, sonatas, 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 palfages in perpetual semi-
quavers, 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
duet concertos are, with due propriety, filed his Stre-
taganze; being full somewhat more extravagant, capri-
cious, and eccentric than the rest. But this rapidity and
difficulty are only comparative with the sober strains of
Corelli, Albinoni, Alberti, and Teffarini; it was all plain
falling, at the rate of ten knots an hour: there was no
difficulty of slentument, expression, or modulation to en-
counter. 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'.
STRAUBILICH, a town of Bavaria, in the bishopric
of Bamberg; 13 miles N.N.E. of Bamberg.
STRAUChÆGISDIUS, in Biography, a German math-
ematician, and Lutheran divine, was born at Wittenberg
in 1632, and after a course of education in his native place,
he removed to Leipsic, where he continued two years,
taking, on his return, the degree of master of arts. In
1653 he became adjunct of the philosophical faculty,
deputing on the occasion "De Periodo Juliano," and on
other chronological subjects. In 1659 he was made pro-
fessor of mathematics, and having obtained the degree
of doctor in divinity, he was appointed, in 1664, to be pro-
fessor of history. In 1669, having declined other invitations,
he accepted the invitation of the senate at Dantzic, to be
professor of theology, and parlor 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 in Alberti, and carried to Colberg. As far
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 Dantzic, and even the Calvinists themselves, had
not interceded for him, and obtained his release in 1678.
He then returned to Dantzic, regained his former employ-
ments, 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
ferocious advocate. His mathematical works are, "Geogra-
physica Mathematica;" "Dorina Afrorum Mathematica;"
"Tabula per Universiam Mathem in summopere
necesfarior;" "Tabula Sininum et Tangentem et Loga-
rithmorum." His other productions consist chiefly of dif-
ferrations relating to chronology and figural subjects.
STRAUERSDORFF, in Geography, a town of Austria;
9 miles W. of St. Polcon.
STRAVIK, a town of European Turkey, in Bul-
gary, on the Black Sea, 30 miles S.E. of Ismail.
STRASBURG, a town of Brandenburg, in the
Middle Mark; 33 miles W. of Cultrin. N. lat. 52° 38'.
E. long. 13° 52'.—Allo, a town of Germany, in the
county of Schwartzburg Rudolstadt; 6 miles W. of Sonder-
hauen.
STRASFURTH, a town of Saxony, in Thuringia;
4 miles S. of Weißenfleec.
STRASSBURG, a town of Brandenburg, in the
Middle Mark; 13 miles S.E. of Bernau. N. lat. 52° 37'.
E. long. 13° 55'.
STRASSENECK, a town of the duchy of Sturia;
12 miles S. of Windflich Graz.
STRAW, in Agricultue, the common name of the flak
or item on which grain grows, and from which it is thrashed,
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 store-cattle, or other flock,
it should constantly be made use of when first threshed out;
as by keeping it gets muty, and is not by any means eaten
to well or completely by cattle: in this view, the thrashing
out large quantities at a time by the threshing machine,
STRAW.

...and stacking, or putting it up in other ways, is unfavourable to the perfect consumption of the fodder, and the thriving of the farm-look. There is likewise another point necess-
mary to be regarded in respect to this article as fodder, which is, that the inferior kinds should be first had 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 rated meal-times, the binding of straw becomes, he thinks, essential to good management. Each truss, 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 business of "foddering" is facilitated, and a waffle of straw avoided.

And further, it has been remarked by Mr. Young, that if the cattle are fed with straw, it should be done with attention. The best farmers in Norfolk are generally agreed, he says, that cattle should eat no straw unless be cut into chaff mixed with hay: but, on the contrary, that they should be fed with something better, and have the straw thrown under them, to be trodden into dung; and he is much inclined to believe, that in most, if not in all cases, this maxim will prove a just one. The common cafes of straw-feeding are, of cows, young cattle, or black cattle just brought in, and not yet put to fatting. With regard to cows, the food is certainly, he thinks, insufficient, and 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 hummered, and yield at once adequately. And that for young cattle, it is still worse management: for their growth is stunted, and they never recover it. It is his opinion, that black cattle from poor mountains had better be put to straw than any other flock; but here, 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 harveft 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 fize 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-
dyard dung, all this remaining 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, answers very well, especially with some form fuculent food. And it has been fated by the author of the "Synopsis of Husbandry," that bean-straw, if well harvefted, forms a very hearty and nutritious diet for cattle in the winter-
time, and both oxen and horses, 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-
meat. Mr. Young also fuggles the great importance of putting beans in sufficiently early, and the resent food enough, as the straw, well harvefted, is worth from 26. to 36. per acre; and that Mr. Arbuthnot's teams, which were always hard-worked, never had a truss of hay while the bean-straw lasted. Pea-straw, or hulun, 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 fated by Mr. Marshall, that he met with an idea that cattle may be fattated with straw; or, in other words, may be ferved 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 oat 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 thorough the inferior 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 uninteresting 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 north of England, where they go loofe among a much greater plenty; but whether it proceed from the 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 fort of fodder can be wholly confumed by the flore-look, it is probably a better method to make use of it in that way, than by littering the yards with it, as the manure is without doubt much inferior, and other articles, such as forra, &c., may, in many cafes, be provided as litter.

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 ifalls or yards, especially where much green food is used, is very great, and often of vast importance to the farmer, as has been fated in con-
idering the means of ifall-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 ifances. See STALL-Feeding.

The fale of the wheat-straw, which is often permitted, is not unfrequently a matter of great consideration in dif-
ferent situations. The use of the cut straw, or hulun, of pulse crops, has lately, too, been found very great in the feeding out or fattening different forts of cattle and other animals.

It has been lately fated, by Sir Humphrey Davy, that dry straw of wheat, oats, barley, beans, and peas, and spoiled hay, or any other fimilar kind of dry vegetable matter, is, in all cafes, useful manure. That, in general, fuch fubfiances are made to ferment before they are em-
ployed, 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 talked like mucilage. And from the fame quantity of wheat-straw he gained five grains of a fimilar fubfance.

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 objec-
tion to this method of using straw, from the difficulty of including and completely burying fuch as is long, and from its rendering the humus light, or in a littery flatte.

Where straw is made to ferment, it becomes a more

manageable
manageable manner; 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 less 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 its influence, it is thought, would be much more lasting, and perhaps ultimately more beneficial.

Straw, Fea, Hacking of, the cutting up and reaping of the pea crop, in the haumul, in the field, when tawn by the drill or hand, in the floured manner. It is performed by means of two hooks of the reaping kind, by one of which the straw or haulm 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 preferring Fruit-tree Blossoms and other Crops, in Gardening, the means of guarding and 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 expose. This is a method which it is stated to have been practised with great success in the more northern parts of the island, in different papers inserted 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 from four to six feet distance from each other; the lower ends being sunk a little into the ground, and the upper ones rising fo as just to reach below the copings of them; securing the tops of those at each end of the particular spaces or distances, by means of a strong nail or hold-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 on the 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, palling 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 twenty inches lower down, 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 left, 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 fruitification 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, woolen nets, which are much recommended for this use by some, the writer has never had the opportunity of seeing them in such cases.

It has also been found, that these sorts of ropes are very useful in protecting and preferring other early garden crops from the effects of the cutting frothy 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 sides 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 preferring fruit-blossoms, and crops of other kinds, may be practised 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 this 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 hom, with wooden collar-trees, to which are fastened rope-traces.

Straw-Cutter, in Agriculture, a name sometimes applied to the person 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 cafes 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 where the straw is prepared and littered with straw for the use of neat cattle and other animals, as well as the yards into which fodder and other horfes are taken during the winter season, to be fed on straw and other similar matters, in a cheap manner,
drier, especially near the metropolis, and other large cities and towns.

**STRAWBERRY, in Botany and Gardening. See Fragaria. 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 strawberies, 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 fort of fruit is illustrated and recommended as very extensivo: it shades the roots from the sun; prevents the waste of moisture by evaporation, and consequentially in dry times, when water is scarce, and watering necessary, makes a less 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 leaning fruit from retting on the earth, and gives the whole an air of neatness, as well as an effect of real cleanliness, which should never be wanting in this fort 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, are about seventy-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 width of each bed 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 trusses, 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 trusses, six be allowed for the short straw taken out and applied to other uses, twenty trusses will, it is said, remain, which cost this year ten-pence a truss, or sixteen 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 dunghill as soon as the crop is over. The cost of this practice cannot, therefore, it 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 smihed, 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 favouring was immediately, it is said, brought to account in the increase of other crops, by the use of the water spared from the strawberries, and besides, the berries themselves were, under this management, it is observed, as fair and nearly as large as in ordinary years, but that the complaint of the gardeners this season was commonly, that the scarlets did not reach half their natural size, and of course required twice as many to fill a potte as would do it in a good year.

It is noticed, that in wet seasons or years the straw is of less importance in this point of view, but that in years moderately wet, the use of strawing sometimes makes watering wholly unnecessary, when gardeners who do not straw are under the necessity of retorting to it, and that it is well known, if watering be once begun, it cannot be left off until rain enough has fallen to give the ground a thorough soaking. Even in wet seasons or years the straw is said to do considerable service, as heavy rains never fail to dash up abundance of mould, and fix it upon the berries, which is entirely prevented by it, as well as the dirtiness of those berries that lean down upon the earth; so that the whole crop is kept pure and clean: no earthly taste will be observed in eating the fruit that has been strawed, and the cream, which is sometimes foiled when mixed with strawberries, by the dirt that adheres to them, especially in the early part of the season, will retain to the last drop, it is said, that unfulfilled red and white, which gives almost as much satisfaction to the eye while we are eating it, as the taint of that most excellent mixture does to the palate.

It is not improbable that this old practice might be usefully and advantageously revived, and the material applied in the manner of large ropes, such as are employed for protecting and preferring the blossoms of fruit-trees and different common garden crops, or larger, as in that case short straw might be made use of as well as that which is long and more expensive.

It has also been remarked, in another paper in the same Transactions, by Mr. M. Keens, that, in consequence of having noticed the deterioration of several kinds of fruit, when propagated in the usual modes of slips, buds, cuttings, focien, or divisions of the parent root, he has for a considerable time employed himself in raffing new varieties from seed, which has not only afforded him amufement, but considerable profit. About the year 1806, he raffed, as it is said, a great many strawberies from seed; and the feed he fed tbat the last was that of the large white Chilli strawberry. The produce of plants thus obtained, was, it is said, in general white, and in no way finewaiced: one, however, among them attracted his notice, as very different from, and far superior to all the rest; and in the following year it fully justified the preference he had given it. The growth of the plant was free and vigorous, the stalk erect, stronger and more able to sustain the fruit than that of any other kind known, which alone, it is thought, would give it a decided superiority over others in wet weather. The shape of the fruit is round, like its parent, the Chilli strawberry; and its colour, being of a very fine deep crimson, gives it a richness to its appearance, far above that of any other strawberry yet known. The seeds project considerably and defend it from bruise, which prefers the fine bloom upon the fruit, and renders it by far the most portable, as it is the most beautiful, fruit of its kind that has been hitherto cultivated.

It is, however, remarked by the Society, that the flavour of it is not high, but there is a probability of its being useful in the markets of the metropolis and perhaps others.

The rafing of strawberies in this way would, therefore, seem
feem to be deferving of more attention than has yet been
dowed upon it.

STRAWBERRY, Barren and wild elevated, 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 Fragraia.

STRAWBERRY-Blite. See Blitum.

STRAWBERRY-Gingrefall. See Potentilla.

STRAWBERRY-Spinach. See Blitum.

STRAWBERRY-Tree. See Arrutus.

STRAWBERRY-Trefall. See Tropil.

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. 38° 56'; E. long. 237° 34'.

STRAWBERRY Cap, a mountainous path 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-
ard's river, N. lat. 46° 45'; W. long. 91° 44'.

STRAWT, in Rural Economy, a term signifying the
dock of a horle without the hair; also the tail of flangu-
tered cattle or sheep, where the skin is removed.

STRAY, in Geography. See Viena.

STRAY. See Eyraw.

STREAK-Fallowing, in Husbandry, a particular fort
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 so lying on that which is not; when this is
plowed, it is then clean-ploughed, and laid so smooth, that it
will come at sowing time to be as plain as before. This
is done when lean or poor lands are not wadry enough to
bear clean tillage, nor light enough to be set to ward.
The intent of this tillage is to keep the fun from scourching
them too much; but in many places they think this wears
the land too fast, and therefore are not fond of having re-
course 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 shou'd be carefully
avoided in cheese-making. See Dairying.

STREAM Anchor. See Anchor.

STREAM Cable. See Cable.

STREAM-Tin, in Mineralogy. Particles or maffes 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 process used to separate the earthy
matter from it, which consists in paffing 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 some-
times intermixed with particles of native gold. See the fol-
lowing 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 slate of the rocks, which are interfeeted
by metallic veins. Tin-ore or tin-ore policles: great hard-
ness 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 an
other 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 maffes 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 posfeefing some charac-
teristic 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 higher than at present at some former
period. Many of the stream-works or repositories are of
very ancient date, as they occur considerably below the pre-
rent level of the rivers. Human fllaxes, and the horns of the
eel, or flag, have been found in the beds of sand which
cover them. In the stream-works near St. Auliffe, 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 Plymouth:
the latter is important, as proving that gold once exfted in
regular veins. In St. Blazey Moor there is a depth of
twenty feet of alluvial coil. The first stratum next the sur-
fase is composed of gravel refting upon mud; the succeeding
stratum is gravel, containing a little tin-ore: this lies upon
a bed of dark combustible peat-earth. Immediately under
this lies a bed of stream-tin, about five feet thick. Great
part of this stream-tin has been wrought out at very
remote period, and before iron instruments were in use; for
several wooden pick-axes, made of oak, hulm, and box,
were discovered in it a few years since. Stream-works some-
times extend under the sea on the coast of Cornwall. One
of the most remarkable of these works is in a branch of
Falmouth 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 Der-
byshire Report, p. 373, mentions a mass of lead-ore, 25 lbs.
weight, being taken out of a gravel at the top of a hill in
the village of Wyanton, which proves that mafles 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 softer 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 ma-
terials in which it was imbedded have been washed away.
See Vein.

STREAMING, or Stream-Works, denotes the ma-
agement of the stream-tin. The first part of this busines, af-
fering the ground which contains it, is to sink a
hatch, or shaft, three, five, or even fathom deep, to the
rocky shelf or clay on which the tin is stratified. If, upon
trying a shovelf 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 be-
byles, or living-streams. The streamer next carries off what
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 shovelf of it as
it rises into a tpu, which is an inclined plane of boards for the
water to run off, about four feet wide, four high, and nine
feet long: in which, with shovelfs, they turn it over and over
again, under a cascade of water which washes through it, and
separates the wafe from the tin, till it becomes one half
The best of the tin is collected by its superior gravity, in the head of the tye, under the calccde; and the refuse and foil are cast into the beds of adjacent rivers, or buried under the gravel and flones that form the interior flatra. This kind of tin is dredged by washing it again in a smaller tye, called a gaunce, with a leaf current of water, and greater care. The richer part is put into large vats, and the waile is dried again, till what remains becomes refuse; the tin is then lifted through wood or wire sieves, which separate the greater and smaller particles: the smallest tin is put into another firmly weaved horse-hair sieve, called a diluter, by which it is made saleable.

Some of the nodules of tin are melted 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 gourse, are triturated and pulverized in the stamping-mill, so that all waste may be cleared from the tin by several ablations, as in the dressing of mine-tin. See Drifting of Ones.

Besides these stream-works, there is another fort, occasioned by the refuse from the stamping-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 dressers, called lappars, probably from the Cornish word lappar, or dancer, from the method of moving up and down with naked feet in the boulders, 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 stone-tones and clay, well cemented and cramped together with iron, called the callie, or flatum super flatum, in such quantities, that from 8 to 12 cwt. of tin, by the consummation of from 18 to 24 fifty-gallon packs of charcoal, may be melted 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 meon-tyne trough, called the float; whence it is laded into kegs through or moulds, each of which contains about 3 cwt. of metal, called flabs, bckks, or pieces of tin, in which size and form it is sold in every 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 melted from a pure mineral by a charcoal fire: whereas mine-tin is usually corrupted with some portion of munde, or other minerals, and is always smelted with a bituminous fire, which communicates a harsh fulphureous quality to the metal. Pryce's Mineral. p. 136, &c.

STREAMERS, in a Skip, the same with pendants; which see.

STREAMS, Made, in Agriculture, such as are formed for the use of land, live-flock, or other rural purposes, by means of art.

Much improvement of this fort 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 couries or pallsages 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, farmheads, and lands in the flat of grafts, 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 exposed 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 Distrits," that not uplands only are susceptible of this fort of improvement, but even low-lying vale lands, marshes, and rich feeding grounds, are not unfrequently deficient of good water for pasturing of flock; 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 partry or other ground, should be supplied with a constant stream. Where the quantity of water is small, in comparison 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 fupply to the fupply, the manner in which it is distributed. Where there are continual streams, the fupply may drink at dilations 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, Mills, in Rural Economy, a term commonly applied to the leads or runs of water which constitute the moving powers of this fort of machinery, and which are mostly formed by means of art. In most of the mountain districts, whether in Scotland, in Wales, or in the west of England, where there are fants for the most part, of the over-float kind, streams of this fort, commonly of the artificial kind, are almost every where to be met with, some of which are of very considerable length, and the antiquity of which cannot now be ascertained. In flat districts, too, where under-float mills mostly prevail, these fants are not unfrequently to be found, as conducting the water which is to put them in motion.

Wherever cuts for streams or leads of this nature are to be formed, it should certainly be done in a fixed and safe manner, so as that no water may in any way be walked or lost.

STREATHAM, in Geography, is a parish in the east half 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 Saxon, signifying a dwelling on the highway. The manor of Tooting-Boc, 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 Rule, 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-houte and part of the offices converted into a residence. On the side of the common, between Streatham and Tooting, is Streatham-
park, the property of Mrs. Piozzi, relic 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; one by Dr. Johnson, to the memory of Mr. Thrale and Mrs. Salusbury, mother of Mrs. Piozzi. Mr. Lysons, in his Enquiries 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 lent in large quantities to some of the hospitals in London. This parish was, in 1611, computed to contain 440 houses, and 2729 inhabitants.—Beauties of England and Wales, vol. xiv. Surrey, by F. Shober.

STREBERICH, a town of European Turkey, in the province of Bosnia, anciently called "Argentina," from the silver-mines found in its vicinity; 70 miles W. of Belgrade.

STREBLSUS, in Botany, $\frac{1}{2}$ twirled or zigzag, in allusion to the dissected branches.—Laurerice. Cochinchin. 614. Clafs and order, Dioecia Tetrameria. Nat. Ord. ... Gen. Cha. Male, Cal. Perianth of four ovate, concave, spreading leaves. Cor. none. Stam. Filament four, zigzag, longer than the calyx; anthers roundish, of two cells.

Female, on a separate plant, Cal. as in the male, permanent. Cor. none. Pet. German superior, roundish; style long, deeply divided into two branches; filigmas simple. Peric. Berry roundish, two-lobed, of two cells. Seeds ovate, solitary.


Obf. Loureiro calls the berry itself monogynus. Perhaps one of the cells is always abortive.

1. S. affinis. City Des dais of the Cochinchinefs. Leaves ovate, entire, rough.—Native of mountainous woods in Cochinchina. A large tree, with remarkably twirled, spreading branches, the ultimate ones very short. Leaves alternate. Male flowers in numerous, scattered, small, falcate heads; female ones solitary, scattered, on fimple flalks.

2. S. cordatus. Tjung Xu of the Chinese.—Leaves heart-shaped, furrowed, ribbed.—Found about Canton, in China. A middle-sized tree, with spreading branches. Leaves alternate, acute. Male tree with numerous, small, falcate, conical, lateral clusters. Filaments flatish. Anthers spiral. Female tree not observed by the author. We have no knowledge of this genus, but from the above description.

STREET and Road Dung, in Agriculture, the mixture of animal and vegetable matters, scarped and swept up from the streets of large towns, and the roads in different places, which is found to be excellent as a manure. See MANURE.

STREET Soil, the mixture of earthy scarpings collected from streets and employed as manure. In the Corrected Account of the Agriculture of Glouceffhire, this is laid to be a molt valuable manure, and now as eagerly fought for there, for the purposes of the farm, as it was formerly neglected.

This fort of subfiance, as manure, may often be molt beneficially made ufe of for grain-crops, especially when intimately blended with good rich matters of the mould kind, in addition to tho[e already contained.

STREHAJA, in Geography, a town of Walachia; 18 miles E. of Czernitz.

STREHLA, a town of Saxon, in the margravate of Meifen, on the Elbe; 14 miles N.W. of Meifen.

STREILEN, a town of Silesia, in the principality of Bregi; 16 miles W.S.W. of Bregi.

STREIDORFF, a town of Austria; 5 miles S.S.W. of Ehrnprunrn.

STREIGHT. See Straight.

STREIN, or Strinius, in Biography, an Austrian baron, with the title Von Schwartzanau, was born about the year 1538. The first object of his attention was jurisprudence; but afterwards, under the care of Francis Hotman, he professed 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 Familis Romanorum," which was published at Paris in 1593, fol. by Henry Stephens; and of "Steppen Gentium et Romanarum Familiarum," in the 7th volume of "Graevii Theatinarum Rom. Ant." He also wrote "Commentarius de Rob. Bellarmino Scriptis ad Litibus," 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. Biog.

STREITBERG, in Geography, a town of Austria; 12 miles S.S.W. of Ebenfurth.—Also, a town of Germany, in the principality of Culbach, infaluated in Bamberg; 36 miles S.W. of Boreuth. N. lat. 49° 49'. E. long. 13° 10'.

STREITDORF, a town of Austria; 8 miles N. of Korn Neuburg.

STREITFORT, a town of Transylvania; 13 miles N.N.E. of Fogaras.

STRELEN, a town of Saxony, in the margravate of Meifen; 15 miles N. of Meifen.

STREILTZ, Great Striletz, or Wilko Strileze, a town of Silesia, and capital of a circle, in the principality of Oppeln; 14 miles S.E. of Oppeln. N. lat. 50° 27'. E. long. 17° 15'.

STREILTZ, or Old Striletz, a town of the duchy of Mecklenburg, situated in a marshy district; founded by Otho and Ulrich, counts of Furftenberg, in the year 1329, and entirely destroyed by fire in 1575 and 1676. Duke Adolphus Frederick refided here, but when his palace was burnt down, in 1713, he built another in the vicinity, at a place called "Glenke," and in 1733 founded a town adjoining to it, under the name of "New Streiltz," supposing that in time it would be so enlarged, that Old and New Streiltz would become one place. Streiltz gives name to one branch of the house of Mecklenburg, called Mecklenburg-Streiltz; 50 miles W. of Stettin. N. lat. 53° 22'. E. long. 13° 18'.

STREILTZ, Little, a town of Silefia, in the principality of Oppeln; 14 miles S. of Oppeln.

STREILTZ, a town of Scotland, in the county of Perth, built in 1763, for soldiers discharged after the German war; 10 miles N. of Perth.

STREILTZIA, 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 princess queen of Great Britain, a princess of the house of Mecklenburg-Streiltz. Few persons 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.—Ant. Hort. Kew. ed. 1. v. 1. 285. ed. 2. v. 2. 54. Schreb. Gen. 796. Wild. Sp. Pl. v. 1. 1189. Mart. Mill. Dict. v. 4. Thunb. 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 lowestmost boat-shaped; two upper ones bluntly keeled. Nectary of three leaves; the two longest equal, rather shorter than the petals, broad at the base, then tapering, with a folded waxy border, embracing the flamin and lyle, half arrow-shaped towards the top, with a thick doral appendage; the third leaf much shorter, ovate, compressed, keeled. Stem. Filaments five, inserted into the receptacle, thread-shaped, three of them embraced by one leaf of the nectary, two by the others; athers terminal, linear, erect, parallel, about as long as their filaments, concealed in the nectary. Pfl. Germen below the corolla, oblong, bluntly triangular; style thread-shaped, the length of the filaments; stigmas three, awl-shaped, rising above the nectary, erect, glued together in an early flat. 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. Thumb. Prodr. 45. Willd. n. 2. Ait. n. 1. (Heliconia alba; Linn. Suppl. 157.)—Flower-stalk 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. Mallon in 1791. It flowers in the flove, from February to May. The root is perennial, with long and thick fibres. Leaves radical, about six feet long, resembing those of a Mafa. Flowers white, bearing but a small proportion to the magnificent foliage.

Though this is what the younger Linneaus meant by Heliconia alba, his specific character is erroneous, and the synonym of Rumphiis belongs to a species of Heliconia, not well ascertained.

2. S. Regiana. Canna-leaved Strelitzia. Ait. ed. 1. n. 1. t. 2. ed. 2. n. 2. Willd. n. 1. Redout. Liliac. t. 77, 78. Curt. Mag. t. 119, 120. Andr. Repol. t. 432. (S. ovata; Ait. n. 3. Heliconia Bihai; J. Mill. l. c. 1. 5. 6.)—Leaves ovate, not one-third the length of their footstalks, which are nearly as long as the flower-stalk.

3. S. angustifolia; Ait. n. 5.—Flower-stalk, as well as the footstalks, seven times as long as the lanceolate leaves.

4. S. parvifolia; Ait. n. 6.—Flower-stalk, as well as the footstalks, twenty times as long as the linear-lanceolate leaves.

Native of the Cape of Good Hope, flowering in our flove 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 Mafa or Canna, except in the want of a stem. The leaves are smooth, rigid, and coriaceous, erect, on long, flat, stout, nearly cylindrical, smooth, radical footstalks, sheathing at the base. The form of the leaf itself is usually ovate, acute, entire; wavy or crisp at the base, especially on one side; furnished with a faint line mid-dial which tends off several simple, oblique, parallel, transverse veins. Sheaths one or two, at the top of the cylindrical, simple flower-stalk, 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 bluish purple nectary, both together composing one of the most brilliantly coloured flowers in nature.

We presume to think the S. ovata of Hort. Kew does not differ from the only variety of the S. ovata, as it was given to the marquis by Mr. Bamber Galcynv. Of this we are certain, that offsets of the original root, in the flove of the late marchioness, where for many successive years we have observed them, gradually diminishing in the base and breadth of their leaves, became like S. angustifolia, and then parvifolia, of Hort. Kew. Similar varieties may indeed have been bred imported from the Cape, but this does not prove their specific difference. In some specimens the leaf dwindles to a mere point.

3. S. firnosa. Mealy-talked 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 flove at Kew in February and March. It was introduced by Mr. Joseph Banks in 1795. With this we are unacquainted, and therefore cannot premise to judge how far it is specifically distinct from the foregoing.

STREITZIA, in Gardening, affords a plant of the herba-
ceous, 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 pan-tin of the flove; afterwards, when the plants are large, they should have plenty of mould, that the roots may be extended into the rotten top, 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 best in the dry flove and conservatory departments.

This is highly ornamental among flove-plants.

STREME, in Geography, a river of Brandenburg, which runs into the Havel, 4 miles S. of Rathenow.

STRENE, in Antiquity, new-year's gifts; 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 viri firnosi: Symmachus adds, that the use of them was first introduced by king Tatius, Romulus's colleague, who received branches of vervain gathered in the sacred grove of the goddess Strenas, as a happy pro-

age of the beginning year.

Anciently, a pound of gold was given to the emperors every new-year's day, by way of firina. Du-Cange ob-

servers, that firina, or firina, 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.

STRENBG, in Geography, a town of Aulria; 10 miles E.S.E. of Ens.

STRENG, a river of Brandenburg, which runs into the Havel at Brandenau.

STRENGNAS, or STRNGNAS, a town of Sweden, in the province of Svedermanland, situated on the Mxler lake: it is the fce of a bishop, and has a celebrated gym-

nams.
fum, or fermary, founded in the year 1626, by Guttavus Adolphus; 32 miles W. of Stockholm. N. lat. 59° 20'.

E. long. 16° 55'.

STRENGTH, vis, force, or power.

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 quantites of the mafs of their blood; the whole strength of an animal being the force of all the muscles taken together; therefore, whatever increases 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 veflils being destroyed, wonderfully lefns the strength.

The sudden suppression of perspiration, though it increases the quantity of the blood, as it must considerably do fo, by Sanctorius's calculation, yet it lefns the strength; because the retained matter, being what ought to be evacuated, does alter the texture of the blood, as to make it unfit for muscular motion.

Suppose the increafe of quantity to be connected with an extraordinary vifedity, the quantity of small fermentable parts decreasing as the vifedity increafes, the quantity of animal spirits separated in the brain will be lefs; and the tension of the fibres being in proportion to the animal spirits forced into them, they will not be able to counterpofe the great weight of the blood, and fo the strength will be diminished.

Belliini proves, that if the blood be fo vifitated as to increaf or diminish strength, it amounts to the fame as if the blood were in a natural state, but its quantity increafed or diminished in the fame proportion: fo that the blood, when vifitated, may fo impair the strength of the muscles, as even to spoil digestion; and yet, in fame cafes, it may be fo vifitated as to help digestion, and increafe strength.

M. de la Hire, in a calculation of the strength of a man in drawing and bearing, fhes, 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 lefs than one would imagine.

He adds, that this force would be much greater, if the man were to walk backwards, and that it is for this reafon, that watermen fetch their oars from before backwards: and though, he observes, the gondoliers of Venice fetch them the contrary way, yet this is, becaufe they choose to lose the advantage of strength, to have that of facing the place they are going to, in the numerous turns and canals they there meet with.

It is known by experience, that a horfe draws, horizontal- taily, as much as seven men; consequently, his strength will be 189 pounds. A horfe, as to pulling forwards, has a great advantage over a man, both in the strength of its muscles, and the disfpofition of the whole body; but the man has the advantage over the horfe in ascending. M. de la Hire fhes, that three men, laden with 100 pounds a-piece, will ascend a pretty steep hill with more ease and expedition than a horfe laden with 300 pounds.

Hakewell, in his Apology, p. 238, furnifhes us with abundance of instances of extraordinary strength.

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 attended to. 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 hypothesis, and consequently are not only discordant amongst 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 refeptive investigations, while we only contemplate the analytical procedes 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., were they perfectly elastic in one cafe, or perfectly rigid and incompreffible 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, consequentially, 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 class are more particularly to be distinguished Mariotte, Parent, Belidor, Mushchenbroek, 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 the 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 depended 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, a 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 Mushchenbroek 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 Mushchenbroek appears to have taken, and the minuteness with which he describes the proceed he employed, cannot but incline us to adopt his results, in preference to Emerson's, till some further 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 institution; and as nothing will doubtless have to be wanted to render the course complete, either with regard to the selection of proper woods, or the accuracy of 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 for distinguished for its improvements in machinery of every kind, it is somewhat singular that no writer has treated of it in the 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 artisans, and the determined purpose of improvement and refinement which he sees in every workshop. Every cotton-mill appears an academy of mechanical science; and mechanical invention is spreading from these fountains over the whole kingdom. The philosopher is mortified to see this ardent spirit so cramped by ignorance of principles, and many of these original and brilliant thoughts obscured and clogged with seedlefs 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 lemons."

Without entering here upon the subject of corporeal 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 affign to this article, and on which, after all, so little satisfactory information is to be expected, we shall proceed to examine the different strains to which a body may be exposed, and its tendency to exhibit 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, fretchers, 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, poles, and truss-beams.

3. It may be broken across by a force acting perpendicularly to its length; as in joints, 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 prel, &c.

On the direct Cohesion of Bodies.—The force 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 assigned, nor any reason offered, for supposing but that, in such cases, the strength varies directly as the area of the section of fracture, and is totally independent of the length or position; except, indeed, so far as the former may increase the weight or force, when the body is suspended in a vertical direction, or in any other position where the weight of the body itself increases the force applied. Abstracting from this, every part is equally liable to fracture, being throughout stretched by the same force. But this supposes a perfect uniformity of corporeal 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 rather broken than a shorter one of equal quality and thicknesses. It is a fact perhaps drawn from experience, but it is one which cannot be introdced 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
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 Mufchenbroeck affords to produce the greatest strength.

<table>
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<tr>
<th>Steel-bar</th>
<th>Soft</th>
<th>120,000</th>
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<tr>
<td></td>
<td>Razor-tempered</td>
<td>150,000</td>
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<td>Malacca</td>
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<td></td>
<td>Banca</td>
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<td>Tin cast</td>
<td>Block</td>
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<td>English block</td>
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<td></td>
<td>English gran</td>
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<td>Lead cast</td>
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<tr>
<td>Regulus of antimony</td>
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<td>1,000</td>
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<tr>
<td>Zinc</td>
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<tr>
<td>Bifmut</td>
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<td>2,600</td>
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</tbody>
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Two parts of gold with one of silver - 28,000
Five parts of gold with one of copper - 50,000
Five parts of silver with one of copper - 48,500
Four parts of silver with one of tin - 41,000
Six parts of copper with one of tin - 41,000
Five parts of Japan copper with one of Banca tin - 57,000
Six parts of Chilis copper with one of Malacca tin - 60,000
Six parts of Swedish copper with one of Malacca tin - 64,000
Balls consisting of an unknown proportion of zinc and copper - 51,500
Three parts of block-tin with one of lead - 10,200
Eight parts of block-tin with one of zinc - 10,000
Four parts of Malacca tin with one of regulus of antimony - 12,000
Four parts of lead with one of zinc - 4,500
Four parts of tin with one of lead, and one of zinc - 13,000

These results are very useful, provided they could be securely depended upon; but we could wish to see familiar experiments repeated by other philosophes: not that we wish to undervalue the labours of Mufchenbroeck, to whom the arts are much indebted for many valuable deductions, but so 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 6000 lbs., a mixture is produced, whole strength 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 suspect it is nothing more than a false idea arising out of a 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 coheison of metals, we must now attend to another very important subject; viz. the strength of timber.

The coheison 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.

1. The wood immediately surrounding the pith or heart of a tree, is said to be the weakest, particularly if the tree is old; others, especially Buffon, affect 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.

2. 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 little difference of strength depending upon their northern or southern direction. It is true, generally, that that wood is the strongest whole annual plates are thickest, the ligament 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 clove-grained wood it is scarcely perceptible.

The only author who has enabled us to judge of the accuracy of his experiments is Mulchenbroeck, who has described very minutely his apparatus, and his method of performing the experiments. The pieces he employed for this purpose were parallelepipedons, cut down in the middle to 4/5 of an inch square, or 1/3 of an inch section. These results, reduced to the section of a square inch, are as follow:

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<td>Beech oak</td>
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<tr>
<td>Orange</td>
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<td>Alder</td>
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<td>Mulberry</td>
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<td>Willow</td>
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<tr>
<td>Cedar</td>
<td>4,880</td>
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</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>
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<th>Wood</th>
<th>Lbs</th>
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<td>Oak, box, yew, plum-tree</td>
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<td>6070</td>
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<td>Willow, plum</td>
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<tr>
<td>Red sir, holly, elder, plane, crab</td>
<td>5000</td>
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<td>Cherry, hazel</td>
<td>4760</td>
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<tr>
<td>Alder, alh, birch, willow</td>
<td>4390</td>
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</tbody>
</table>

With regard to the absolute results in these two tables, we do not, in 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 subfequent experimentalists have not been able to find equal strength: thus M. Petit says, on the authority of his own experiments, and those of M. Parent, that the utmost strength of a square inch of oak does not exceed 8640 lbs.; whereas Mulchenbroeck makes it 15,000 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 cafes; yet we conceive it to be a very important one, as we have always found the strength of wood of the same kind, to depend a great deal upon its weight or specific gravity. The same experiments give for the strength of ash 17,000 lbs., and fir from 10,000 lbs. to 13,000 lbs., both considerably different from Mulchenbroeck’s tabular results. The pieces from which these weights were found were cylindrical, very accurately turned to one-third and one-fourth of an inch in diameter; but to avoid any errors that might have place in gauging the diameters, their circumferences were taken by winding a fine silk thread ten times round them, and then dividing the length of it by 10 for the circumference.

On the Resistence of Bodies, when pressed longitudinally.—It is obvious that a body, when pressed endwise, by a sufficient force, may be crushed and deformed; and this may take place, either by a total separation of the matter as it is compacted, 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 that which takes place in beams supported at each end, and loaded in the middle; a subject which will be treated of in a subjequent 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 Bernoulli, in his investigation of the properties of the elliptic 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 inventendi

As to the experiments that have been made on this kind of strain, there are few from which much practical information can be obtained. M. Petit says, that his experiments, and those of M. Parent, shew that the force necessary for crushing a body is nearly equal to that which will tear it asunder. He says that it requires something more than 60 lbs. on every square line of found oak to crush it. But experiments 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 impracticable; it is therefore fortunate that we have little occasion for very accurate information on this head: what it is more defirable to be acquainted with is, the resistance which a pillar or post will offer to compresion before bending, the length being taken into consideration; for it is obvious, both from theory, as well as from a practical view of the subject, that the length of the beam must be an important datum in this kind of strain, although it is not in the former, viz., in opposite being drawn asunder; it is therefore very defective to state the requisite forces in both cases to be equal, or indeed to state any proportion whatever between them.

M. Girard, in his "Traité Analytique de la Résistance des Solides," Paris, 1798, details a great variety of experiments made on beams of fir and oak of considerable dimensions, by means of a certain machine constructed for the purpose. But these experiments were not made so much with a view of breaking the pieces submitted to the prejure, as to measuring their deflections, and eliminating what the author calls, after Euler, their absolute and relative elasticity; they do not furnish us with the kind of results above alluded to, as having been attempted by MM. Petits and Parent.

Through the whole course of M. Girard's experiments, much irregularity was observed, so much, indeed, as to render 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 investigations. The following table contains many of the most important 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 thickness or depth, and the latter in the direction of the least thickness or breadth; the seventh and eighth columns contain the measure of the greatest deflection, or veredisse 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 observed, that M. Girard has given several more measures of deflections, weights, &c. than we have copied; we have, in all cases, taken his first two and last two, and omitted the intermediate ones.

The experiments marked with * 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 transverse strain, or rather on the deflection caused in beams by loading them in the centre with different weights, their extremities being supported on two props.

The oak-beams were the same which had been submitted to the longitudinal prejure, 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 subseuent 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 workmen call spoars.

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 prejure, for which purpose he gives us the following formula, viz., let $f$ denote half the length of a beam, supported at each end and loaded in the middle, and let half that weight be denoted by $P$, and $b$ the quantity of the beam's deflection; also $\pi$ the semi-circumference of a circle, whose diameter is 1, then the absolute elasticity $Ekk = \frac{Pf^4}{3b}$, and the weight $Q$, under which the same beam will begin to curve, when pressed endwise, will be expressed by

$$Q = \frac{\pi^2 Ekk}{f^4}$$

or, by substituting for $Ekk$, we have

$$Q = \frac{\pi^2 P}{12b}$$

We cannot, however, say how far this formula will apply, it being very difficult to ascertain the commencement of deflection in the actual experiment.

M. Girard gives us also two other formulas, for estimating the deflection of oak and fir beams, when loaded in the middle by a weight, and supported at each end, viz.,

for oak $\frac{Pf^4}{3b} = \frac{(1178.4451)}{1.3} f + 0.3 a h^2$;

for fir $\frac{Pf^3}{3b} = (816.1128) a h^3$.

where $P$ is half the weight, $f$ half the length, $b$ the deflection, $h$ the depth of the beam, and $a$ 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 ufeful for practical cafes.
STRENGTH OF MATERIALS.

Girard's Experiments on Oak-beams, pressed in the direction of their length.

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<th>No. of Experiments</th>
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<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>Veined Sine of greatest Deflection</th>
<th>Weight in Kilograms</th>
<th>Time in Hours</th>
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<th>Breadth in Metres</th>
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<td>22.939</td>
<td>25.00</td>
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<tr>
<td><strong>14</strong></td>
<td>1.9484</td>
<td>0.1601</td>
<td>0.1015</td>
<td>32.7728</td>
<td>1.4613, 1.2937</td>
<td>0.0131, 0.0100</td>
<td>39.656</td>
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<tr>
<td><strong>15</strong></td>
<td>1.9484</td>
<td>0.1330</td>
<td>0.1060</td>
<td>28.3705</td>
<td>1.2092, 1.4342</td>
<td>0.0068, 0.0011</td>
<td>32.999</td>
<td>33.33</td>
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<tr>
<td><strong>16</strong></td>
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<td>0.1285</td>
<td>0.1082</td>
<td>26.9030</td>
<td>0.9742, 0.6495</td>
<td>0.0045, 0.0045</td>
<td>32.999</td>
<td>33.33</td>
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<tr>
<td><strong>17</strong></td>
<td>2.2731</td>
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<td>0.1082</td>
<td>35.7076</td>
<td>0.9742, 0.6495</td>
<td>0.0029, 0.0028</td>
<td>32.999</td>
<td>33.33</td>
</tr>
<tr>
<td><strong>18</strong></td>
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<td>0.1579</td>
<td>0.1533</td>
<td>50.8712</td>
<td>0.9742, 1.2937</td>
<td>0.0051, 0.0023</td>
<td>32.999</td>
<td>33.33</td>
</tr>
<tr>
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<td>0.1872</td>
<td>0.1579</td>
<td>72.8837</td>
<td>1.2092, 1.2937</td>
<td>0.0034, 0.0034</td>
<td>17.318</td>
<td>20.00</td>
</tr>
<tr>
<td><strong>20</strong></td>
<td>2.5979</td>
<td>0.1894</td>
<td>0.1579</td>
<td>65.5456</td>
<td>1.2989, 1.6237</td>
<td>0.0023, 0.0101</td>
<td>62.534</td>
<td>110.00</td>
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</table>
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 least, but more commonly in both. It will also be observed, that some of the beams broke under less pressures than others, of the same or less dimensions, borne 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 forms deftions of establishling, 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, viz. in the detail of the experiments, rather than in theory deduced from them, we ought to estimate 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. Ganthev, in the fourth volume of Rozier's Journal de Physique.

This engineer exposed to great pressures small rectangular parallelepipeds, cut from a great 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 fottile, used in building.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Hard stone.</td>
<td>8</td>
<td>8</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>12</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>16</td>
<td>128</td>
</tr>
<tr>
<td>Soft stone.</td>
<td>9</td>
<td>16</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>18</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>18</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>24</td>
<td>432</td>
</tr>
</tbody>
</table>

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 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.

It appears, however, that 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 ample mechanical apparatus might have been made sufficient for the purpose; and if any tolerable uni-

formity 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. Ganthev'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 least, as observed in his experiments, 406,000 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 square foot; and chalk, 9000 pounds.

Besides the above experiments on the force necessary for crushing stone pillars, M. Ganthev 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 4600 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 insertion; and if it rests on two props, a foot distant from each other, it requires 206,000 pounds laid on its centre to produce the fracture. We shall merely observe, that these results are very incongruous 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 132 pounds; and if, which will bear 17,000 pounds on a square inch, supined vertically, is broke 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 resistancy of the same body to a transverse strain; but it is absolutely impossible to have the difference stated by M. Ganthev. 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 conflicting the work in which M. Ganthev'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 acting perpendicularly or obliquely to its length, while the beam itself is supported at its two extremities, or by one end being firmly fixed in a wall, or other solid and immoveable 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 possesed, in proportion to their length, breadth, depth, firm, and position. It appears that this philosopher was led to these investigations, in conformance of a visit that he made to the arsenal of Venice, and the results of which were published in his Dialogues in 1633. Galileo supposed solid bodies to be composed
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composed of small fibres applied parallel to each other, and
distanced, or allumed, at first, the force with which they re-
acted the action of a power to separate them, applied
parallel to their length; and thence readily deduced that
their resistance, 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 considered
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 relia-
tance of the integrant fibres is proportional to their sum,
multiplied 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 resistance of each fibre
to be the same, and, therefore, as wholly independent of
their quantity of extension at the moment of rupture.
Supported on the result of these reasonings, 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 untried; as
well as certain anomalies, or which then appeared as such,
in the works of art. To some of his observations on this
subject 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-
per, however, first to define a few of the terms which more
commonly occur in the course of our investigations.

We have already explained what it is to be understood by
the absolute strength of a body, or its strength of direct
coliction; 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, forces or strain, they are
used, the former to denote the force or power with which
any mafs or body refists a brefh or change in its flate,
which a prefhure orroke upon it has a tendency to pro-
duce; and the latter are used indifferently to express the
force which is exerted on any such mafs, 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 a fracture fit for its purpose, unless the
strength, in every part, be at least equal to the forces laid
on, or the strain exerted in that part; and hence the ne-
cessity of an acquaintance with the nature of the relia-
tances 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 caufe of producing the mischief they were intended to prevent.

In order to illustrate the theory of reliaances of bodies,
when expofed to a tranverfe strain, according to the hy-
pothefis of Galileo, let R S T V (Plate XXXIX. Me-
chanics, fig. 1.) reprefent a solid wall, or other immovable
mafs, into which the beam, C G, is infected; and let
W represent a weight flupended from its other extremi-
ity. Then flupending the beam to be infuperably ftrong
in every part, except in the vertical feftion A B C D, the
fracture must necefly take place in this feftion only,
and, according to the hypothefis of this author, it will
turn about the line C D, whereby the fracture, com-
mencing in the line A B, will terminate in the former, C D.
Galileo also further fuppofes, that the fibres, forming the
feveral horizontal plates or lamina from C D to A B, act
with an equal force in refifting the fracture, and, therefore,
differ in their energy only as they act at a greater or lef

distance from the fulcrum C D. Now, from the known
principles of the lever, it is obvious that the equal forces
acting at the feveral distances o a, o b, o c, o d, &c. of the
lever o r, will offer reliaances proportional to their refeptive
distances; and, therefore, that the fun of all their re-
labances, that is, of the conflant quantity f, the fun of all their energies or reliaances will be exprifed by A C
\( f = C m f + C m f / + C m / + &c. = f \times (A C +
C m + C m / + &c. ) \)
This, however, fuppofes the feftion 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 feftion, the feveral
small weights must be proportional to the breadth of the
feftion at the point where it is fuppofed to act: the illus-
tration, in this cafe, however, is equally obvious.

Since then the whole reliaance to fracture is made up of
the sum of the reliaances of every particle or fibre acting
at different distances on the lever C A, which is fuppofed
to turn upon C as a fulcrum, there must necelfarily be some
point in that lever, in which, if all the feveral forces were
united, their rea-tion to the weight W would be exactly
the fame as in the actual operation, and this point is the centre
of gravity of the feftion, as is readily demonsrated as follows.

Let A B C (fig. 2.) represent the feftion of any beam
whatever, F H any variable abjefts = x, and D E the cor-
responding double ordinate = y; then, by what is flated
above, the energy, or force, of all the particles in the line
D E, will be as D E x H F, or as x y, and confequently
the fluxion of that force will be y x y, and therefore
the fun of them = f y x y, or fluent of y x y; alto f y x = area
A B C; whence, alinimg G to be the centre of energy,
we muft have \( F G = f y x = y x \),
whence
\( F G = f y x \)

which is the well-known formula for the centre of gravity.

Here follows the refulting very fimple theory for the
strength of beams placed firmly in a folid wall, or other
inmovable body; viz. that the weight neceffary to pro-
duce the fracture, is to the direct force of coliclion of all
the fibres in the feftion, as the diftance of the centre of
gravity of that feftion from the point where the fracture
terminates, to the length of the beam, or diftance of the
weight from the fame point.

Nothing more fimple can be defigned as a general theory,
but unfortunately it is founded on hypothefes which have
nothing equivalent to them in nature; in the firft place, it
fuppofes the beam to be infuperable, and infuperably ftrong,
except at the feftion of fracture; fecondly, that the fibres
are inextenfible 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 feftion is exerting its force in refifting
extension; and, laflly, (if this be not implied in our fecd
objeftion,) that every fibre acts with equal energy, what-
ever may be its quantity of extension. Now, with regard to
the firft of these fuppofitions, it is obvious that no beam of
timber, nor any other body, is perfectly incompressible; nor

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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 constant resistance, independently of its quantity of extension, if it be not incorrect, is of that nature which ought not to be allowed, 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 1650; 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 inclination, from which he concluded, contrary to the former opinion, that every body was composed of extensible fibres, and assuming the principle first laid down by Dr. Hooke, viz. "ut tensio sic vis," he concluded that every fibre, instead of acting with an equal force, exerted a power proportional to its quantity of extension on the, 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 incomparable, 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 action was supposed to be equal to the several equally decreasing weights r, r', r'', r''', &c. as fig. 4. The only alteration which this new supposition introduced into the final results was, the removal of the centre of energy, G, 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 A B C (fig. 3.) represent the section of fracture on any beam; F H = x, any variable abscissa; and D E = y, the corresponding double ordinate; also 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

\[ d : x = \frac{f}{F} \]

the force of a particle at H; and the number of particles acting at this distance being y, we shall have \[ \frac{f y}{d} \] 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 \[ \frac{f y}{d} \]; and hence the sum of all the resistances of every fibre in the section will be \[ f \frac{y x^2}{d^2} \]; now this is to be equal to the direct coëfion of all the fibres acting at some required distance F I; that is, \[ F I = \frac{x}{d} f y x^2 \times \frac{F}{x} = \frac{f}{d} x \]

...
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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 believed, 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 transferre strain we are considering, that only a part, and probably but a small part, of the whole number of fibres, has a tendency to resist the fracture by means of their tension, while the rest of the fibres act merely from their resistance to compression. Du Hamel we believe, the first author who demonstrated the fact by experiment. He took sixteen 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 52 pounds, the mean of which is 47. 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 filp of hard 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, 40, 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 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 filp of hard wood, and stuck in tight, broke with 551 lbs. at a medium.

Six bars cut half through, and the cut filled up in the same manner, bore 542 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 fill 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 training it, bore afterwards 572 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 saw-cut being filled up with a harder wood, which rendered the beam flatter than when it had its natural fibre, 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 three beams of 6, 30 inches long, 2 inches deep, and 1 inch thick, broke with 882 lbs. 871 lbs. 872 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 stiffer than the fir, the deflection of the beams was throughout greater, which shew that they had lost in stiffness by the cutting; whereas Du Hamel's beams had gained stiffnesses 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 transferrely by any weight, whether as suppoSed 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 sIgned 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 suppoSed the rotation to be made about the centre of compreSSion, instead of its being made about the neutral axis, and sIgning 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 cafes, 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 computation, 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 determinant, 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 subj ect to, according to the manner in which it is suppoSed; 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 fuch of our readers who are conSvergent 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 suppoSed their ends at C, C', to be held towards each other by a rope or cord C C'.
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C C'. Now if we suppose the lever $A'P' \perp C'$ to be fixed by any means to the position shown in the figure, while the other lever, $A PC$, 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 solidly in the wall; and, 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 circumstances like the fibre at $C$ (fig. 6.), when the beam is supposed to pass through the wall, and a weight $W = W'$, acting in the direction $A'P' = A'P$.

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 $P'A'$, 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 resting on a prop in the middle, to produce the fracture.

2. And hence again it follows, that whatever weight will be just sufficient to break a beam when fixed solidly 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 its centre.

For let the weight $W$ press upon the beam at $C$ (fig. 9.) then is the weight equal to the prefaces upon $A$ and $B$;

and the preface upon $A = \frac{W \times B}{A}$, while the preface upon $B = \frac{W \times A}{B}$; but the re-action of either point of support is equal to the preface 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 weight at $C$ is, as the preface at either point of support into its distance from $C$, that is, the preface $\frac{W \times B}{A} \times A C$, or as $\frac{W \times A C}{A B} \times B C$, which are manifestly equal the one to the other; but as $W'$ and $A B$, are given, the stress 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 case the beam 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 prefaces upon $A$ and $B$ will be equal to the whole weight; and if $w$ be the weight of the part $B C$, its preface upon $A$ will be $\frac{w \times \frac{1}{2} B C}{A B}$, and this referred back to the point $C$, will give $\frac{w \times \frac{1}{2} B C}{A B} \times A C$ for the stress, which therefore varies as the rectangle $B C \times A C$, as before.

4. When a beam is 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 $A B C D$ (fig. 10.) represent a beam firmly fixed at each end, which is to be broken by a weight hanging upon its centre-point, 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 $A$ as to act equally upon the arms $D E, C E$, 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 $E F$, besides the weight $W$, which we have seen is necessary to overcome the resistances at $D$ and $C$, an equal weight, $W'$, must be added to overcome the equal resistance in the section $E P$; therefore the whole weight is equal to double that which would break the beam when only loosely 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 $A B C D$ (fig. 11.) represent a beam fixed in a wall at the angle shown in the figure; let $D I$ be the vertical direction of the weight, and let this weight be represented by the line $D I$, 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. 2.; but the result of experiment by no means justifies such an hypothesis, nor does a phyletic 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 stress 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,
consequently, the fibre is the greatest, or the strength the least, when the load is placed in the centre.

3. The resistance to fracture in a beam supported only at its extremes, is to the resistance of the same when fixed at both ends, as 1 to 2.

4. The force upon a beam, arising from any oblique action upon it, is as that force into the cofine of the angle; or the resistance will be in this case as radius to the cofine.

These results are all independent of any particular theory of resistance, 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. Baffon, 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 preserves 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 while our views are carried no farther than determining the proper dimensions of timbers, in buildings, mechanical constructions, &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.

Instead, 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 resistance of the fibres to fracture by a weight P, 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 distances into the sines of their respective angles of directions; that is, as $\frac{A I'}{A I'} = \frac{A C \sin A C Q}{A C}$, whereas our former result was $\frac{A C \times P}{A I}$; 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 of deflection to radius.

This is sometimes a very important quantity, as we have seen beams of three feet length, and two inches square, deflected twelve or thirteen inches, that is to say, to the amount of one-third of their length, or 40°: and the cofine of 40° 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 A B C D (fig. 13.) is therefore kept in equilibrio with regard to its support, 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 re-action of the props; which will therefore be greater than $\frac{1}{3} W$, the quantity we have supposed in our former investigation, in the ratio of $S P$ 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 be $W$, the real weight that must be employed will be $\frac{W}{D}$; $D$ 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 $\frac{W'}{D'}$.

Hence, supposing the former beam to have the fame 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 $W : W' :: 1 : 2$ 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 2 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 fame time, or that the fame 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 A D, C B; 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 said 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 3 to 2, or 9 to 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, was broken 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; whereas the theory, which takes no account of deflection, gives 4, 8, 16; but what is stated above, shows that Parent's numbers are those which ought to be found by experiment; and the fame explanation renders the results in the following table of Belidor also perfectly reconcilable 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 six 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 490 lbs.; the ratio of which numbers are not very different from those above stated.
STRENGTH OF MATERIALS.

Beller's Experiments.—These pieces were found even-grained oak; the column \( b \) contains the breadth, \( d \) the depth, and \( l \) the length, all in inches; \( p \) shows the number of pounds which broke them, and \( m \) the mean weight, also in pounds.

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<th>N°</th>
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<th>( l )</th>
<th>( p )</th>
<th>( m )</th>
<th>How fixed.</th>
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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 show that the strength is proportional to the square of the depth.

3. Experiments 1 and 5 show the strength to be nearly in the inverse ratio of the length.

4. Experiments 5 and 7 show the strength proportional to the breadth and square of the depth.

5. Experiments 1 and 7 show, 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, show that the strength of beams fixed at both ends is to that of those which are only supported in the ratio of 3:2.

We have shown 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 shows itself 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 4th of the strength, has only about 4th; and the philosopher should endeavour to discover the cause of this diminution, that he may give the artist 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 broken 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 \( W \times \text{cof.} \); \( D \) 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 cafe 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). Consequently, if \( W \times \text{cof.} \) is the weight which breaks the shorter beam, \( \frac{4W}{3} \times \text{cof.} \) 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 admonished that it should not have occurred to so keen a mathematician as the one to whom we have alluded, or to some one 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 = 2.20558 lbs. avoirdupois.
## STRENGTH OF MATERIALS.

**Table of Buffon's Experiments on the Strength of Square Oak-beams, supported at both Ends.**

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<thead>
<tr>
<th>No. of Experiments</th>
<th>Side of the Square</th>
<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>
<th>Mean stretching of the Fibres</th>
<th>Length of the Piece</th>
<th>Weight of the Piece</th>
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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 rely 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 above 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; \( s \) 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 fupposed to turn; and \( l \) the length, also in inches; and \( W \) the required weight; then

1. When the beam is fixed with one end in a wall,
\[
W = \frac{fad}{l}.
\]
2. When the beam is supported at both ends, then
\[
W = \frac{4fad}{l}.
\]
3. When the beam is fixed at both ends,
\[
W = \frac{8fad}{l}.
\]

The weight in both the latter cases being supposed 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 same.

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,
\[
W = \frac{fad}{lD}.
\]
2. When the beam is supported at both ends,
\[
W = \frac{4fad}{lD}.
\]
3. When the beam is fixed at both ends,
\[
W = \frac{8fad}{lD}.
\]

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 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 shows it to be weakened 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 these 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 defect is the most obvious; and particularly in 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 formulas, 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 supposed 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 those 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 neutral 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 resist the fracture at point \( D \); and tenion being at only one-third of the distance they have assumed, these combined would make the real strength only one-twelfth 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 \( 4\frac{1}{3} \) times; that is, the computed strength is about \( 4\frac{1}{3} \) times greater than it would be, if the neutral line were, as we have supposed, 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 \( \Delta x \) with the same energy; and to Leibnitz, that the tension is as the force. But one or 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 operation.
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 repeating 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 disposed, 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 at 1 to 2.

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 denote the distance of the centre of tension from the neutral line, \( a \) the area of tension, and \( l \) 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,

\[ W = \frac{2fa d}{l} \times \text{cof.} \ D. \]

2. When the beam is supported at both ends,

\[ W = \frac{8fa d}{l} \times \text{cof.} \ D. \]

3. When the beam is fixed at both ends,

\[ W = \frac{12fa d}{l} \times \text{cof.} \ D. \]

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 reeling obliquely, or acted upon by an oblique force; the two latter formulae become,

4. For the beam supported at each end,

\[ W = \frac{8fa d}{l} \times \text{cof.} \ D \times \text{cof.} \ I. \]

5. For the beam fixed at each end,

\[ W = \frac{12fa d}{l} \times \text{cof.} \ D \times \text{cof.} \ I. \]

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 cases, 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 \( l, d, \) and \( D \), represent the length, depth, and deflection of any beam; and \( l' \) and \( d' \) the length and depth of any other beam, whole deflection \( D' \) is required; then,

\[ D' = \frac{l' \cdot d^2}{l \cdot d'^2}. \]

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 13,000 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 tenon \( x \), the depth of compression will be \( 2 - x \), which also denote these areas; and we must have, therefore,

\[ \frac{x^2}{2} : \left(2 - x\right)^2 : 1 : 3; \]

or \( 3x^2 = 4 - 4x + x^2 \); or \( x^2 + 2x - 3 = 0 \).

Whence \( x = -1 + \sqrt{3} = .732 \approx a; \)

also \( .732 \approx \sqrt{\frac{2}{3}} = .366 = d; \)

\[ \tan \text{ of deflection} = \frac{5}{\frac{1}{6}} = .3666666. \]

Whence the angle \( D = 9^\circ 34'; \) and its cosine \( = .9860; \) therefore, by formula 1,

\[ W = \frac{2fa d}{l} \times \text{cof.} \ D = \frac{2 \times 13000 \times .732 \times .366}{30 \times .986} = 235 \text{ lbs.}. \]

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,

\[ W = \frac{8fa d}{l} = \frac{8 \times 13000 \times .732 \times .366}{30} = 928 \text{ lbs.}. \]

Example 3.—Required the weight that would break the same beam fixed at each end.

Rejecting the deflection, we have from formula 3,

\[ W = \frac{12fa d}{l} = \frac{12 \times 13000 \times .732 \times .366}{30} = 1492 \text{ lbs.}. \]

Note.—We have here assumed 13,000 for the force of direct cohesion; this, however, rather exceeds the greatest strength of fir, which varies from 10,000 to about 15,000 lbs.

Example 4.—Assuming the direct cohesion at 13,000, 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 \( x \) be the required length of the beam, in inches; its weight
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 \( \frac{1}{3} x \).

Hence, by substituting \( \frac{5x}{96} \) for \( W \) in formula 1, we have

\[
\frac{5x}{96} = \frac{2 \times 1300 \times 0.732 \times .366}{\frac{1}{3} x}
\]

or \( 5x^3 = 192 \times 2 \times 1300 \times 0.732 \times .366 = 133728 \).

Whence \( x = \sqrt[3]{\frac{133728}{5}} \) 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

\[
30^1 : 5 : : \frac{1}{3} x : \frac{5}{3600} x^3
\]

Whence the cosine \( = \sqrt{1 - \frac{25}{1800}} \), and the above equation becomes

\[
\frac{5x}{96} = \frac{2 \times 1300 \times 0.732 \times .366}{\frac{1}{3} x \sqrt{1 - \frac{25}{1800}}}
\]

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 cast-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 or weakest piece of dry heart of oak, 1 inch square and 1 foot long, bore 650 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 465 lbs.; but broke with a little more.

With respect to cast-iron, he concludes that a bar of the weakest kind, an inch square and a foot long, would break with 2190 lbs.

The following are some of the experiments he mentions. See Banks on Power of Machines.

Experiment 1.—Two bars of cast-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, as the bars were a little bent, but very little.

Experiment 2.—Two bars, of the same length and thickness, were placed in a similar manner, making an angle of 22 1/2° 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, viz. as 3826 to 7071; and as 3826 : 7071 :: 4 tons : 7.6 tons: that is, if the second bars broke with 4 tons, the first ought to have taken 7.6 tons to break them; and it is likely that would, if tried, have been the case.

Experiment 3.—Another bar was placed horizontally upon two supports, exactly three feet distant, which bore 6 cwt. 3 qrs., or 675 lbs., but broke when a little more was added.

Experiment 4.—The same experiment repeated, with the same result.

Experiment 5.—The bearings were 2 feet 6 inches apart; the bar broke with 9 cwt. Three more experiments were tried at 3 feet; the average result was 6 cwt. 2 qrs. 73 lbs.

Experiments tried at Colebrooke-Dale, on curved Bars of Cast-Iron.

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 sunk in the middle 3 1/2 inches, and rose again three-fourths when the weights were removed: the same rib was afterwards tried without abutments, and broke with 55 cwt. 10 qr. 14 lbs.

2. Rib 20 feet 3 inches span, a segment of a circle 3 feet high in the centre; it supported 100 cwt. 1 qr. 14 lbs., and sunk 1 1/2 in the middle. The same rib was afterwards tried without abutments, and broke with 64 cwt. 1 qr. 14 lbs. The thickness of these ribs is not specified; but the experiments 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 cast-iron, at Mellors, Aydon and Elwell's foundery, Wakefield. The iron came from their furnace at Shelves, 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 very little more; they all bent about an inch before they broke.

1. The first bar broke with
   - 96 lbs.
2. The second bar with
   - 95 lbs.
3. The third bar with
   - 99 lbs.
4. A bar made from the cupola
   - 364 lbs.
5. A bar equally thick in the middle, but the ends formed into a parabolic form, and
   - 97 lbs

Weighing 6 lbs. 3 oz.

The same gentleman made many other experiments, and concludes, from the whole, that cast-iron is from 3 1/2 to 4 1/2 times stronger than oak of the same dimensions; and from 5 to 6 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 fir 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 relative to the form of beams possessing equal strength throughout, or beams of equal restistance; 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 forces 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

\[ \text{into} \]
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 said to be a beam of equal refilience: 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 parabolical.

2. If the depth is the same throughout, the breadth must be as the lengths, and the upper and lower sides of the beam will be triangular.

3. If the several sections are 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 cast-iron bar an inch square, and fixed at one end, will break by the twist when 631 pounds are suspended with a screw 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, CORROBORANTS: such medicines as add to the bulk and firmness of the solids.

Strengtheners differ from cordials, as a bandage does from a flesh-brush; the latter are such as facilitate and drive on the vital actions; but the former, such as confirm the stamina, 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 waste which coulant motion makes in the constitution, were it 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 they not somewhat furnished in their composition, which is fitted to fall into, adhere with, and recruit, that which is wasted off. And those particles must be much more disposed to do so, whose adhesions are greatest, when once they come into contact; such as those of bodies we call glutinous, and which easily form themselves into jellies, and such-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 cohesion will be much the stronger, with whatever they happen to fall into contact. See Nutrition.

Medicines of this tribe are therefore of great service in fevers, when 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 consistence to the juices, as fits them also for nourishment. There are likewise other caules which may weaken the solids, by admitting or occasioning them to relax too much.

Whatsoever, therefore, acts as a stimulus, and crips and corrupts the fibres into a more compacted tone, which molt andier 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 superficial 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 sand-box two or three days; or, till the spirit of wine is of a fine purple colour; pour off this tincture, and press the faces 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; set this in a still for two or three days, then pour off this tincture; mix it with the former, and putting the whole into a glafs body, distil off a great part of the spirit of wine; then put the remainder into a glazed earthen pan, and evaporate it to the form of an extract, adding, toward the end, three ounces of liquor of orange-peel. See Nutrition.

STRENGTHENING PILLS. See Pill.

STRENGTHENING Banks 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 cases. See Sea-Wall, and Embankment.

STRENITZ, in Geography, a town of Bohemia, in the circle of Boleflau; 3 miles W. of Jung Buntzel.—Alfo, a town of Bohemia, in the circle of Chrudim; 6 miles N.E. of Pelitzka.

STRENUA, in Mythology, a goddef among the Romans, of an opposite character to the goddef of "Sloth," who, according to St. Angulfine, made men to over-act, and who had a temple at Rome. These godfeds of floth was named Mars, and Streuna and Ageraon inspired their votaries with vigilance and courage. The chape of Streuna was situated, as Varro informs us, near the Via Sacra.

STREPTOSUS, the name of a dilferer common to the habitants of some parts of the Alps, in which the face, neck, and arms, are fo diffent with flatuences, as to make a noife, when struck, like a dry bladder diffent with wind.

STREPSICEROS, in Zoology. See Ovis.

STREPTACHNE, in Botany, from ἱερά, twisted, or spiral, and ἄχν, the pointed fummit of the glume, which infeuibly becomes the awn, without any intermediate joint.—Brown Prodr. Nov. Hall. v. 1. 1759.—Cladis and order, Triandria Deynia. Nat. Ord. Gramina.

Eff. Ch. Calyx single-flowered, of two lax awnles valves. Floret stalked; outer glume involute and cylindrical, with a terminal fimple awn, twisted below, without any joint; inner glume awnles, enclosed in the outer. Stigmas feathery.

1. S. stipoides.—Gathered by sir Jofeph Banks, in the tropical part of New Holland. A grafs with the afpeft of an Aristida or Stipa, differing from the latter genus in the want of an articulation between the awn and its glume. Brem.
STREPTOPUS, from Gr. στρεφω, to twirl, on account of the very singular spiral tube of the corolla.—Dryander in Roxb. Coromand. v. 25. (Tortula; Wild. Sp. Pl. v. 3. 159. Ait. Hort. Kew. v. 4. 38.)—Clasf and order, Didynamia Angostifolia. Nat. Ord. Perisitae, Linn. Vites, Juff. Gen. Verbanae, Jull. in Ann. du Mus. v. 7. 63. Brown. Gen. Ch. Cal. Perianth inferior, of one leaf, oblong, twining, with five angles, five intermediate furrows, and five marginal teeth, permanent, enveloping the fruit. Cor. of one petal; tube cylindrical, rather longer than the calyx, slightly curved, spirally twisted in the upper part; limb in five equal, obovate, spreading segments. Stam. Filaments four, inserted into the upper part of the tube, two of them longer than the others; anthers converging, roundish, two-lobed. Pyl. Germen superior, four-lobed; style cylindrical, length of the filaments; stigma large, of two lips; the upper very short; lower elongated, flatulate, recurved. Peric. Berry dry, enveloped in the coriaceous calyx, of two lobes, each separable into two parts. Seeds solitary in each part, vertical, oblong, acute, armed at the outside with prominent, sharp tubercles. Eff. Ch. Calyx with five teeth. Corolla regular, with a spiral tube. Berry dry, with four nutrient seeds. 1. S. afferum. Rough Streptopus. Oehrs of the Bengal. Roxb. Coromand. t. 146. (Tortula afferum; Wild. n. t. Ait. n. t.)—Native of the East Indies. Found by Dr. Roxburgh, only in the vicinity of Samohautal, on the terraces of old walls of pagodas, flowering during the wet and cold feasons. This plant is not put to any use. While young it is not inedible, though resembling Verbena lappulacea. The root is perennial. Stem rather shrubby, perennial, with rough, square, leafy, opposite branches, from two to four feet high. Leaves opposite, flat, heart-shaped, serrated, one and a half or two inches long, clothed with hooked bristles. Flowers white, in very long, simple, terminal, minutely bracteated, fruits, the frond 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 moulds long sago named Tortula, fee that article, we cannot account for Wildenow's name for the present genus being preferred in Hort. Kew. to that already published by Mr. Dryander himself. STREPTOPUS, from Gr. στρεφω, twisted, and oφω, a foot; because of a peculiar twist about the middle of each flower. —Michaux Boreal-Amer. v. 1. 200. Pursh 252.—Clasf and order, Monogynia Monogynia. Nat. Ord. Sarmentaeae, Linn. Apelleaf, Juff. Gen. Ch. Cal. none. Cor. inferior, somewhat bell-shaped, smooth, of six lanceolate acute petals, reflexed at the point. Nectary a furrow along the middle of each petal. Stam. Filaments six, awl-shaped, much shorter than the corolla, inserted into the base of each petal; anthers oblong, pointed, erect. Pyl. Germen superior, globose; style longer than the filaments, slightly triangular, erect; stigmas three, very short, obtuse. Peric. Berry nearly globose, smooth, with a thin skin, of three cells. Seeds several, though but few are perfect, nearly ovate, with a naked scar. Eff. Ch. Corolla inferior, of six petals, somewhat bell-shaped. Nectary a furrow in each petal. Stamens very short. Berry globose, smooth, membranous, of three cells. Seeds few, naked at the scar. Ofb. This genus, more allied to Corevallaria than to Uvularia, is distinguished from the former by its polypeetalous corolla, with nectariferous furrows; from the latter by having a berry, not a capsule, and the want of an appendage, or tuft, to the scar of each seed. vol. XXXIV. 1. S. amplisepalum. Heart-shaped Streptopus. Redouté Liliac. t. 259. (S. dipterus; Michaux n. 1. Pursh n. 1. Uvularia amplisepalum; Linn. Sp. Pl. 436. Wild. Sp. Pl. v. 2. 93. Ait. Hort. Kew. v. 2. 246. Walditi. Kitaib. Hung. v. 2. 182. t. 167. Polygonatum rafumum; Ger. Em. 904. Laurus alexandra; Matth. Valgr. 556, ed.)—Smooth. Leaves heart-shaped, clasping the stem, entire and smooth-edged. Anthers with a simple point. —Native of Bohemia, Hungary, Dauphiny, Switzerland, &c. as well as in shady mountainous woods from Canada to Pennsylvania, flowering in May and June. The root is fibrous and perennial. Stem erect, twelve or eighteen inches high, herbageous, 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 Mathiolius's cut. Berry orange-coloured, the size of a pea, with a thin rind. We cannot but prefer the preservation 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. roensus. Rose-colored Streptopus. Michaux n. 2. t. 18. Pursh n. 2.—Smooth and shining. Leaves oblanceolate, somewhat clasping the stem, minutely fringed. Anthers with double points. —On the high mountains of North Carolina and Pennsylvania, as well as in Canada, flowering from May to July. Michaux, Pursh.—The leaves are rather longer than in the foregoing, less heart-shaped, fringed with minute ferratures. Flowers rose-coloured. Anthers short. 3. S. languidus. Downy Streptopus. Michaux n. 3. Pursh n. 3.—"Somewhat hoary and wolly. Leaves sessile, pointed, slightly heart-shaped. Flower-stalks 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 those species, yellowish-green, resembling an Uvularia. Berries red, feebly perfecting more than one or two seeds. Neither of these two latter species have, as yet, found their way into the gardens of Europe. STRESO, Grow, in Geography, a town of the island of Rugen; 9 miles S.E. of Bergen. STRETCH. When at sea they are going to hoist the yard or haul the sheet, they say, Stretch forward the sheets; meaning, that the part which the men are to haul by, should be put into their hands, in order to their hauling. STRETCHER, in Sea Language, a sort of staff fixed athwart the bottom of a boat, for the rover to place his feet against, in order to communicate a greater effort to his ear. 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 standing, 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. STRETENSK, in Geography, a town of Russia, in the government of Irkust; 52 miles E.N.E. of Nertchinsft. N. lat. 54° 22'. E. long. 113° 14'. STRETHAM. See Streatham.
STRETTENBEB, a town of the duchy of Carnethia; 6 miles E.S.E. of Freburg.

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 first subject, may be shortened, provided enough is left to remind the hearer of the whole.

STRETTON, CHURCH, in Geography. See Church-Stretton.

STREWWARD, 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.

STREVER, in Ichthyology, a name given by many to the fish called by authors after Pisiculus. Gofen, in particular, calls this fish gobius after.

STREUFORD, in Geography, a town of Germany, in the principality of Coburg; 4 miles S. of Hilburghaunen.

STREWING of Peas, in Agriculture, the name of a method of sowing, in which the peas are made to throw the peas in by hand, and the usual measure is that of three buffets to an acre. They should be sown about six weeks after Christmas, and the buffets be made about sixteen inches apart; but this 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 through 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 breadth part, in order that the earth or mould may, at the same time, be turned to both sides 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 four in width at the top, being wrought by one horse only. It is sometimes made so as only to form the drills, the peas being dropped or fired in by the hand. It is also occasionally contriv'd 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 Hennep, and runs into the Saal, 2 miles N. of Munnerlah, in the duchy of Wurzburg.

STRELLE, in the Ancient Architecture, the lift, fillets, or rays, which separate the fringes or fluting of columns.

STRELLE, among Naturalists, denotes the small grooves or channels in the shells of cockles, fiddlecobs, &c.

STRIANOW, in Geography, a town of Poland, in Volhynia; 36 miles S.W. of Luckow.

STRIATA CORPORA, a term used by anatomists to express two protuberances of the brain upon the crura of the medulla oblongata.

STRIATED LEAF, among Botanists. See Leaf.

STRIATED STALK. See Stalk.

STRIATULA, in Natural History, a name given by Mr. Lhuyd to a species of sifilis plants of the fern-kind, remarkable for their striated appearance.

STRI BILIGO, a name given by some authors to any port of cutaneous efflorescence.

STRICK, in Commerce, a corn-measure in Bohemia = 4 viertels = 16 mallels = 192 fieldels. It contains 5383 French or 6516 English cubic inches. Hence 33 bricks of Prague are = 100 English bushels. See Table XXXI. under Measures.

STRICKLE, or Strike, an instrument for striking off the over-measure of corn.

STRICKLE, in Agriculture, a provincial term applied to the wooden contrivance which is placed upon the extremity of the shaft of the scythe for whetting it with.

STRICLESS, in Rural Economy, a name sometimes given to the tool by which the buffet is struck.

STRICTOR, in Anatomy, the same as Spincter.

STRUCTURES of the Esophagus. Chronic inflammation of the membrane which lines the oesophagus, extending by degrees to the mucous coat of the part, increases the thickness of its parietes. This change may happen to such a pitch, that the diameter of the canal is reduced as small that of a quill, and the aliment cannot be swallowed without great difficulty. In this state, deglutition may become fo 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 clysters. The small number of absorbents, however, which proceed from the internal surface of the large intestines, and the flaws of cutaneous absorption, made nutritive clysters 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 fort of case are firm and easy of introduction when the phæt is in them; and flexible and not at all incommending when the phæt is withdrawn after their introduction. In general, they ought to have the diameter of the largest bougies for the urethra, or even the diameter of the little finger. After being intubed, in order to make them more flexible, they should be paffed through one of the nostrils, and when their end has arrived in the pharynx, opposite the illhumus faciem, the phæt must be withdrawn with one hand, while the other part of the instrument is pushed on with the other. Should it bend against the posterior parietes of the pharynx, the surgeon must pafs 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 cæophagus.

It is obvious, that when the catheter is not provided with the phæt, 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, Bover overcame the refiflance, 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 paffed through the mouth, and its upper end brought up into the noftril by means of Bellocq'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 pafs from the nostril into the pharynx, and refiflance in the situation of the obturation is difficult to overcome.

The elastic gum catheter being placed in the noftril, 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 cæophagus was compressed throughout its whole extent, by enlarged lymphatic glands. They had acquired such magnitude, that no solid nor liquid food could pas. Richerand easily introduced through the left noftril an elastic catheter without the phæt. An afferent 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 paffed into the patient's mouth. It defended a long way into the cæophagus, separating the parietes of the part, which were forced too much against each other by external preflure. 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 differentiation.

The contraction depending upon a thickening of the parietes of the oesophagus, must be distributed 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 perseverance in the use of the elastic gum catheter and bougies, the oesophagus may be dilated like the urethra, and the thickening of its costs diminished. See Richerand's Nofographe Chirurgicale, tom. iii. p. 314. edit. 2.

Sir Everard Home considers stricturn of the oesophagus 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 under the same circumstances, with respect to the formation of strictures, as the urethra. If a bougie of a proper size be introduced down the pharynx, it will often be stopped by the stricture 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 cafes, in which the obstruction is only of a spasmodic nature, and in these a bougie may be passed quite down. It is curious, that strictures high up in the oesophagus often occasion ulceration in this tube very low down towards the stomach, just at strictures in the urethra excite ulceration in that passage towards the bladder. This is most apt to occur, when strictures of the oesophagus 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 stricture itself may be destroyed. A bougie introduced under such circumstances will, in general, have its point entangled in the ulcer, and when so skillfully directed as to go down into the oesophagus, it will meet with a difficulty while it is passing the commencement of the ulcerated part of the oesophagus, and another impediment where it leaves the ulcer, and enters the found portion of the urethra below. These two refractions may lead to the supposition, that there are two strictures, while, in fact, the only one is above the ulceration, as already described.

According to Sir Everard Home, true strictures of the oesophagus, like those of the urethra, occupy very little extent of the passage, confining 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 oesophagus, 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 paffes 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 stricture.

The method of treatment practised by this gentleman, consists either in occasionally passing a common bougie through the stricture, 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 argentum nitrat. See Praet. Obs. on Strictures, &c.

Spasmodic strictures of the oesophagus 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 performed by the continental surgeons. Such instruments at once prevent all mecellity for any action in the diseased part, and operate mechanically by their pressure in producing an absorption of the stricture.

Strictures in the Urethra. See urethra.

STRIDOR DENTUM, a grinding of the teeth. Prooper Alpinus, in his treatise De Praeg. Vit. et Mort. Jegrot," 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 Laurus, 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 camp, a hundred and twenty feet long, and sixty feet broad, used for encamping 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.

STRIGAUS, in Geography, a town of Silezia, in the principality of Schwedtitz; 9 miles N.W. of Schwedtitz. N. lat. 50° 50'. E. long. 16° 21'.

STRIGEL, Victorinus, in Biography, a German divine, and one of Luther's early disciples, was born at Kauffbeurn in 1524. 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; from thence he went to Frankfurt, and in 1558 was made a private professor of theology at Jena. In 1556 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 Leipzie next to Amberg; and then to Heidelberg, where an apoplexy terminated his life in the year 1559. His works, besides poems, consist chiefly of commentaries on various parts of the bible. He also wrote 28 Annotations on Josephus, Judith, Arifotle, and Cicero; 8" Oraciones veteris Graece de Gloria Ecclesie," 8" Thedoretri Dialogi III. Gr. et Lat.;" and 8" Bofili Hexameron." He was also author of 8 " Ratio legendi Scriptura Prophetarum et Apostolorum;" and of a Latin version of the Book of Wisdom, which is inserted in "J. A. Fabricii Codex Vet. Test. Pseudepigraphus." A long dilatation on the life and writings of Strigel was published by C. E. Weidmann at Tubingen, in 1732. Gen. Biog.

STRIGENDORF, in Geography, a town of Silezia, in the principality of Neisse; 5 miles S.W. of Grotkan.

STRIGES, in the Ancient Architecture, are what in the modern we call stringers.

Z. 2. They
The were thus denominate, as being supposed to have been originally intended to imitate the folds or plaits in women’s robes; which the Latins call frigs. The fillets or spaces between them were called ferris.

STRIGGIO, ALESSANDRO, in Biography, a Florentine gentleman and musical composer in the service of the grand duke Cosimo II. of Medici. He was a luminist 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 Univerfalis," and by the historians of Italian poetry, Creciamboni and Quadri, as one of the earliest composers of music in Italy for the stage. In the preface to "Def

dizione degli intermedii fatti nel palazzo del gran Duca Cosimo," he writes on the preface of the serenissima altezza dello eccellentifimo Arciduca d’Austria, Panno 1597"

It is said the music to these interludes, which seem to have been only madrigals, was set by Alessandro Striggio, nobiliflmo gentiluomo Mantovanio.

His madrigals, in six parts, were published at Venice in 1566. A copy of these is preserved in the Cheltenham collection at Oxford. Some of them, however, were printed seven years earlier in the zdo Libro de le Mufo, from which we scoered several in the British Museum; but we did not find them remarkable either for genius or science.

There seems an attempt at singularity, in accelerating the parts, but cleanliness is wanting in the harmony, and accent in the melody; the subject 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.

STRIGIL, an instrument used among the ancients in their baths, and at some of their gymnastic exercises.

It served to abrige the sweat, or other fordes, from the body. Persons who intended to bathe, or to use any of these exercises, when they entered the gymnasia, put off their clothes in the apodyterium; after which, each of them as intended to box, wrestle, or to use any of the more violent exercises, went into the alipterium, where they were washed and then returning into the place where the dust was, they were sprinkled with this as they passed along, and then entered upon their several exercises; after this they returned to the alipterium, where they had the sweat and fordes wiped off from their bodies by the alipi with an iron firrigil.

The fordes taken off from the body, and consisting of oil, dust, and sweat, were preferred for medicinal purposes, and we find them used among the old physicians.

The firrigils were of the shape of a gardener’s knife; they were made of different materials, as ivory, horn, gold, silver, iron, brass, and the like; but in some after-times the word was only used to signify a linen cloth, or a piece of sponge, which every one carried about him for his own use. The fordes, fayed for medicinal purposes, were called firrigenta.

STRIGILLA, in Botany, received that name from Ca


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 petals. Nectary a short cylindrical tube, of one leaf, hairy at the

summit, bearing the anthers. Stam. Filaments scarce any, except the nectar be to considered; anthers ten, erect, linear, besprinkled on the inner surface with flary hairs. Fil. Germen superior, ovate; style triangular, the length of the flamine; stigmas three, prominent, globose, combined. Peric. Capsule? of six cells. Seeds foatory.


—Gathered by Joseph de Juficco in Peru. Cavanilles describes it from one of his dried specimens. The flower is frubily, with round downy, rough, leafy branches. Leaves alternate, elliptical, entire, three or four inches long, single-ribbed, vein, on short thick flacks; smooth above, clothed with reddish down beneath. Flowers in axillar simple clusters, flatter than the leaves. Ripe fruit unknown.

STRIGMENTUM, the fifth, dirt, or fordes, ablerged from the skins of fkode that hathed in the baths and places of public exercizes among the ancients, or from the walls of bathing-places, or statues let up in them.

These were all referred for medicinal purposes, and were properly of three kinds. The first, or first firrigent, consisted of the sweat, oil, and fordes, collected in those places. The second kind was the firrigents of the palizada, consisting of the same things, with the addition of dust, which was thrown upon the bodies of the perfons before they entered on those exercises. The third kind was that collected from the walls of the gymnasia, 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 rust, or arugo, of thofe metals which were collected from them with it.

These firrigents were supposed to be of a heating, drying quality, and serviceable; they were, therefore, used for diaculating the parotides, and for condylomata of the anus. Those of the palizada were used to draw out collections of matter about the joints; and applied in the manner of a cataplasm, were said to be of great use in the feicaties; and thofe 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 feburihe.

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 face. It is apt to crumble to pieces between the fingers, and stains the skin in handling. It melts freely in the mouth, and has a remarkable smoothness, but very little astringency in its taste, and leaves a sensible girtiness between the teeth. It is sometimes veined and spotted with small mole;
cules of an earth, like the whitish variegations of the red French bole. It makes a right effervescence with afee, or any other acid mentrum, and fuller no change of colour by burning. Hill.

1. STRIGOSULA, in Natural History, a name given by Mr. Lhuyd to a species of baffle cyliner-shell.

1. STRIGOVA, in Geography, a town of Hungary, situated in a valley betwixt hills covered with vines, suppos
to be the ancient "Strigonium," where St. Jerom was born; 8 miles W.N.W. of Clakathurn.

STRIKE, in Commerce, a measure of corn in London, &c. 40 of which are = 80 bushels = 20 comus = 10 quarters = 2 rails = a boll.

Strike is also a measure containing four bushels; two of which make a quarter. A strike of flux is as much as can be hekckled at one handful.

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 topsails, at least half-mast high, they say, She strikes: meaning, she yields or submits, or pays her devoir to that man of war, as she palles by. See Jeers, Sail, and Salute.

When a top-mast is to be taken down, they say, Strike the top-mast.

And when any thing is let down or lowered into the hold, they call it striking down into the hold.

Also, when a ship touches ground in a shoal-water, they say, She strikes.

STRIKE a Hull. See Hull.

STRIKE a Nail, in the Mangez, is to drive through the horse's toe, and the horn or hoof of his foot, and to rivet it for holding on the shoe.

STRIKE a Vein. See Bar.

STRIKING. The punishment appointed by our laws, 33 Hen. VIII. cap. 12, for striking in the king's palace, where his royal person refiides, by which blood is drawn, is perpetual imprisonment, and fine at the king's pleasure; and also, for shafting the offender's right hand, the solemn execution of which sentence is prefidered in the statute at length. See Lord-Steward.

But striking in the king's superior courts of justice, in Westminster-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 stroke or a blow in such court of justice, whether blood be drawn or not, or even aslashing a judge, fitting 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 conviiction, by verdict of twelve men, or by his own confession, or by two lawful witnesles, at the assizes or seisions, be adjudged to have one of his ears cut off; and if he have no ears, he shall be burned in the church with a hot iron, having the letter F, by which he may be known for a fray-maker and fighter; and besides shall be 106 feet excommunicated.

STRIKING or Pithing of Animals, in Rural Economy, the method of suddenly slaughtering or klling them for dom-estic purposes, by the use of a small sharp iron-pointed knife struck in fo as to divide the spinal marrow, instead of the more protracted 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 spectators. See Pithing.

It is defiirable, on several accounts, that this sudden mode of killing neat cattle, and other sorts 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 poftehion, 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 related by the writer of the Corrected Report of the Agriculture of Shropshire, that a butcher at Wifbech, in Lincolnshire, practised this mode several years ago, in consequence of the representations made to him of it, by captain Clarkfon of the navy, who had seen animals so slaughtered for the use of our fleet, when at Jamaica: that, after his death, Smith, another butcher of the same place, adopted the same method; and that, in the year 1756, he (the writer) procured, by favour of Mr. Clarkfon, to disfigured 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. That if a line were drawn from ear-root to ear-root, at about an inch and a half distance from the horns, or places for them, and the centre of this line were found, this centre or spot would be the place where the knife should enter, in striking the animals. That the knife which he makes use of is not in the form of a dagger, nor is it drawn or thrust in with any great force: it is rather larger than a common knife, 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 car 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 fame instant the bullock drops, and is apparently out of all sensibility of pain. He was informed also, that it is not once in a thousand times that any person mis aconte 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 said hardly ever to fail. However, if it should at any time, the knife is at least so 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 business. In this case, it is sup-posed, there would hardly be the pain of two seconos to the animals. However, in speaking to Smith's apprentice on the subject, he was at first so affurred by him, that he had no difficulty in finding the proper spot for the purpose, and that the ual dki the knives. This practice obtains pretty generally on the Lincolnshire side or bank of the Humber river, as at Barton, and several other places. Calfes, fleeces, pigs, and other animals, are said 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 fo far as tendernesses 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 shewn, that though the spinal marrow may be divided, the nerves that supply the organs of respiration and molt of the sense 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 instantly be killed in the most certain and effectual manner; and that by performing this operation in the same way, it will be attended with constant 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 instantly complete the buffets; or the operation might probably be performed in an equally complete, convenient, and more expeditious manner, by the discharge of a small pellet, loaded in some proper way for this purpose, and suitably directed.

In some of these ways the present brutal, beating, hammering, and digging practice may probably be got quit of, which, for many reasons, is highly desirable.

The proper modes of constructing housetops for slaughtering animals in, have been already noticed under the proper head. See Slaughter-House.

Moll of the facts, experiments, and reasonings, on this subject, may be met with in the above work, and in the 8th volume of the Philosophical Transactions.

Striking-ill, Blood, or Sicknfe, a diseafe in sheep, which is not unfrequently of a very dangerous and fatal nature. It is perhaps the most quickly destructive of all the disorders to which these animals are subject. It instantly strikes or attacks them, as it were, and hence the name, being an affection of the braxy kind. It is well known in moll parts of the country, but is more prevalent in some places than others. It is said to be most common on rich improved pature lands, and in situations where clothe-feeding is most practifed; and is not unfrequently experienced by the flock-farmers, on their sheep being put upon the clover, especially in some of the midland counties.

The particular appearances of the diseafe are, where its progress is capable of being distinctly marked, that after separating themselves from the rest of the flock, they become uneasy, cease to feed, stand as if in great pain, stretch out the fore-legs to relieve themselves, and, when they can, drink frequently. On approaching them, they appear duller than the other sheep, drooping their heads in a particular manner. On being narrowly examined, their eyes are found to be heavy, dull and half closed, with an inflamed watery appearance; the breathing is short and difficult, and the belly twitched up in a convulsive manner; the mouth, tongue, and skin, are dry and parched; and the pulse strong, and rather frequent. They grind their teeth, lie down and rise up repeatedly in a quick manner, often stand motionless, with the head down and the back erect, or creep away from the rest of the flock, with a slow flitch motion, to some retired spot or place, where they lie in a bleating or rather screaming flate from agony; their wool claps to the body, which sometimes swells to such a degree that the parts give way, and strong convulsions come on, which are often succeeded by death in a few hours from the first striking or onset of the complaint. In some marsh-land tracts, in the last stage of the diseafe, they lie down, keep looking towards their bodies, and foam at the mouth, or bile, as it is called, which is almost a certain sign of their immediate dissolution.

In some cases they will live several days, though seldom a week, unless they recover, which is a rare occurrence. In the course of this time, there is but seldom any passage through the bowels; the urine is scanty, and high-coloured; and the blood is absolutely black, and so thick, that when a vein is opened, scarcely a drop or two oozes, it is said, from the orifice.

On the examination of the body, after death, almost every part of it exhibits appearances of inflammation and mortification, or tendency to putrefaction, more or less strongly marked. When the flomach, intestines, or other of the belly parts or viscera, are the seat of the diseafe, or molt affected, it is said to be in the red or bowels; the part in which it seems to have begun being very dark-coloured, and emitting a more offensive smell than any other: but when in the muscular parts, to be in the fheep or blood. Again, when, in the first of these kinds, there is an extraordinary effusion of bloody serum into the cavity of the belly, it has sometimes been distinguished by the name of water-ficknfe. And from the examinations which have been made in this way, it is thought that there would seem to be even more kinds of this sort of sicknfe than those named; and that although the practical utility of such distinctions, in a diseafe 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 diseafe may be obtained.

Some think that, before the above noticed parts, the heart, lungs, and liver, sometimes appear to be primarily affected in this diseafe, as is easily perceived by the dark and livid appearance of the particularly 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, clasfs, or kinds of this disorder which have been noticed above, there are several varieties, as below.

The first variety of the fift kind, or that of bowell-sicknfe, as it is often called, is the belly. This being the principal seat of the diseafe, may be said to be a sort of gaffritis, or inflammatory state of that organ. In it, the belly is profusely thickened, the carcasse much discoloured, and a four pititious matter diffused throughout the whole body, especially the fliey parts of it. The fatty matter appears the least changed; but although it melts down into a greasy flate, 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 fulphureous kind, which is characteristic of the diseafe, and from which it has sometimes been named, as well as from the place of its chief seat, and the flomach and bowels are prodigiously dilated with air, having the same intolerable fetor. A general rednfe pervades the whole bowels. The two first flomachs are rarely the particular seat of the diseafe, 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 flomach, especially the third, is mostly quite dry, and may, it is said, be crumpled to powder between the fingers. The kidnies 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 fort of fickens, it peculiar to sheep of the hog kind on the first setting in of fruit, is not to be distinguished during the life of the animal, but by the excessive swelling of the belly, and it almost always speedily fatal.

Another variety of this kind, that most nearly resembles the above, is that where, instead of the stomac, the small guts are inflamed and mortified, and which may be denoted a fort of enteritis, or inflammation of the bowels. In this, the carcass is much less swelled, and not nearly so blue and putrid, except that the chewed grays in the maw is very stiff, and almost quite solid to the feel; the stomach is scarcely affected in the leat, but the small intestines are mortified, black, soft, and almost quite rotten, the inflammation having evidently originated in one of the latter folds of thee. In one or two instances, a small fold or doubled in the intestines was noticed, which, by some wind passing through them, had forced its way through the thin texture of the bowel, and brought the grays mingled with the fat hanges. This was full 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 purl obstructing all passage through them.

It is faid only to attack hog-sheep, which have plenty of grays when the weather is mild, during forms of snow, when their walk is much circumfered, and when they are confined to the tops of the heather, bent, and other dry faple feed. It is not, it is faid, so speedily fatal as the preceding fort or variety of this difcase, and that the sheep sometimes linger a day or two in great agony, without appearing much swelled. It is sometimes termed the dry brown.

A third fort or variety of this difcase, which has sometimes its chief feat in the urinary bladder, may be considered as a fort of cystitis, or inflammation of that part. The appearances of the disorder, it is faid, in this fort, resemble those of the firt of the above varieties, and that the putrid taint of the carcase is nearly the fame.

And in a fourth fort or variety of this kind, atimes in the belly, on being opened, the whole bowels are found swimming in bloody water, although none of it is contained in the abdomen. The gall bladder is contracted and thrown to a fize 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 carcases examined by Mr. J. Hog, as he had been led to fufpect by a writer on the subject. The smaller apartment of the stomac had some purple spots on it, which were thicker than the ret of its subtane.

This variety, having the peritoneum, which covers the whole intestines, and lines the cavity of the belly, as the principal feat of the disease, may be confidered as a fort of peritonitis, or inflammation of that membrane or covering. It is faid 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 firt 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 fluck by the palm of the other hand.

In the firft variety of the second division or kind of this disease, often termed fickens in the flf and blood, or the fift of the whole disease, in some infances, and tho' the molt violent, no one part of the stomac or bowels seems, it is faid, to be more affected than another. There is a general redness over the whole, and the rufh of the animal is quite tender and soft, upon a futting a greenth hue. In this faine, the disorder may be faid to be a fort of phrenitis, or inflammation of the brain, which partakes of the affection, and the veffels of which are red and turuid, exhibiting, with the exception of the blackneys, the fame appearance as that mentioned in the bowels. In all caffes where this is obferved after death, the disease, it is faid, has been very quicfly fatal, seldom exceeding four, or at most five hours from the firt apparent affection of the animal.

Another variety of this nature, which is the fift of the disease, or that fort of fickens which is feated in the blood, is not fo readily difcerned in the living animal; nor does it affect the carcase fo much, it is faid, if blood be let. There seems to be a tendency, it is thought, in the blood itself to decompofe and putrefy, and not unfreqently there are appearances of inflammation on the membraneous coat that lines the breath, when the disease may be faid to be a fort of pleuritis; or on the diaphragm, when it may be termed a diafphragitis; and the diaphragm on the whole has a strong refeemblance to pleury.

In these two varieties of this kind, whether they be different ones or not, the whole body is faid by Mr. J. Hog to be browned, and fwellled like a loaf; that the fore-legs arc certainly the worst; that the kidneys are in the fame flat of mortification as in the two firt of the above forts or varieties; that the appearances and the fmal are the fame; that the breath arc carried off by it in the fame fhort space of time; and that it is the fame as the black fdauld in young calf beginning to feed on fodder and dry herbage, when the grays fall in the well of Scotland. It is alfo noted, that all the old sheep which die of the fickens, as well as the hogs that fall in May, are carried off by this fort or variety of the disease, although individuals die of it at the fame feafon, when they are dying in great numbers of the howel-fickens. But that, on the whole, the mortality is not nearly fo great, not indeed above one-tenth or one-twentieth of that occafioned by the other.

In refpect to the caufes of the disease, although some few old sheepe and lambs may occafionally perih and be defroyed by it, it may be confidered, on the whole, as a disease peculiar to hogs, it is faid, and that the founder thefe are bred, and the higher condition they are in, the more apt it is to be burthened with this. They are commonly found diffeated among them, and on the fore-logs, and on the diaphragm, the fheep are carried off by it in the fame fhort space of time, and it is not fo violent in its ravages, and the fheep do die when attacked by it. Heath sheep too are fuppofed to fuller more from it than the white-faced and fine-wooled breed. On fettling in feverely, it not unfreqently carries off one-tenth of the young sheep. But it is not half fo fatal by the plan of paftring the hogs with their mothers, it is faid, as that of hurting them or rearing them by themselves, on account of the differences in their habits which are thus produced.

Though fome fheep die of the disease at all feafons, its ravages are chiefly confined to the winter months, commencing fooner or later, as the flate of the weather may be. But it seldom prevails much until after the vegetation has been checked by the early autumn frolt, and is the molt destructive towards the clofe of the year: when at that period there is any sudden change from mild to frotty weather, or if rain in the day be succeeded by frolt in the night, and especially when accompanied by hoar-frolt, it is, it is faid, particularly fatal. It becomes fels frequent after frotty frolt lets 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 caufed or brought on by means of frozen grafts. The roots of ground where frothy mifts settle deep on the lofter grafts, are, it is faid, very dangerous for young fheep to feed and lie upon, as well as those of dry paitures, which are heavily loaded with hoar-frost. The effects of grafts eaten in this flate, on the tender bowels of hog-fheep, refembly, it is fuppofed, those of frozen potatoes eaten by black cattle, which immediately engender prodigious quantities of noxious gases, and quickly bring on inflammation and mortification.

The neceffity of fheep working and eating on places, already barred and fouled, in heavy fventers of snow, is another immediate, and not uncommonly deftroying caufe of the difeafe, as in thofe circumstances they eat any thing that comes in their way, as rotten fern, fog. roots, fpratt, and other coarfe plants, or whatever they can get at.

Some have fuppofed that pet fheep, and thofe that have fhelte in the night-time, are feldom affected by it; but it has been afferted by Mr. J. Hog, that he has fpent many inftrations of domestic fheep, termed fheep, dying of the difeafe; and that in fome northern diftricts, where the small flocks of fheep are nightly houfed the year round in fear of foxes, it rages with uncommon feverity.

In regard to foids or grounds, thofe which are harden, drieff, and fouled, fuch as the ley heathery kind, are the moft liable to have the fheep affected with the difeafe. But all kinds of paitures, which have one part of the herbage fine, and the other coarfe, are liable to caufe the difeafe, and to have great fols from it. Thofe likewise which have a fweet juicy food in a fouled and impure condition in different parts of them, or ifpots of luxuriant grafts, and that of fheep that has old walks, and other places, are very dangerous. The animals naufate thaf-grafs, it is faid, until affected by the froll, when they eat it in quantities evidently dangerouf to them. Where the food that is pro-duced is in the moft conftant flate of fine growth, the fheep in the paitures are the moft fafe from this difeafe.

In refpeft to the cure of the difeafe, in defcription of the fuddennefs of its attack and fatality, it is probably almost imposfible, as nearly one half the fheep attacked by it, are faid to be dead before they are defcovered to have been affected. Notwithstanding this, however, a great number of remedies for it have been propofed at different times, and highly extolled for the certainty of their fuccefs; but they have been found of little avail. Some of them, indeed, have contributed to aggravate the difeafe rather than to remove it, as thofe of the spirituous, muffard, and fome other kinds. But if, in any inftance, a cure is at all poifible, it can only be efrected, it is faid, by fuch means as are calculated to counteract and remove inflammation, and thofe employed in the very inftant or onfet of the disorder. Of thofe means, blood-letting is perhaps chiefly to be depended upon, and the venous in the tale, on the infeys of the fore-legs, and the angles of the eyes, may be opend for the purpose. At the fame time, remedies of the cooling re-frigerant kind, fuch as nitre, and cathartic purging ones of the fafne fort, with caller oil, infufions of leenna, and others of a fimilar nature, may be given; and proper cryllers may be thrown up, in fome cafes, with more efrect: when, if the bleeding be fhoild be full and free, and the purging or evacuation of the bowels fuitable, fome hopes of the recovery of the animal may be entertained. When the fheep do recover, they are however always weak, and require much care and attention to get them through the winter fefion.

Another mode of treatment for this difeafe has been ad-vised by Mr. J. Hog, on the ground of actual experience; but which appears very inconfident and improper. This is, in the firit place, if the animal be found in time, to give it a feverer heat, by running it: if this be not fucceffful, it knows nothing that will. It is to be fo well hunted, as that it does not immediately afterwards lie down on leaving it, or if this be the cafe, it fhould be in the houfe. 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 leaft, has also been recommended: after which a quantity of water-gruel, mixed with butter or fome other softening ingredient, may be administered as an inftruction or otherwise.

Great care is, however, to be taken that none of thofe means are used in the fourth of the above varieties of the difeafe, or that of the watery kind, as they occafion inftant death.

Much more is, however, to be done by the means of pre-vention than thofe of cure in this complaint. There are many, fuch as the proper plans of managing the young hog-fheep in rearing them, as has been fpoken above; the preferving the vegetation of the paiture herbage as much as poifible by proper flockiing and feeding fuch lands; the providing proper supplies of green fucculent food for the flock; the proper moderate use of turnips, as by this means the loffes by the difeafe have been greatly prevented and letfened in different cafes; the feltering and protecting them well; the not allowing them to be over-heated by exertion; the careful removal of all forts of coarse rank grafs in the paitures; the deftruction of the ley heather in the winter hog-paitures by burning or other means; the moving the fheep about early in the morning; the bleeding the hog-fheep previously to the feaon of the difeafe attacking them to a fmall extent; and fome others. Many think great advantages are derived in this way, by pafturing the young and old fheep of the flock all together, as by fuch a mode the difeafe has been almost wholly eradicated, and prevented where it had been intruduced. And that great benefit arises from having the paiture-ground for the fheep, efpecially the hogs, all of the fame quality or kind, whatever it may be. Thofe feveral points are fully confidered and ex-plained in an excellent paper on this difeafe, inferted in the third volume of the "Tranfactions of the Highland Society of Scotland," by A. Duncan junior, M.D., to which the inquire is referred.

Striking-off Wheat-Leaves, or Flogging, a practice or operation performed in fome diftricts, as in Effex, for thinning and clearing away the large broad leaves of ftrong full wheat-crops. In executing this fort of work, the men, with ficklefs or reaping-hooks that have sharp edges, when these leaves 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 is faid, they are done carefully, or damage may ensue from it.

This curious practice is, however, very little known or employed in other diftricts, and probably roll feldom neceffary in any cafes.

Striking-off Ant-Hill Machine, an instruument or machine contrived for the purpore of striking off or clearing paiture-grounds of their forts of hills, which are sometimes very injurious.
injuries 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 have 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 Essex, lately published by the Board. Striking or Switching of Hemp and Flax, in Rural Economy, the means of beating and preparing them over the wooden flump or flock, so as to render them soft, and clear of the sheaves or heavy matters that hang about them. Striking of Meat, the practice or first operation in curing it with salt. The smallest-grained sort of salt is thought to be the best for this purpose, whether it is done in the dry or moist manner. See Salt.

Striking-Watch. See Watch.

Striking-Wheel, in a Circle, the same with that by some is called the pin-wheel, because of the pins which are placed on the round or rim, (which in number are the quotient of the pinion divided by the pinion of the detent-wheel.) In sixteen-day clocks, the first, or great wheel, is usually the pin-wheel; but in such as go eight days, the second wheel is the pin-wheel, or striking-wheel. See Clockwork.

Strilek, in Geography, a town of Moravia, in the circle of Hradich; 14 miles N.W. of Hradich.

Strillozzo, in Ornithology, a name by which some authors have called the emberiza alba, or bunting, or perhaps a bird somewhat different from our bunting, and common in Italy; for it is not yet ascertained, whether the trillozzo specifically differs from the bunting, or only by some accidental varieties.

Strimba, in Geography, a town of European Turkey, in Moldavia; 18 miles N.W. of Birlat.

Strimiz, a town of Bohemia, in the circle of Leitemitz; 18 miles W. of Leitemitz.

Strimon, or Emboli, a river of European Turkey, in Romania, which runs into the gulf of Consta; 6 miles S. of Emboli.

Strindden, a town of Norway, in the province of Drothenheim; 5 miles N.E. of Drothenheim.

Strindden. See Mar. See Matsuyama.

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 conceived fretted or drawn by weights; and then, ceteris paribus, the tones of two strings are in a direct ratio of the square roots of the weights which fret them; that is, e.g., the tone of a string fretted by a weight 4, 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 violin 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 octave, or the like, will at the same time tremble of its own accord. See 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 to struck. Thus, supposing A to be an upper octave to c, and therefore an a b c unison to each half of it flopped at b; 1 b 2 if, while a c is open, A B be struck, the two halves of this STR 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 removing it successively from one end of the string to the other.

In like manner, if A B were an upper twelfth to c, and, consequently, an unison to its three parts a, 1, 2, and 2 c; if, a c being open, A B be struck, its three parts a, 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 Mr. William Noble, of Merton 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 published it before, he immediately resigned all the honour thereof. Phil. Trans. abr. vol. i. p. 626.

This phenomenon is better explained under the articles Sound, Harmoniques, Vibrations, Fundamental, and Generate.

We shall add to the article String, musically considered, D'Alembert's definition of the term corde fanae in the original edition of the Encyclopédie, and copied by Rousseau in his Dict. de la Mus. Corde fanae is any string stretched 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 backwards 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 communicated to the whole string, in vibrating it will produce a sound, and its sound will always accompany its vibrations. Geometricians 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, 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 inversely 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 any exactitude, in his Rara, or work, entitled "Methodus Analyticae investigationis elementorum directa et inversa," 1715; and these fame laws have likewise been demonstrated by John Berouilli, in the second volume of the "Memoires de l'Acad. Imperiale de Peterbourg."

From the formula (adds Rousseau) which results from these laws, and which may be found in the Encyclopédie, art. Corde, 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 thickenss, the number of the vibrations in equal times will be as the roots of the numbers which express the ratio of the tension of the 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 thickenss, or diameter of the string.

3. If the tension and thickenss 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 necessary to observe, that the tension of the strings is not represented by the weight or preture of the tension, but by the roots of the same weights; thus, the vibrations being reciprocally as the square roots of the tensions, the weights of the tension are reciprocally as the cubes of the vibration, &c.
From the laws of the vibrations of strings, are deduced those of the sounds which result from them. The mere vibrations a string makes in a given time, the more acute is the sound; and the lesser vibrations a string makes, the deeper is the sound. 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 preffing 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 founding, or the usual part of it next the bridge, the bridge found only of the greatest common aliquot will be heard. See Harmonics.

The word notes, in French, is used frequently in compositions for the fundamental sounds of the key; and the different chords which alter the modulation in the fade, or prolong a phrase, are often called harmonic chords.

String, in Ship-Building, is a strake or strakes within, under the gunwale, and answering to the fore- and stern-sheets of sail: it is scarfed in the same manner as the fore- and stern-sheets, and bolted through the ship's side into the foot of the strake 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 affix the floor.

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 that in thicklands, 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 unite all the streams, form the rivers.

STRING-HALF, among Horfis, an involuntary and convulsive motion of the muscles, which extend or bend the hough. When it feizes the outside muscles, the horse droops, 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-half 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 neat cattle, which is to be removed nearly in the same manner.

STRANGIA, in Ichthyology, a name given by authors to that species of the gaudin, which is called by some lata, and by others mycterus plumbeus; by us in English the cusk-pout. Olaus Magnus calls it the borkhur.

STRIP, at Sea. A chafe is said to trip himself into short or fighting falls, when he puts out his colours in the poop; his flag on the main-top; his streamers or pendants at the end of his yard-arm; furls his spirit-sail; pecks his mizen; and flings his main-yard. In which case, the chafers must prepare himself for fight.

STRIPE the Magpie, To, is to unrig a flipp, or direct the sails of their machinery and furniture, otherwise called deflaming.

STRIK, To, in Rural Economy, a term signifying to drain the last milk from cows.

STRIPED STALK. See Stalk. STRIPED Velvet. See Velvet.

STRIPPING, in Agriculture, a term applied to the operation or practice of fumbling or taking off a thin portion of the surface of lay or other ground, in a fort of alternate manner; a thin slice or piece of the turf 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 turf or other surface be but half of it stripped or cut up and turned, the whole is completely covered over, presenting a flapped 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 south-western counties of the kingdom.

STRIPPING of Hop-Poles, in Rural Economy, the practice of clearing and removing the waite birds 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 birds remain long twined about them while they are lying upon the moist ground. The price of stripping poles of this kind of this sort of incumbrance, is most commonly about three or four 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 or Paring-Shares, in Agriculture, that fort of stripping or paring contrivance which is fixed upon ploughs for the purpose of stripping, paring, or taking off the surface or sward of lay-ground, in some cases, in breaking 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 milkings or afterings.

STRITHAGEN, in Geography, a town of France, in the department of the Orne; 8 miles N.W. of Rodelc.

STRIVALE, in Ichthyology, the name used by many for the fifth more usually known by the name of oper, the boar-fish.

STRIVALL, 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. 25° 30'. 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
with brightly recurved feathers; the head, auricles, and
eyes, large; the tongue is bident.

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 retractile; auricles large,
covered with a membrane; outer quill-feathers serrate on
each edge; the claws are hooked and sharp.

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 sections, viz: those that have ears or
horns, and those that have none. These horns are length-
ened feathers on each side the head, and are capable of be-
ing 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.

* Bufo; Great Owl, or Rufous Horned Owl, varie-
gated 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 smaller
spots and markings of brown, black, and grey;
both together with innumerable freckles or minute specks of the
fame colours. It is found of a deeper or lighter hue, ac-
cording to various circumstances of age, health, and climate;
the larger wing and tail feathers are obliquely varied by
dusky transverse bars; the bill is black, the eyes are very
large, and of a bright reddish or golden orange-colour;
the legs are short and strong, thickly clothed, down to the
very claws, with fine, downy, and facetaceous plumes; the
claws are extremely large, strong, and black.

This species, including the varieties above enumerated,
appears to be very generally diffused throughout the tem-
perate and northern parts of the old continent, and is even
supposed to occur both in North and South America. In
this country it is rarely seen; in Germany it is rather com-
mon. 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 supposed, 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 alone, 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 favourite of Minerva. The owl thus venerated ap-
pars 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
fear'd to Proserpine: its appearance forebode unfor-
tunate events, and according to Pliny, the city of Rome
underwent a temennum floration in consequence of one
of these birds having accidentally strayed into the Capitol.

CAPITOLINA; Virginian Owl. Body above brown,
varied with fine, zigzag, tawny, and cinnamon lines;
neath pale-ash, with transverse brown stripes; throat and
sides of the breast orange, streaked with brown. This is
an inhabitant of America, and is less than the last. Ac-
cording to Mr. Edwards, it approaches in magnitude nearly
to the greatest horn or eagle owl: the beak of this in
seems not at all inferior to that of a cat; the wings,
when closed, measure from the top to the ends of the
quills, full fifteen inches; the bill is black, the upper man-
dible is hooked, and overhanging the nether, as in eagles
and hawks, having no angle in them, but plain on its edges;
it is covered with a skin, in which are placed the nostrils,
and that skin hidden with a brilliantly kind of grey feathers,
that grow round the bases 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-reddish; 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 breast 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 regu-
larly; the inside of the wings is coloured and variegated
in 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 Hud-
on's Bay, frequenting muddy ditches, and uttering, it is
said, a most hideous noise in the woods, not unlike the hal-
looning of a man, so that passengers, beguiled by it, some-
times lose their way.

SCANDINAVIA; Scandinavian Owl. Body whitish,
with black spots. It inhabits the mountains of Lepland, and
is the size of a turkey.

CEYLONENSIS; 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 Raja Alka.
The length of this species is nearly two feet, and its weight
about two pounds and three quarters. The bill is horn-
coloured; the irid's 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
the others.

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; second quill-feathers with four blackish bars.

*Coryphys*; 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; checkers white; quill and tail feathers barred with reddish-white.

*Asio*; 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 *Tzekolt*. Its colour is a variegation of black and brown.

*Brachyotos*; American Owl. Head and body above cinereous, beneath rufous; rump white, spotted with black; wings and tail rufous, with cinereous and grey transverse 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 and colours, is very strikingly allied to the *S. bubo*, 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 under parts, 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 deflected nest of a buldard 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 albicoalour; the bend of the wing and the covers 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 unfrequent 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 by night, with much elanor, and often approaching the dwellings of the inhabitants.

*Brachyotos*; 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 Arrows 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 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 closed, reaching beyond the tail; whereas in common kinds they fall short of it. The short-eared owl is a bird of paffle, 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 mouse-hawk. It never flies, like other owls, in search of prey, but sits quietly on the stump of a tree, watching the appearance of mice. It breeds near the coast, making its nest with dry grasses 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 assails 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 are 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.

*Brasiliana*; Brazilian Owl. Body above pale rufous, spotted with white, beneath white, with rufous-brown spots. It inhabits Brazil, and is about the size of a thrush. Bill, irides, short feet, and toes, yellowish.

*Nevia*; Mottled Owl. Body grey, beneath paler, 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, with black lines; breast buff, with small arrow-shaped spots. Inhabits Ceylon, and is seven inches long.

*Zorea*; Sardinian Owl. Feathers of the ears eight or nine, bill greenish-yellow. It inhabits Sardia and Italy; the toes are naked, seven inches long; it is solitary, does not migrate, and makes a howling noise.

*Carniolica*; Carniolic Owl. Body whitish-ash, with blackish spots and transverse stripes. It inhabits Carniola; and makes its nest in hollow trees and rocks.

*Deminuta*; Yaik Owl. Body red, of a small size. It inhabits the forests upon the Ural. It resembles the *S. bubo* in colour and form, but is much less; it weighs scarcely a pound; it builds its nest in twigs 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
cies 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, con-
siderably in the cast of its colours, according to the various
circumstances of age and sex, and when young it is said to
be wholly grey: the irides are also said to be of a pale yel-
low 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 scops 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 swal-
low. 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 gently rilling, wooded regions, but not among
lofty mountains, and it lives chiefly on insects and earth-
worms. 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 make a
very near approach, and then only retires to hide itself
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 confounds of a quick
and often repeated whistle. It constructs no nursery, but de-
posits its eggs, to the number of five or six, in the hollows
of trees. In Italy, the young are full-gledged by the begin-
ing of July, when they follow their parents during the
night for food, till they are able to feed themselves, and
to procure grashoppers, 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 continues only
so long as their dependence is necessary for their support.
After that period is elapsed, their familiarity fades, 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 whitish, with a few brown
lunate spots. This is found in Europe, America, and Asia,
and is two feet long; it flies abroad by day, and preys on
hers, hares, mice, and sometimes carrion; makes a howl-
ing noîse: in winter it is often snow-white. A variety has
numerous spots; 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 intense cold it mi-
grates to the shores. It adds horror even to that country,
by its hideous cries, resembling those of a perfon in deep
diffêres. It is rare in the temperate parts of America, and
strays seldom as low as Pennsylvania and Louisiana: 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 prob-
ably on hares; hence its Swedish name karfang. In Hud-
son's Bay it is almost domesticated, harbouring in places
near the tents of the Indians. It is scarce in Russia, but
rather common on the Uralian mountains, and all over the
north and east of Siberia, and in the Asiatic empire, even
in the hot latitude of Aftarkan. In Kamtschatka it is very
numerous.

TENGMAI; Swedish Owl. Body grey, with small
round spots. It inhabits Sweden, and is the size of a black-
bird.

* 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 bars, 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.

PENINSULATA; Spectacle Owl. Head white, smooth,
downy; body above, area of the eyes, and chin, brownish;
below reddish-white; the breast is barred with reddish-
brown. It inhabits Cayenne, and is twenty-one inches
long.

CINEREÀ; Sooty Owl. Head, neck, and wing-coverts,
footy, with dirty-white lines; breast and belly whitish,
with large oblong dirty-brown spots. It inhabits Hudson's
Bay; is two feet long; flies in pairs, and preys on mice or
hares. The bill is whitish; irides yellow; the tail is marked
with oblique brown and dirty-white streaks; a part of the
feathers from the chin to the vent bare of feathers.

TAPACUTIA; Spotted Owl. Back and tail-coverts,
spotted with dirty; breast and belly of a dirty-
white, with reddish lines crossing each other. This also is
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.

CUNIICULARIA; Coquimbo Owl. Body above brown,
beneath white; legs warty and hairy. It is found in Chili;
it 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
irides are yellow; the body above spotted with white.

ALICO; Aluco Owl. Head rufous; irides black; frill
quill-feathers rufous. This is found in diverse parts of Eu-

ope; is about fifteen inches long; lives during summer
in woods, in winter near habitations; it feeds on mice.

SILEVSTRES; Austrian Owl. Body variegated white and
brown; the space round the eyes is white, the irides red. It
inhabits Austria; is the size of a fowl; the covering of the
head is an elegant radiant wreath of white feathers.

ALBA; White Owl. Body above tawny, spotted with
grey, beneath white; quill and tail feathers rufous, the
latter tipped with white. It inhabits Austria, as does the
next.

NOCTUA; Rufous Owl. Body pale rufous, with longitudi-

nal brown spots; the irides are brown.

RUPA; Ferruginous Owl. Body rufous, spotted with
brown; the irides are blueish. It inhabits the woods of
Idria.

SOLONENSIS; Solonec 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, varied with reddish and white; toes
horn-colour.

* FLAMEA; Common Owl. Body above pale yellow,
with white dots, beneath whitish, with black dots. It in-
habits Europe, America, and Northern Asia, and is about
fourteen inches long.

BARBATA; Mountain Owl. Space round the eyes and
chin black. Bill and irides yellow; body cinereous; pri-
mary quill-feathers ferrate on both edges.

* STRIDULA; Tawny Owl. Body rufous, the third quill-
feather
feather is longer. It inhabits Europe and Tartary, 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 consider 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 manners of the brown owl, or, as it is called by Pennant, the wood 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 skin them with as much dexterity as a cook does a rabbit.

Arctica; Arctic Owl. Body russet-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.

Fulica; 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 is, says Edwards, who was the first describer 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 with a greg 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 feathers round the eyes are white, a little shaded with brown, and daubed with small, longish, dusky spots; the outides of these feathers, towards the ears, are encompassed with black; without that again is a little white; the bill is covered almost with light-coloured bristly 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 tiopt 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 withinside are of a dark ash-colour, with white spots on both webs; the prime quill is spotted within, and without on its outer web, and hardly any of that reflecting back of the points 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 across than the outermost; it is barred across by seven or eight transverse narrow bars of light brown; the breast, belly, thigh, and coverts under the tail, are white across, 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. Thosc were natives of Hudson's Bay, where its native name is Caparacoock. It preys on white partridges and other birds, and is so bold as to attend near the fowler 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 rusty-brown colour.

Uralensis; Ural Owl. Body white, with longitudinal brown spots in the middle of each feather. It inhabits the mountains of Ural, in Siberia, and is said to be of a hen. The bill is of a wax colour; the irids and eye-lids are black; orbits ash; the rump is white; the tail is long and wedge.

Accipitrina; Caspian Owl. Body above yellowish, beneath brownish-white; both sides and longitudinal blackish streaks, belly dotted with black, irids citron. This inhabits the Caspian sea, and is the size of the brown owl. Bill black; wings beneath and vent white; quill-feathers outside yellowish, within white tesselate 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.

Novo Scelendia; 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.

Ceyennensis; Ceyenne Owl. Body tawny with reddish, and transversely waved with brown; the irids are yellow. It inhabits Ceyenne, and is the size of the ferece-owl. The bill is horned, claws black.

Dominicenins; St. Domingo Owl. Body beneath rusous; breast a little spotted. It inhabits St. Domingo; resembles the brown owl: bill larger, stronger, and more hooked.

Tolichia; Tolichia; 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.

Chichiti; Mexican Owl. Body tawny, variegated with brown and black; the eyes are black, the eye-lids blue. It inhabits New Spain, and is about the size of a hen.

Acadica; Acadian Owl. Body above bright bay, spotted with white; beneath dirty-white, mixed with rusty. It inhabits North America, and is seven inches long. The bill is brown, the irids yellow, crown with pale spots; orbits cinereous, toes brown.

Passerina; 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 plumes, 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 depolit 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 state, soon exhibit a ferocious character, and differ totally in temper and manners from those of the sexes, or little barn owls.

*Arnoena*: White-fronted Owl. Body buffy-brown, beneath paler; forehead white; quill-feathers barred with black and white. It inhabits North America, and is five inches long. The bill is blueish, tipped with black; the irises are yellow; a semicircular white line behind the eyes to the crown; lower part of the belly and legs cinereous; claws black.

*Stizzano*, in Geography, a town of Naples, in Principat* Citera; 12 miles S.W. of Amalfi.

*Stroaking*, a method of cure where 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.

That *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. Thoroughby, 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 stroaker, Mr. Greatrix; and adds, that when Mr. Greatrix stroaks only for pains, he uses nothing but his hand; but that for ulcers, or running sores, he uses sputte on his hand or fingers.

*Strobile*, a word used by surgical writers to express a pledge of a twitted form.

*Strobilites Vinum*. See Vinum.

*Strobilus*, in Botany and Vegetable Physiology, cymose, 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-veiil of the same structure and character. (See *Pericarp*.) A *Strobilus* or Cone, is a catkin, hardened and enlarged into a seed-veil, usuaily of a woody texture; sometimes rather coriaceous; rarely pulpy. In the most perfect examples of this sort of fruit, the seeds are closely sheltered by the scales, as by a capule, which, when dry, separate and spread, as so not to be brought together again, except by immersion in water. Thus the seeds, generally winged, are allowed to escape in dry weather. Of this, the various species of *Pinus*, as well as the Cypresses, 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 flattened bivalve capsule, totally distinct therefrom. The *Platanus, Liquidanbar, and Compania*, have globular catkins, in which brittles or tubercles supply the place of scales, and are so far analogous to a real *Strobilus*. In *Juniperus*, the structure of whole fruit, in its origin, is exactly analogous to that of *Pinus*, what should be the scales of a Cone, become juicy instead of woody, and compose a soft homogeneous berry, in which the seeds are embedded.

*Strobnitz*, in Geography, a town of Bohemia, in the circle of Bechin; 4 miles S.S.W. of Gratzan.

*Strobulus*, among the *Ancients*, a kind of mitre, which rose 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.

*Strobos*, in Ancient Geography, a town of Macedonia; which was a Roman colony.

*Strocal*, in Glans-making, a long iron instrument like a fire-hoovel, used to empty the metal out of a broken pot into a whole one.

*Strocha*, in Geography, a town of the duchy of Stiri; 4 miles W. of Rotterdam.

*Stroe*, a town of Denmark, in the island of Zealand; 6 miles S.W. of Fredericenburg.


Gen. Ch. Cal. Pieranth inferior, of four ovate, acute, deciduous leaves; the two outer ones concave; inner flat. Cor. Petals four, lanceolate, all turned to one side, fawdy, with claws the length of the calyx; sometimes wanting. Nectary of one leaf, ligulate, lanceolate, ascending, inserted into the elongated receptacle towards its base; its tube flenter, longer than the petals. Stam. Filaments five, sometimes but four, thread-shaped, unequal, inserted into the stalk of the germen, two in the middle, three below, longer than the nectary; anthers oblong, erect. *Pf. Germen* on a stalk exceeding the length of the flaments, ascending, oblong; style none; stigma fiddle, obtuse. *Pera*. Berry coriaceous, tilted, cylindrical, of one cell and two revolute valves. Sted numerous, kidney-shaped, compressed, smooth, imbricated in three rows, imbedded in pulp.


1. *S. farinosa*. Mealy Stroemia. Vahl Symb. v. 1. 20. Willd. n. 1. (Cadaba farinosa; For. cent. 3. n. 12.)—Leaves oblong, mealy. Flowers with petals, and five flaments.—Native of Arabia. A *flab*, with round branches, which, when young, are covered with a glauccous powder. *Leaves* alternate, on very short stalks, half an inch broad, entire, obtuse, without veins, flat, befrinkled, especially at the back, with a glaucaous powder. *Stipulas* none. *Cluss* terminal, of fix or eight *flowers*, drooping in the bud. Petals four, undulated. Nectary white, small; its limb revolute, narrower than the tube.—The Arabs call this plant *Afyr, Korrob*, or *Sarah*, and consider it as a counter-poison, with which intention they either chew the young and molt tender floros; or eat them dried and pulverized.

2. *S. tetrandra*. Tetrandonous Stroemia. Vahl. ibid. Willd. n. 2. (Cleome fruticosa; Linn. Sp. Pl. 937. Burm. Ind. 140. f. 46. f. 3.)—Leaves elliptic-oblong, obtuse, with a small point, naked. Flowers with petals, and four flaments.—Native of the East Indies. The *flam* is shrubby, round, branching, leafy, smooth. *Leaves* nearly two inches long, falted, green and smooth on both sides, with one rib, and many oblique veins. *Cluss* terminal, ample. *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 *flamen* are inserted far up the stalk of the germen, but still much below the latter, so that this flower is by no means gymnandrous.

3. *S. glandulosa*. Glandular Stroemia. Vahl. ibid. Willd. n. 3. (Cadaba glandulosa; For. cent. 3. n. 13.)—Flary and viscid. Leaves roundish. Flowers without petals.—Native of Arabia, where it is called *Funnaim*. The *flam* is shrubby, with round branches, clothed, like the whole plant, with glandular hairs. *Leaves* long, entire, pointed, brittle, half an inch broad. *Cluss* terminal, of four from to fix drooping *flowers*. *Fruit* rough with club-shaped bristles.

4. *S. rotundifolia*. Round-leaved Stroemia. Vahl. ibid. Willd. n. 4. (Cadaba rotundifolia; For. cent. 3. n. 11.)—Leaves
Arabia, antiquities. 

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STROEMSHOLM, in Geography, a town of Sweden, in Weitmaaland on the Melar lake; 54 miles S.W. of Upfal. N. lat. 59° 30'. E. long. 16° 14'.

STROGLI AVACA, 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 to be more readily.

STROKESMAN is the perfon who rows the hindmost oar in a boat, and gives the stroke which the relt are to follow; so that all the oars may operate together.

STROLL, in Agriculture, a term provincially applied to a narrow slip of land.

STROM, in Geography, a town of Norway; 14 miles S.S.W. of Berga. Alto, a town of Sweden, in Jamtland; 47 miles N.E. of Olterfund.

STROMA, island of, is situated in the Pentland Firth, about a league from the shore of Canis bay, and county of Caithness, Scotland. It is a low island, 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 Stroma 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 horman weather, the spary of the waves is tided above the summit of the.eu the rocks in such torrents, as to run in rivets to a reservoir 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 Stroma, the dead bodies of the islanders were preserved from putridity for many years, and some of them were exhibited in a chapel, as antiquities. The claim to the island of Stroma was once contended by the earls of Orkney and Caithness, and decided in favour of the latter, because venemous animals were found to live here and die in the Orkneys. The name of Stroma, or Strom, is significative of the impetuous currents that prevail around the island. — Carlile's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, 8vo. vol. iv.

STROMATEUS, in Ichthyology, a genus of fishes of the order Apopes: the generic character is as follows. Head comprefled; teeth both in the jaws and palate; body ovale, broad, digipery; tail forked. There are three Species.

FIATOLA. Body beautifully barred. It inhabits the Mediterranean, and has two trimachs.

PAHU. The back is of a gold-colour; the belly is silvery, This is chiefly found in South America and Tranquebar; it feeds on lesser fish and vermes; the body is slender, covered with small thin deciduous scales; the flesh is white, tender, and reckoned very delicious food. Its other and minor characteristics are, that it has a middle-fided head, sloping, 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 gill very large, the cover of one piece, and surmounted with a membrane; the lateral line nearly the back, broad, silvery; vent nearer the mouth than the tail; the fins are long, falcly, 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 finger long, and not crofled with irripes.

Befides the above species enumerated by Gmelin, Dr. Shaw mentions the following.

CHILICUS, or ash-coloured Stromates 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 cinary, with a cast of yellow on the fins 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 thicknes; 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 pieces in India ufe this fish both in its fresh and salted state, prepared in various ways. The trivial name with them is Pampel.

ARGENTUS; Silvery Stromates. The lobes of the tail of this species are equal. It is of the fame 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 dusky 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 Stromates. 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 blackfih, with a silvery cast about the breast 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 onicli (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 Stromates and that of chetodon; but as the species of the Stromates are delitute of ventral fins, they cannot be placed in the same artificial order, and must rank among the apodes. • The fame is the cafe with fome other genera which are natually allied to fishes placed in very different orders. This forms the greatet objection to the Linnean arrangement of fishes; it would, however, be diflicult 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 bithorpe of Munster: 20 miles S.E. of Munster. N. lat. 51° 45'. E. long. 8° 15'.—Alb., a town of France, in the department of the Rhone and Moleffe, and chief place of a canton in the district of Simmen. The place contains 663, and the canton 7943 inhabitants, in 25 communes; 26 miles W. of Montz. N. lat. 49° 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 Τρώμβος (Strongyle) 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. Τρόμος, who is said to have reigned in the Lipari or ΑΕολιων islands, 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 Τρόμος and Λιφάρι.) Spallanzani, who had an opportunity of making observations on this volcano, does not seem much inclined to receive implicitly all that the people of Stromboli so positively assert concerning it, more especially as the mariners of the other ΑΕολιων isles are of a different opinion. Accordingly it is a prevalent expression among the mariners of Feleuda, "Stromboli is the mother of the mariner's gale;" and this is an instinctive idea, not made on purpose. 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. Dalmont, is an aggregate of fragments of shoers; and with these shoers, which are entirely opaque, and are attracted by the magnet, 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. The sea easily penetrates through it; for by digging in any part of the shore to a little depth, sea-water is found, somewhat frethened by passing through the sand. This sand occupies that part of the island which fronts the east and the 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 defiles, that have been stripped of the sand, either by the action of the rain-water, or that of the winds. The base of the island is about nine miles in circumference. The sand of the summit of Stromboli has been been discovered, and that of the other two kinds. Our author has particularly described these other substances above enumerated. Upon the whole he observes, that that island may be said to be formed, as far at least as externally appears, of scoriae and lavas; and that the material origin 3 B and

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, as 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 vetigere of such; but these vetigere 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 earthly depictions of the rain-waters, the matter ejected into it by the preceeding 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 cir- cular form, and not more than 340 feet in circumference, are composed of a confused mixture of lavas, scoriae, 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 appeared to be agitated by two distinct motions: the one intire, whirling, and tumultuous; and the other, that by which it is impelled upwards. When this liquid matter is raiied 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 inflated, 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 burr, 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 infladted with bubbles, it is accompanied with a found, 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 subsided, about 40 or 50; and, therefore, the greatest risings of the lava may be estimated at about 20 feet.

The component substances of this island are scoriae, lavas, tufs, pumices, and peculiar iron. Two species of the scoriae 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; dispersed in flata forming one body with the subincant lavas, which, at some remote period, flowed from the summit of Stromboli. This lava, when discovered, was found of black shoers and white felspars; the body of its substance differing 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 scoriae and lavas; and that the material origin 3 B and
and increase of Stromboli is to be attributed to porphyry, which, melted by subterranean conflagrations, and rared by elastic gaseous substances, arose from the bottom of the sea, and, extending itself on the fides, in lavas and fcoriz, has formed an ifland 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 Cretanian era by about 250 years, the date of the reign of Agathocles, the celebrated tyrant of Syracuse. This volcano burned likewise in the times of Augustus and Tiberius, when Diodorus 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 gulls 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 fide of the ifland, 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, produced near the apertures whence those fumes arise, are found 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; a supposition rendered the more probable by the prodigious subterranean accumulations of this mineral, which have been discovered in various parts of the globe.

Although Stromboli and Lipari (which lie) lie nearly under the fame 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 land. 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 ifland is frequently agitated by ifterns to such a degree, that the billows sometimes rise to one-half the height of a rock, on the north-ea fide of the ifland, called the rock of Stromboli, 500 feet in height. The shore of Stromboli has neither port nor harbour; and vessels, in cave of heavy ifterns, can only seek some little refuge on the back of the ifland. 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-cells and murenas; the fhiery, however, produces no branch of commerce, and only servs to supply the ifland, principally the foreigners who visit it; as the natives usually live on salt meat.

Malacay 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 pasfilla and pallolina 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 habitation of the iflanders are built in the fame part, and under the fame aspect. They are an irregular assemblage of cottages and fishermen's huts. The population of the ifland amounts to about 1000 persons, and has been for some time increasing; in consequence of which, exertions have been made to enhance the cultivable ground, by clearing away the woods. The characteristic of these iflanders, by some misrepresented as savages, is nearly the fame 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, subsisting, in their natural wild state, in the woody part of the ifland; the musket and the ferret are their only enemies. The birds of paffage are the fame as at Lipari.

STROMBUS, in Natural History, a genus of the class and order Vermes Teftacea. 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. Thse shells in their younger iflate want the lip, and have a thin turbinate appearance; many of them therefore, for this reafon, have been miftaken by authors, and referred to a genus to which they do not belong. There are about forty-five species, divided into separate fections, according as the fpecies have lips projecting, lobed, dilated, or tapering.

Species.

A. Lip projecting into linear Dirifions or Claws.

Fusus. Shell tapering, smooth, with a fubulate beak and toothed lip. It is found in the Red sea; resembles a murex, in having the beak rather ftrait; nevertheless it approaches nearer the genus strombus, in being smooth, and having the lip toothed; the shell is brown, and tranfverfely friate at the base; the pillar is white; the beak is black outwardly.

* Pes Plelecani; Corvorsant’s Foot. Lip with four palmate angular claws; the mouth is smooth. It is found in the America 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 five furved claws, and recurved beak. It inhabits the Indian ocean, and is very rare and valuable. The shell is large, brown varied with white; the back tuberculate; lip friate; it has fix claws, including the beak, which are long; the two hind-ones are divergent and bent outwards.

Scorpius. Lip with four knotty claws, the hinder one is very long. It inhabits the Indian ocean, and is four inches long.

Lambus. Lip with about seven ftraight 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.

Millepeda. Lip with ten inflected claws, and subfriate mouth; the back is comprefed and gibbous. It inhabits the southern coasts of Asia.

Clavus. The shell of this species is tapering, smooth, with a fubulate beak and a simple lip.
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.

Fasciatus. Lip entire; the back is crowned with three rows of pruinose rings, and rosy between them. It is found in divers parts of Africa.

Raninus. Lip thin, rugged, expanded 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 thick, and generally varied with colours.

Pogonius. Anterior lip prominent, rounded, smooth; the spine is spinous; beak three-lobed, obtuse. It inhabits South America.

Alatus. Anterior lip rounded, prominent, smooth; spine unarmed; beak three-lobed and obtuse.

Margina tus. Lip a little prominent; the back margined, smooth; beak entire.

Lucanus. 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.

Gibberulus. Lip a little prominent; back smooth; whorls gibbous, 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.

Oxiscus. Shell obovate, 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; spine crowned with tubercles; the upper one minute. It inhabits South America. The shell is variegated, refembling the next; but is thinner, and armed with much less spines, and thought to be a younger species of S. gigas.

Gigas. Lip rounded, and very large; the shell is crowned; the belly and spine have conical 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 rote-colour.

Laticornis. Lip rounded and very large; the belly is unarmed; the spine a little knotty. It inhabits Asia. The shell is solid, fourteen inches long, varied with brown and white, sometimes radiate; the lip within is white; the mouth rosy.

Eridonix. Lip rounded, short; belly smooth; spine a little knotty. It inhabits southern Asia; and is about three inches long.

Membran. Lip retuse, gibbous; belly and spine knotty, with knotty plaits; aperture two-lipped, smooth. It inhabits India; 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.

Vittatus. Lip rounded, short; belly smooth; spine elongated; the whorls are divided by an elevated future. It inhabits Asia; and is about four inches long. The shell is whitish, with brown bands.

Succintus. Lip rounded, retuse; belly smooth, with four, pale, linear, punctured belts. It inhabits different parts of Asia.

Sinuosus. Lip tapering, entire, slightly plaited, and crowned with fine spines; the spine is prickly. It has been found lithetero 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 whitish, with numerous parallel lines, above angular, and crowned with very sharp spines.

Fissicidella. Lip continued into a longitudinal cleft ridge. It inhabits India, and is found frequently in a fossile state in Campana.

Unicus. Lip tapering, short, striate; the belly and spine have knotty plaits; 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 spine plaited. This is very like the S. urceus.

Costatus. Lip very thick, flat whorl crowned with tubercles, the interfaces of the tubercles plaited; the next transversely ribbed, the rest transversely striate.

Brionyx. Shell conic, with mucronate eight-toothed lip and knotty spine. It is about seven inches long; extremely rare. Shell brown, varied with white and blueish clouds. Some authors suppose it is not of this division.

Affinis. Shell transversely striate, gibbous; spine unarmed; the first whorl crowned with tubercles.

Latus. The lip of this species is a little prominent, and twice emarginate beneath; the first whorl of the spine is smooth in the middle, and transversely striate on each side; the others are crowned with obtuse knots.

Levis. Shell smooth, filvery, radiate with brown, with oblique, transverse plaits; the spine is elongated, with inflated rounded whorls.

Vexillum. Shell solid and subcylindrical, with alternate, reddish, and ochraceous bands; lip denticulate within; pillar flat, gibrous, 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 spine.

Tuberculatus. Shell ovate, oblong, tuberculate; lip thickened. It inhabits the Mediterranean. The shell is coarse; the whorls covered with rows of raised horny dots; lip gibbous; aperture ovate; the beak is very short and recurved.

Palustris. Shell smoothish; lip separated behind. It inhabits the Savannas 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 striae.
AFTER. Shell smooth, lip separated before and behind. It is found in the fens of Amboyna, and is more than two feet long. It is of a black-brown or bay, within white, very finely fluted transversely; aperture ovate; spire flat, with twelve flat with continuous whorls.

Leveleatus. Shell flatulate, brown, with seven spiral impressed lines; the aperture is ovate.

Puncatus. Shell flatulate, yellowish-white, broad flat with red near the future; the shell grooved.

Virex. Shell flatulate, cincereus, transversely fliate; whorls nodulous, and marked with red streaks. It inhabits Coromandel; and a variety is found in the Friendly illands.

Auritus. Shell barred 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 maries of Africa, and is nearly two inches long.

Agnatus. Shell smooth; the lip very prominent, and marginate behind.

Dealatus. Shell with transversely, fliate, black whors; the outer ones smooth, and with the margin of the lip and pilar white.

Fuscus. The shell of this species is brown, with numerous tubercles on the whors; the lip is separated before and behind, within it is fliate with brown.

Marginatus. Shell brown; the lowest whorl is edged with white.

Lividus. Shell subangular, with spicous knots; the lip is separated on the fore-part.

Sereus. Shell convex, fliate, white, with a few fulous streaks; the pillar is fliate and inflected.

Sinuier. Whors turned contrary; the shell is thin, and longitudinally fliate. It has hitherto been found only in a folidate in Switzerland.

STROMENTO, Ital. in Medic, an instrument, plu. Stromantes, instruments, certain machines contrived to produce musical tones and intervals, in imitation of the fcale 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, ὁγματις, implying only an instrument, it is now underloid to be the instrument, par excellence, and all music performed on instruments is termed organical. For the three different kinds of instruments of which the tones are produced by wind, strings, and percussion, see instrument.

STROMLINGUS, in Ichtyology, 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 smalller.

STROMNESS, in Geography, a small town in the island of Pomona, and thire of Orkney and Shetland, Scotland, situate in the south-west part of the Mainland, poofling an excellent harbour. At the commencement of the last century this place was small, and much confined in its commerce, in conformance of an arbitrary a alleviate by the neighbouring royal borough of Kirkwall. This was at laft removed by a decree from the supreme court, and the subsequent confirmation of the house of lords. After that period, Stromness began to increase in size and importance, and is now a place of considerable trade and extent. The population return of 1811, computes the inhabitants of Stromness parfii to be 2297, and the houses 424. The inhabitants are trademen, shop-keepers, pilots, or shipmaters, and small proprietors of land. Here are a poft-office and grammar-school, with a flax-mill, tanery, and brewery; a market for cattle is also held here. The old church of Stromness being runious 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-quary, with appearances of lead and iron ore.—Carlile's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, vol. v.

STROMOE, one of the Faroe illands, in the Northern ocean, and the largest; being about 30 miles in length, and 10 in breadth. N. lat. 62° 16'. W. long. 7°.

STROMSOE, a town of Norway, in the province of Aggerhusa; 18 miles S.W. of Christiania. N. lat. 59° 44'. E. long. 10° 16'.—Alfo, a small illand in the North sea, near the coast of Lapland. N. lat. 69° 15'.

STROMSTADT, a town of Sweden, in Weft Gothland, on the coast of the North sea, celebrated for its shell-fifh. 32 miles N.N.W. of Uddevalla. N. lat. 58° 56'. E. long. 11° 4'.

STRONDERBACH, a river of the duchy of Berg, which runs into the Rhine at Mulheim.

STRONG, a river of Bavaria, which runs into the Semp, 2 miles E. of Mospur.

STRONG, a township of America, in the district of Maine and county of Somerset, situated on the Kennebeck, and containing 424 inhabitants.

STRONG, Land, in Agriculture, a term sometimes applied to heavy, stiff, tenacious lands, which are not easily managed when in the tillage state. Some think that strong or heavy lands should always be fallowed when intended for wheat-crops, 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 fort of tillage for all these different crops, and that the left 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 forts are likewise thought by many, not to be capable of being easily kept in order andameliorated by crops of the green kind, as the feeding them off on the ground poaches and tempers them to such a mortary state, as renders them bitter 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 process is the best and most ready means of reforing them. However, those who are friendly to the expensive, waitful, 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 forts of such crops, draining, and treading upon the proper times and leasons for managing them, every fort of difficulty and inconvenience will be at an end, and such objections to managin them in other ways be of little or no avail. See Fallowing.

STRONG PLACE and Pulp. See the Subtantices.

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 Drorheim; 42 miles S.S.E. of Drorheim.

STRONGILIO, a small illand in the Grecian Archipe-

1930;
lago; 6 miles S.W. of Paros. N. lat. 37°. E. long. 25° 10'.

STRONGNAS. See STRONGNAS.

STRONGOLI, a town of Naples, in Calabria, Italy, on the east coast of the Strait of Messina, containing four churches. This was anciently the city of the Bruttii, called "Petilia," and said to have been built by Philoctetes.

STRONGYLAN, in Ancient Geography, one of the Æolian islands. See STRONGOLI.

STRONGYLES, in Geography, a mountain on the N. side of the island of Candia; 8 miles W. of Candia.

STRONGYLUS, in Natural History, a genus of the class of Arachnida. 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, distal, pellucid membranes. There are only two species.

STRONGIAN, or STRONTIANITE, in Mineralogy, Stroutian carboufate of Haüy, a mineral composed of a peculiar earth combined with carbonic acid, so called from Strongian in Angleterre, where it was originally found in veins along with galena, heavy spar, and calcareous spar, in a rock of gneiss. Its colour is generally pale green and greenish-white, sometimes inclining to yellowish-white. It occurs massive and crystallized. The crystals are acicular with fixed faces, terminated by low fixed pyramids. The crystals are aggregated in diverging groups. The massive Strongian has a shining pearly lustre, and a fibrous and radiated structure. The crystal-fragments are long-grained and even, and present a flattening luster.

STROPHADES, in Ancient Geography, two islands of the Ionian sea, 450 fathoms from the coast of Peloponnesus, over against and west of Yparis, according to Strabo.

Here mythologists place the Harpies.

According to Klaproth, it contains only 0.6 water, and 69.5 of the earth. This mineral has been found also in Saxony, at Baunfels, and near Popayan in Peru.

Strongian is divided into four sub-species by Werner: foliated celestite, radiated celestite, fibrous celestite, and compact celestite. These are all combinations of strotian with sulphuric acid; this species has been called celestite, on account of its generally inclining to a blue colour. Foliated celestite, strontiane sulphate, Haüy, sometimes inclines to a redish-white and pale fleshy-red: it occurs massive and crystallized in irregular six-sided and eight-sided tables, and in rectangular four-sided tables. The crystals are rather small. The surface of the massive varieties is fractured, and the fame is the case with the lateral plates of the tables. The structure is foliated: it has a shining and pearly luster, and is transparent. It yields to the knife, but is harder than heavy spar: its specific gravity is 3.960. It contains from 54 to 57 per cent. of strotian, sulphuric acid, from 42 to 46, according to the analyses of Vauquelin and Klaproth. This mineral has been found in various situations, and particularly in the vicinity of Bristol. Radiated and fibrous celestite differ from the above in their structure merely. Compact celestite has a yellowish-white or yellowish-grey or brown colour, and sometimes an ochre-yellow.

It occurs in peloidal or kidney-shaped masses, imbedded in marly clay with gypseum, at Montmartre near Paris, and is said to form a whole bed in Champagne: its colour is derived from the oxide of iron. Its specific gravity is 3.592. It consists of:

- Sulphate of strotian - 91.42
- Carbonate of lime - 8.33
- Oxide of iron - 0.25

All the varieties of celestite 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 candid and acid savour, 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 fossil, called "Strontites." It is in the vicinity of lead-mines, and inhabited by miners. N. lat. 56° 40'. W. long. 5° 38'.

STROONGH, a rocky island in the strait of Sunda. S. lat. 57° 51'. E. long. 105° 50'.

STROOP, in a Ship. See STRAP.

STROPHADIS, in Ancient Geography, two islands of the Ionian sea, 450 fathoms from the coast of Peloponnesus, over against and west of Yparis, according to Strabo. Here mythologists place the Harpies.

STR-
STROPHE, in the Greek and Latin Poetry, a flanze, or crown of garlands or wreaths, including a perfect fene, succeeded by another, confiding of the fame number and meafure of verfe, and in the fame difposition and rhythmus, called antifrophe. 

What the couplet is in fongs, and the flanze in epic poetry, flrophe is in odes.

The word is Greek, στρόφη, from στρώς, I turn; because at the end of the flrophe, the fame meafures returned again; or rather, as the term related principally to the music or dancing, because, at first coming in, the chorus, or the dancers, turned to the left; and, that meafe ended, they turned back again to the right.

STROPHEA, among the Romans, a perfon who prefided and made the flrophe. See STROPHIUM.

STROPHIUM, in Botany and Vegetable Phyfology, a little curved appendage, as the name imports, to the fear or base of fome feeds. It is either of a fuguous, glandular, or callous nature, and may be found in Afarum, Gar. t. 14; but especially in feveral papilionaceus genera, as Ulos, Spartium, Buflers, and Platylebium. The elastic tunic of the feeds in Osadis has been mitfaken for a Strophiun by fome botanifts.

STROPHIUM, among the Romans, a fhort fwath or band, by which the young women kept down the fwellings 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, a town of Sileia, in the principality of Oels; 24 miles W.N.W. of Oels. N. lat. 51° 22′. E. long. 16° 49′.

STROPOPO, 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 fkeins.

STROTH, Fredefi ANDREW, in Biography, a German writer, was born at Tribleva, in Sveifh Pomerania, in the year 1753; and became firft rector of the fchool of Quefulinburg, and afterwards had the fame office in that of Gotba.
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 Helmstäd and Halle. He died, at an early age, in the year 1785. Among his works are enumerated the following: "Chrestomathia Latina, &c." Quedlin. 1775, 8vo.; "Chrestomathia Graece, &c." ibid. 1775, 8vo.; "Euclis H. E. lib. x. et, &c. Vit. Conflantini. lib. iv. &c." Hal. 1779, 8vo.; " Xenophontis Mem. Socr. Graec." Gotha, 1780, 8vo.; " T. Livii Oper. Pentas I., &c." Lipp. 1780; "Pentas II." Gotha, 1782, 8vo.; " Theocriss Iddilla Graec., &c." ibid. 1782, 4to.; " Egyptica, &c." pars i. Gotha, 1782, pars ii. ibid. 1781; 8vo. Gen. Bibl. 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 Bilsley, 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 persons engaged in that art. 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 Domeday survey, this manor appears to have been comprehended in the adjoining parish of Bilsley; it now belongs to Peter Wathen, esq. The church, which consists of a nave, chancel, and four aisles, with a tower and spire at the west end, has been erected and repaired at different periods. An endowed free-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 5251: the number of hovels to 1184. A weekly market is held on Fridays, and two fairs annually. John Cantor, an ingenious natural philosopher and mathematician of the last 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 Barbadoes; 4 miles N. of Speight's Town.

STROUDS, a town of America, in the road from Lexington in Kentucky to Virginia; 17 miles N.E. of Lexington.

STROUDSBURG, a town of Pennsylvania, in Wayne county; 80 miles N. of Philadelphia.

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 Vespasiano, 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 sustained 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 finish 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 so soon after the revival of literature.

STROZZI, Ercole, son of the former, who was occupied, like his father, in the magnificery of Ferrara, but excelled him in the province of literature. He is highly commended by Calugiini, 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 intimate friend of cardinal Bembo. Having married a lady, named Barbara Torella, to whom a person 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. Bibl.

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 republicans of Florence, he could not acquiesce in the arbitrary government of that house. After the death of pope Clement VII., when the sovereignty was posseted by duke Alexander de Medici, he joined the party who aimed at re-forming 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 property would be confiscated, and the honour of his two daughters endangered, Filippo promised, 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 resift the establishment of Cosimo, as Alexander's successor, Strozzi put himself at the head of a body of soldiers; 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 say, that he had once endured the torture with great firmness. A poinard having been negligently left in his apartment, he made use of it to write upon the mantle-piece the line from Virgil,

"Exoriate aliquis nostris ex officis ulterius!"

and then pierced his breast. In his testament, he charged his children to remove his bones from the place of their imprisonment at Florence to Venice, that, after his death, they might be deposited in a free country. He died in 1538. Strozzi posseted the highest dignities at Florence, without pride or ostentation; and so much was he attached to republicanism, that he was offended by being called "Usurer," 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 marshall of France, and was succeeded in the post by his son. Bayle. Gen. Bibl.

STRUCHIUM, in Botany, a name adopted by Browne, we cannot tell with what intention. See Etiulia, and SPARANNOPHORS.

STRUCTURE, in Architecture. See Building. Structure.
Structure of Minerals, in Mineralogy, is one of the most important external characters of minerals. Structure is deduced 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 stone in whatever fragments it may be broken. (Traité Élemantaire de Mineralogie.) The principal modifications of structure are, according to the French mineralogists, either lamina, lamellar, fibrous, radiated, or compact. Of these, the lamellar more properly belongs to rocks.

The lamellar structure consists of larger lamina, 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 lamina, differed 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 molybdenite.

The compact presents no distinguishable separation into parts, as in Jasper.

Mr. Aitkin defines structure "to be that division of a whole into smaller aggregates, which has been made by Nature according to general laws," and structure to be "the causal division of a whole into fragments." These characters have been improperly confounded by the Wernerian mineralogists, but are essentially different: the structure may vary according to the length of the stroke by which it is produced; the structure is an invariable character. The structure of minerals is either perfectly crystalline, imperfectly crystalline, or promiscuous. The crystalline 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 slight 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 rock-crystal 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 flowing 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 pearl spar; and sometimes occurs massive, as in curved lamellar heavy spar. The next deviation is where the lamina 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 lamina are rarely parallel, but generally crofs, 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 fuchiform; when diverging in opposite sides, fuculate; and when diverging on all sides, foliated.

In some cases, two distinct 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 distinct concretions, forming a mass, either by means of a small proportion of cement, or by a slight degree of mutual cohesion. It may consist of globular concretions, as in roe-stone and oolite, or of granular concretions, as in sand-stones. The granular concretions may be so small, as to be imperceptible without the aid of a lens. When no distinction 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 masses of which rocks are composed; the external structure may be foliated, schistose, tabular, lamellar, or globular. The internal structure denotes the mode of aggregation of the substances of which the larger masses are composed, and may be porphyritic, granitic, amygdaloidal, or conglomerated; see Rocks and Strata.

Structure of the Earth. See System.
the new college of finance, and the other in the department of war. Brandt, Berger the physician, and other confidential persons, remained confidentially 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 prince, and as she knew the nurseries, originating at Friedenbourg, that were circulated on this occasion, she was not unapproachable for them; they might serve as pretenses to wrest from her the power which she had acquired. She was unfortunately dependent on Struenfee, who, by the abuse of his power, 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 protection of the queen, if he had conducted himself with more moderation, he would have defeated the machinations of those who were meditating his ruin. His friends, probably foreseeing his fall, became cool and indifferent; and the people in general, while they despised his power, excused 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 dissatifaction and tumult that prevailed increased Struenfee'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, endeavoured to forestall his removal from power, and he himself wished for a release. 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 Struenfee could no longer resist or control the counsels and operations of those who were hastening his downfall. Notwithstanding the measures which he adopted for infusing his own personal safety, and which were interpreted by the people into a kind of avowal of his political misconduct, every thing went to the contrary, and he was abandoned by 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 Struenfee, 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 Köller, an inveterate enemy of Struenfee'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? Stand by me: give your advice."—"Sign this," replied Ranzau, "it will save my sovereign and the whole royal family." The king took hold of his pen, but let it drop as soon as he cast his eye...

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on the name of his comfort. At length he suffered himself to be perjured; and Ranza, supported by colonel Eich- fladt, whose dragoons surrounded the palace, and some other officers, carried out the fatal order; and, in a manner the most violent and brutal, feized the person of the unfortunate Matilda, and conveyed her in a carriage to the castle of Cronenburg. Struensee's arrest was followed by the appointment of a commission for his trial; and the proceedings against him were carried on with great zeal and severity. 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, flated 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, "Struensee had lived an avowed free-thinker. He was convinced, however, of the exilence 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 thousand 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 losing their effect, he soon fell into a state of the most violent anguish and despair. A visit, however, which he received from the celebrated Dr. Munter, (see his article,) a clergyman of Copenhagen, who went to see him in prison on the 1st 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 Christianty; listened to his doubts and objections, and answered them in the mildest yet most forcible manner; and at length gained so much on 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 disrepect personally thrown 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 resolved that Struensee should suffer an ignominious death, rejected all representations made in his favour, and on the 25th of April palled 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 sentence had in every point been confirmed by the king, and that the 28th was the day appointed for its being carried into execution. The unfortunate count heard this intelligence with the utmost composure; and declared, that in regard to the ignominious circumstances attending his doom, he was perfectly easy, as he believed in a future resurrection. He spent the intervening time in a manner becoming his situation, and suffered according to his sentence, along with his friend Brandt, who had also been condemned, amid an immense concourse of spectators." Gen. Biog.
This Halle, another pink Sloane Mart.
The ducky wing 3
189.
November.
Ornithology, Bowers name Willd. the Petals Jacq. 249.

1152.
and term he should a genus 4.


STRUMBLE's, in Geography, a cape of South Wales, on the N. coast of the county of Pembroke. N. lat. 52°. W. long. 5° 10'.

STRUMEBEL, a river of Carinthia, which runs into the Geil, 8 miles N. of Tarvis.

STRUMPFIA, in Botany, was so named by Jacquin, in memory of Christophor Charles Strumpf, professor of chemistry and botany at Halle, in the duchy of Magdeburg, who in 1752 published there the fourth edition of the Genera Plantarum of Linnaeus. His premature death is regretted by the author of the name.—Jacq. Amer. 218. Linn. Gen. 454.


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; anthers five, united into an ovate body, rather shorter than the corolla, marked with five furrows, and very slightly five-toothed at top and bottom. Pfi. Germen inferior, roundish; style awl-shaped, erect, projecting rather beyond the anthers; stigma simple, obtuse. Friz. Berry roundish, umbilicate, crowned with the calyx, of one cell. Seed foliary, roundish.

Éfli Ch. Calyx superior, with five teeth. Petals five. Anthers fusiform, combined. Berry crowned with the calyx. Seed foliary.


Wild. n. 1. (Thymelea trufectens, rofmanii folio, bore albo; Plum. 1e. 249. f. 251. T. humilior, folis acuti atroveinibus; Slaone Jam. v. 2. 93. t. 189. f. 12.)—Gathered by Jacquin in Curacao, on rocks near the sea, especially in the suburb called by the Dutch de klip. Slaone found his plant near the Palifades, 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 laid to be shrubby, erect, three feet high. The branches (in our specimens) are round, denely clothed with fine hoary down; and appearing as if jointed, from the frequent, strong scars, which mark the insertion of the leaves and stipulas, both which originate from one common annular protuberance. The flowers in flower three in a cluster, nearly sessile, and are lanceolate, entire, rather above an inch long, laid 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-flals axillary, half the length of the leaves, each bearing about five small flowers, on short partial flals. Petals white. Berry soft, white, the size of a small pea. The whole plant has a disagreeable, though not pungent, smell.

There cannot surely be much doubt of this genus belonging to the Campanulaceae, as that order stands in Juffius; but whether it should still remain there, or be transferred to Mr. Brown's Gentianaceae, may admit of a question; chiefly because of the berry and foliary feed. This learned author however seems 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 cucubalus, or berry-bearing chick weed. It had this name from its being found of service in febriceous and tertullous swellings, when externally applied. The name cucubalus seems to have been derived from the word haliococcus, or the winter-cherry, for the ancients esteemed both these plants species of nightshade; and some of them have plainly described the cucubalus under the name of folium b ornirste.

STRUNKED, in Geography, a town of Germany, in the county of Mark ; 2 miles N.W. of Caltrop.

STRUNTJAGGER, Ardeid Bird, or Larus paroicus in the Linnean sytem of Ornithology, is a species of gull found in the Hebrides and Orkneys, with a dukky hooked bill, and narrow nostrils. In the male, the crown of the head is black; the back, wings, and tail, dusky; the hind-part of the neck and lower side of the body white; the tail confines of twelve feathers; the legs are black, small, and incal; the female is entirely brown. See Larus.

These birds pursue the leller gulls till they mute for fear, and catch up their excrement, and therefore they are sometimes called dung-hunters, as also another species of the gull called martinusco.

STRUPPI, among the Romans, garlands or wreaths of vervain, with which the statues of the gods were crowned.

STRUSCHNETZ, in Geography, a town of Bohemia, in the circle of Königratz; 8 miles N. of Gitschin.

STRUT, a term used by some builders for that brace which is framed into the king-piece and the principal rafter.

STRUTHIA, in Ancient Geography, a town of Aia Minor, in Phrygia, on the confines of Lycaonia.

STRUTHIA, in Botany, a name originally given by Van Royen to the Gnidia of Linnaeus; and which being derived from gnyida, a sparrow, appears to have had in view the near affinity of this genus to Pafferea. See Gnidia and Passerina.

STRUTHIO, in Ornithology, a genus of birds of the order Gallinae. Bill subconic; nostrils oval; wings short, unit for flight, feet formed for running. There are four species.

Though the power of flying may be considered as the dislinguishing characteristic of the feathered tribes in general, yet there are some families to which Nature has denied that endowment, while she seems 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 divests to be confined within the narrow limits preferred by her by the fyltem of philosophers. In descending from the clafs of quadrupeds to contemplate the 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 invested with the power of flight, and with other
of the ostrich as a delicacy; and the imperial heath 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 Numidia 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 long feathers that compose the wings and the tail, is 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 vulgarized himself by some military achievement, is allowed to assume them as a decoration to his turban; and the sultan, in the fergalio, when meditating conquests and feats of a more gentle nature, puts them on, as the most irrefitable ornament of his person.

The spoils of the ostrich being thus valuable as articles of commerce, the hunting of that bird is one of the most zealous employments of the Arabs, who train their fleetest horses for the purpose. Although the ostrich be far fiercer than the bell coureur, 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 pushing 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 waving 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 ostrich hides its head, in the vain expectation that the whole body will then be concealed from its pursuers.

Ostriches, though inhabitants of the desert, and possessed of prodigious strength, are, effectually if taken young, neither so fierce nor difficult to tame as might be expected. The inhabitants of Dara and Lybia 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 asserted by Adamson, that at the factory of Podore, he had himself two ostriches, that ran 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 consumes with, bones, wood, braze, iron, or leather, as readily as it will grain and fruit, which, in its native wilds, are probably its principal food.
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 during the month of July, while those south of Africa defer 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 need 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 she very early incurred the reproach of being destitute of parental affection. So far, however, is this from being true, that the continually watches for their preservation, 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.

Castrachus : Caffowary. Feet three-toed; helmet and dew-claws naked. This bird inhabits the torrid zones, and especially the island of Java, whence it was brought into Europe in the year 1597. Its habitation begins in those temperate climates which are contiguous to the precincts 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. Caffowarys 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 so 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-lid 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 here and there intermixed with blackish hairs, that partially cover a blue wrinkled skin. The feathers that cover the body of the caffowary, as well as those for flight, are all of one kind, and of the same blackish colour. They are generally double, having two fillets, that grow from one short trunk, which is fixed in the skin. The small fillets of which the vanes are composed, have no other adhesion to each other, than the bird, when viewed at a distance, seems clothed with hair instead of feathers. The wings of the caffowary are still shorter than those of the ostrich, and consequently still more unfit for flying. They are furnished each with four hard pointed feathers, resembling dart, of which the longest, 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 holiness. But though furnished with weapons that might render it formidable to the rest of the animal world, the caffowary leads a peaceful and innocent life. It gives no more attacks with these, and nothing short of necessity will make it defend itself. The movements of the caffowary, when travelling, are awkward and heavy, nevertheless it will, in running, outstrip the fleetest horse. It is distinguished by the fame voracity which characterizes the ostrich, swallowing every thing that is offered to it, unless it be too large for the circumference of its throat; and it possesses the faculty of rejecting its food, wholly digestible, with the same dexterity with which it took it. The female lays a number of all-coloured eggs, about thirteen inches in circumference one way, and six the other; they are of a greenish colour, with dark green spots.

Novemberia : New Holland Caffowary. Feet three-toed; crown flat; thanks ferrate 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 briefly feathers, varied with brown and grey; throat rather naked, blueish; feathers of the body a little incurved at the tip; wings feebly visable; legs brown.

Rhea : American Ostrich. Feet three-toed, and a round callus behind. This bird is to nearly allied to the ostrich, already described, that it has been considered as his 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 their habitations, or became the victims to superior power. It is by far the largest bird in the new world. The adults are full fix feet high, and the thighs of some of them have been known to equal that of a muscular man. It has a long neck, small head, and flat beak, that distinguishes the black ostrich; but in other respects it has a greater resemblance to the caffowary. The shape of the body is oval; and when fully covered with feathers, approaches to roundness. Its wings are so short as to be useless for flight, but, like those of the ostrich, probably afford affluence 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 cal\-lous kind of heel, which supports the bird, and is supposed to assist it in running. It possesses the same velocity which characterizes 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 hold it, for a while, in the same strange position. Such is their velocity, that the fowages are obliged to fly snares in order to catch them; for they may, in vain, chase them with the swiftest dogs.

The rhea shows the fame indiscriminate voraciouness with the offrich; 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 furtive. The flesh of the young rhea is reckoned good eating, 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 howl, unlike any other.

Gen. Ch. Cal. Perianth inferior, of one leaf, tubular, fading; tube very narrow, elongated; border flat, shorter than the tube, cloven into four ovate segments. Cor. Pedals none. Nectary of eight, more or less ovate, glands, situated at the mouth of the calyx. Stem. Filamentous four, very short, generally concealed in the tube; anthers linear. Pfy. German inferior, ovate, style thread-shaped, the length of the tube; stigma capitate. Peris. Berry coriaceous, dry, ovate. Seed solitary, pointed, or rather beaked.


1. S. juniperina. Juniper-leaved Struthiola. Ait. n. 1. (S. ericiflora; Curt. Mag. t. 222.)—Leaves linear, smooth. Anthers concealed.—Native of the Cape of Good Hope, as indeed are all the species. It flowers almost throughout the year.—A common shrub in our green-houses, whose stem rises to the height of four or five feet, and is perfectly smooth. Branches erect, but when loaded with blossoms they droop considerably; whence the specific name ericiflora, originally given by Linneus, has been judiciously changed.


3. S. imbricata. Tiled-leaved Struthiola. Ait. n. 3. Andr. Repof. t. 115.—Leaves ovato-lanceolate, somewhat fringed. Nectary of four glands. It flowers in the spring and autumn. This is also a tender green-house plant. Stem ericiflora, much branched. Leaves very close imbricated, especially on the branches, dark-green. Flowers axillary, white, tipped with yellow.

4. S. tomentosa. Downy-leaved Struthiola. Ait. n. 4. Andr. Repof. t. 334.—Leaves ovate, downy. Nectary of twelve glands. It flowers in August and September.—In habit this resembles the two preceding ones. Stem ericiflora, wavy, glaucous and downy, as is the whole herb. Leaves ovate, fringed, felthy, callous. Flowers axillary, on the branches, golden-coloured.

5. S. virgata. Twiggy Struthiola. Aiton. n. 5. (S. ciliata et var.; Andr. Repof. t. 139 and 149.)—Leaves lanceolate, fringed. Bractea the length of the gernen.—It flowers from May to August.—Stem upright, much branched. Leaves opposite, narrow, dark-green. Flowers axillary, white, fragrant. A variety of this, which is also figured by Andrews, has red flowers, and is not so fragrant.


STRUTHIOMELA, a word used by Pliny and the ancients to express a sort of quinces, which were smaller than the common kind, and of a sweeter juice, and less aromatic.

STRUTHIOPTERI, in Natural History, a name given to a series of flies, of the clafs 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. There are all early flies, being found in the spring in hedges and bushes.

STRUTHIOPTERIS, in Botany, was so called from Struthium, in its second fentic, on qyrie, and Tepis, a fern. Its large and elegant fronds are not unworthy to be compared to the noble plumes of that bird. See Onoclea.

STRUTHIUM, in Natural History, a name given by the Greeks to a plant called by the Latins lamaria herba, from its use in the manufacture of their wool. Many have supposed the chafeuca of the ancients to be the same with this plant, but this is an error, for the chafeuca of the Greeks is the anthericum of the Latins, as is plain from Pliny; and the same author tells us, that it has leaves like thofe of flax, small, narrow, and smooth. All the accounts we have of the struthium is from Dioscorides, who says that it was a kind of thistle, somewhat resembling the eclymus, and having a large root, long, and of the thickness of two or three fingers, and very sharp 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 chafeuca, or anthericum.

We find the struthium 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 sufficient to convince us of the great error of those who make this plant the olibrum of the later writers to be the same plant. The olibrum is the Smyrnium, or Alexanders, and can by no means be supposed the same with this prickly plant; yet Mader has made them the fame, and has attributed to the Smyrnium, or Alexanders, the virtues which Theophrastus gives to the struthium.

STRUTHIUM, in the Materia Medica, is used by the modern authors as the name of the lutolus, or dyer's-weed, a common wild plant with narrow leaves and yellow flowers.

STRUTHIUM is also used by some for the saponaria, 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 1749, 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 collumes, taken from illuminated MSS., and accompanied 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.
STRUVIUS, George Adam, in Biography, an eminent German jurist, was born at Magdeburg in 1619, and having studied at the universities of Jena and Hildesheim, was, in 1645, appointed a shelor of the juridical court at Hall. In 1646 he took the degree of LL.D. at Hildesheim, and obtained a professorship of law at Jena; and after having occupied considerable posts of legal and political distinction at Brunswick, Weimar, and Halle-Darmstadt, he terminated a laborious life in 1682, much esteemed for his learning, sagacity, and probity. Having been twice married, he was the father of twenty-six children. He was the host of several treatises on legal topics, besides theses and dissertations. Moreci.

STUBAIA, in Ancient Geography, one of the Sporades. STYCHNOS, in Botany, an ancient name, which occurs in Pliny and Dioscorides, derived from στυχηνα, to over-throw. This appellation was doubtless suggested by the overpowering narcotic qualities of the plant to which it was applied; 2ηρημη, of the Greeks being a kind of nightshade.


Gen. Ch. Cal. Perianth inferior, five-cleft, very small, deciduous. Cor. of one petal; tube cylindrical; border five-cleft, spreading, acute. Stem. Filaments five, the length of the corolla; anthers simple. Pf. German superior, roundish; style simple, longer than the stamens; stigma thickish. Peric. Berry with a brittle, though woody, rind, globular, smooth, very large, of one cell, full of pulp. Seeds orbicular, depressed, villous, the hairs spreading towards the circumference.

El. Ch. Corolla five-cleft. Berry of one cell, with a woody rind.


The seeds of this species, well known in our shops as a poison for vermin, by the name of Nux vomica, are a very potent narcotic, being extremely bitter, and almost fetentie. 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 "fater 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 inverting fevers, and the bites of venomous snakes, when that of Naga-mufadie or Lignum colubrinum cannot be obtained.

2. S. colubrina. Snake-poison Nut. Linn. Sp. Pl. 271. (Lignum colubrinum ; Rumph. Amboin. v. 2. 121. t. 37.) —Leaves ovate, acute. Teudrils simple.—Native also of the East Indies.—From the character given of this species, it may probably be what the Telingas call Naga-mufadie. Indian botanists consider this as a variety of the Nux vomica. The leaves are opposite, on short stalks, obtuse, lanceolate, three-nerved. Many different sorts of wood are sent to Europe under the name of Lignum colubrinum.

3. S. potatorum. Clearing-nut. Linn. Suppl. 148. Roxb. Coromandel. v. 1. 9. t. 5.—Leaves opposite, ovate, acute; mostly five-nerved, wined. Cymes 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 flanks. 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 white, 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.

STRYCKIUS, in the Materia Medica. See Nux Vomica and Lignum Cohlurinum. The Faba Staphis, allied to these, constitutes the new genus Staphis, which see.

STRYCHNUS, a name given by the ancients to the plant we call Strychnum, or nightshade. (See Solanum.) Some of the old authors have also called this thymbra; and in the times of Theophrastus we find that tirymal and nightshade were synonymous terms. See ManicuM Strychnum and Stramonium.

STRYCKIUS, Samuel, in Biography, a German jurist, was born in 1640, at Lunez, in the marquisate of Brandenburg, studied at Wittenberg, and after travelling in England and the Low Countries, became professor of jurisprudence at Frankfort-on-the-Oder. Having established his reputation by his writings, he was appointed president of the court of justice, and electoral counsellor. Stryckius occupied several offices of trust and honour, and died in 1770, leaving behind him several volumes of learned dissertations on legal subjects, which were much esteemed.

John Samuel, son of the preceding, was professor of law in the university of Hall, of which his father had been director, and acquired reputation by his lectures and publications. Moren.

STRYE, in Geography, a town of Austrian Poland, in Galicia; 5 miles W. of Halicz.

STRYEN, a town of Brabant; 5 miles S. of Gertrudeburg.—Alfo, a town in the island of Beyerland; 8 miles from Dort.

STRYKE. See Strike.

STRYMA, or Stryne, in Ancient Geography, a commercial town of Thrace, situated near the Litus. It was separated by the lake Iamark from Maroneas.

STRYMALAGA, a town of India, on this side of the Ganges, in the number of those which were situated between the river Ryunda and the Pseudeuloton, according to Ptolemy.

STRYMON, a river which has its source in mount Hæmus, and which formed a boundary between Macedonia and Thrace, before the conquest of the Macedonians had extended the kingdom on this side. At its mouth was the gulf called Strymonius Sinus.

STRYNKELY, in Geography, a small island of Denmark, in the Baltic, between Aroë and Langeland. N. lat. 54° 54'. E. long. 10° 39'.

STRYNOE, a small island of Denmark, in the Baltic, about 2 miles from the W. coast of Langeland. N. lat. 54° 54'. E. long. 10° 28'.

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 Jesus 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-Bois, in Essex, and being afterwards appointed minister of Low Layton, in the same county, he retained this office during the whole of his life. Having access to the numerous MSS. of Sir Mich. Hickes, feer tary to lord Burleigh, he availed himself of them in his subsequent writings on historical antiquities, to which, probably in consequence of this circumstance, he became zealously attched. His first publication in this department of literature was entitled "Ecclesiatical Memorials, relating chiefly to Religion, and the Reformation of it under Henry VIII., Edward VI., and Queen Mary I.," in 3 vols. folio, with an appendix to each volume, consisting of original papers, records, &c. The last of these volumes, which were printed in fuccession, appeared in 1721. 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 last volume being merely a collection of original papers. His much augmented edition of "Stow's Survey of London" in 2 vols. fol. was published in 1720. The historical part of this 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, infolio 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 industry and correctness, which claimed the respect of prelates and learned perions of his own time, and procured for him several small benefices in the church, though he was never advanced to any very high rank. He was for many years lecturer of Hackney, where he spent the latter part of a life, prolonged, notwithstanding his unintermittent course of study, to the uncommon age of 94. His death happened in December 1727. Of his works Dr. Birkes observes, that "his industry and fidelity will always give a value to his numerous writings, however defective of the graces, and even uniformity, of style, and the art of connecting facts."—Biog. Brit.

STRZESZYN, in Geography, a town of Lithuania, in the palatinate of Minf; 18 miles S. of Rohaczow.

STRZLCZE. See Sreblitz.

STRZOW, a town of Austrian Poland, in Galicia; 80 miles W. of Lemberg.

STUART, James, in Biography, commonly called Athenian Stuart, rose from an obscure origin, by his talents and industry, to distinguished eminence. His father was a native of Scotland, and a mariner of humble faction, and his mother a native of Wales. Their son was born in London in 1713; and his parents, though poor, yet respectable in character, gave him the best education which their limited means would allow. Being one of four children, left destitute at their father's death, he was employed, at an early age, in drawing and painting, and contributed to the support of his mother and family, by his ingenuity in designing and painting fans for a shop in the Strand. By his own perverifying but unaided efforts, he gained an accurate knowledge of anatomy, geometry, and the other branches of mathematics. He also studied the Latin and Greek languages; and made himself acquainted with many of the sciences. The fortitude of his mind was no less signal than its other qualities; for he submitted to the excision of a wen upon his forehead, which was grown to an inconvenient size; although he was previously informed that the operation would be both painful and hazardous; and his singular courage was rewarded with success. Urged by a strong desire to seek knowledge and improvement in foreign countries, he first settled a brother and sister in a situation, which would afford them a comfortable subsistence, and then, with a very scanty stock of money, set out on a peregrination tour to Rome. In passing through Holland and France, he occasionally stopped in order to recruit his exhausted purse by the exercize of his talents. Having arrived at Rome, he formed an intimate acquaintance with Mr. Nicholas Revett, a skilful architect. These two friends studied together for several years, and in 1748 concerted a plan for visiting Athens; and having obtained requisite encouragement, they quitted Rome in 1750, and first visited...
visited Venice; and hence they took their course to Pola, in Iltria; and when they had examined the inestimable remains of antiquity in this place, they returned to Venice. In the beginning of the year 1751 they failed for Zant, and thence to Corinth, 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 Mr. Jacob Bouvieric and Mr. Dawkins; and the latter, in particular, took pleasure in offering him and his companion patronage and encouragement. From Athens the two artists went to Salamis, where they copied the remains of a fine Corinthian colonnade. Having visited several islands in the Ægean sea, on their way to Smyrna, they returned to England in the beginning of the year 1755. 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, R.S.S. and S.A. and Nicholas Revett, Painters and Architect," &c. 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 Greenwich Hospital, which he occupied till his death. He was twice married: the second 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, added to his misfortunes, 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 1792, by Mr. Newton; and the third, in 1794, by Mr. Revely. Gen. Brog.

STUART, Gilbert, L.L.D. the son of a professor in the university of Edinburgh, where he was born either in 1745, or in 1748; the date of his birth being uncertain. He was originally intended for the profession of the law; but having acquired a reputation, and the degree of L.L.D. by an Historical Dissertation concerning the Antiquity of Scotland, and who handled, 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 1792, by Mr. Newton; and the third, in 1794, by Mr. Revely. Gen. Brog.

STUARTIA, in Botany. received that name from Linneus, at the suggestion, as it appears, of Dr. Isaac Lawfon, in honour of the famous John Stuart, first earl and then marquis of Bute, who, by his deep and extensive knowledge of this science, and his unbounded devotion to it, merits in no common degree to be the patron of its study and improvement. His name, thus conferred, will doubtless remain, when others innumerable, unworthy so distinguished, will justly be swept away. Still we cannot connive at the ridiculous supererogation of Koenig, who, ignorant perhaps of the application of Stuartia, established a Butea. See our article Plasae, 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, Linneus and some others have written the above name Staurtia; but we restore the true, and universally well-known orthography.—Linn. Gen. 356. Schreb. 470. Willd. Sp. Pl. v. 3. 830. Mart. Mill. Diff. v. 4. Art. Hort. Kew. v. 4. 233. Sm. Exot. Bot. v. 2. 107. Parth. 45. Julfr. 296. Cavan. Diff. 305. Lamarec Illutr. t. 593. (Malahachdronel; Mitchell Ephem. Nat. Cur. v. 3. 216. Cavan. Diff. 302. Schreb. 470. Jull. 275. Lamarec Illutr. t. 593.)—Clas and order, Monadelphia Polyandria. Nat. Ord. Columnifera, Linn. Malacca, Jull.

Gen. Ch. Cal. Perianth inferior, of one leaf, in five deep, ovate, concave, permanent segments. Cor. Petals 3D; five,
STUARTIA.

five, ovate, concave, spreading, equal, large. Stam. Filaments numerous, thread-shaped, shorter than the corolla, 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. Petals superior, roundish, hairy; styles five, cohering or separate, thread-shaped, the length of the filaments; 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. Malac颁donendron. Common Stuartia. Linn. Sp. Pl. 932. Willd. n. 1. Ait. n. 1. L'Herit. Stirp. 155. t. 73. (Stewartia; Malac. Ups. ann. 1741. 79. t. 2. Duham. Arb. v. 2. 283. t. 78. S. virginica; Cavan. Diff. n. 438. t. 159. f. 1. Pursh n. 1. S. marilandica; Andr. Repft. 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 Catesby in England in 1742, but now very rarely seen. It flowered at the marquis of Blundford's in 1834. The stem is thorny, from five to seven feet high, bushy, 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 ribs 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 bracteae 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. Willd. n. 2. Ait. n. 2. Exot. Bot. t. 110. Pursh n. 2. "J. Mill. Ic. t. 3?" (Malachondendron 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. Purjph. 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. Malachondendron. 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 lant. Leaves deciduous, ovate, acute, variously serrated; smooth above; downy and paler beneath. Footstalks channelled, bordered, often reddish. 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 crenate. Calyx in five, very deep, ovato-lanceolate, hairy five-lobed. Styles five, rather distinct throughout, a little spreading, smooth. Stigmas recurved, glandular.

Nothing can be more evident than that these two plants may constitute one natural genus. Indeed their several varieties so nearly approach each other, that the greatest pratical botanists have been in the habit of confounding them as one species. Cavanilles 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 Linnaeus, the late Mr. Davall, or we ourselves at different times, have acquired from various English collections, is the pentagona. A single specimen of S. Malachondendron from Clayton lies in the old Linnean herbarium. This has the stigmas firmly united, so as to be, in appearance, briefly monogyous. Linnaeus, not advertising to that circumstance, took the plant for Mitchell's Malachondendron, 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 Stuartia, or malachondron (S. malachondron). It is an elegant shrub, which was introduced here into garden cultivation from Virginia, in the above country.

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 sown, 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 glass, giving the seeds occasional waterings immediately after being sown, 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 kept and kept under a garden-frame, or in a greenhouse, 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 expeditiously than where that is not the case; proper waterings and suitable occasionall 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 most part by slit laying; and in the ensuing spring and summer, in dry times, frequent waterings should be given; and when screened by means of moderate shade, the best of the former 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
TOWN

The generally wooded, STUBBLE, taking feedlings is insufficient for fuel, and the felled and open timber is in great demand for fuel. To remove the felled trees, it is usual to fell them in the spring when the timber is green. The felled timber is then cut into suitable lengths and left on the ground, where it will be relatively easy to harvest later in the year.

The cutting method, the cutting of the young shoots should be done in pot to pot, and in the spring when the shoots are fully formed, and become proper plants, which are in sufficient time to be harvested. They are afterwards to be managed in the same manner as the feedlings and the layers.

This is a hardy plant, except in the early feeding stage, when it is a little tender, and in need of shelter and protection from cold, frosty, winter feedlings, as has been seen, until it becomes strong and inured to the open air, when it will stand constantly in the open shrubbery quarters without inconvenience.

It affords variety among shrubbery plants, and in collections of the green-house and conservatory kinds.

STUBB, 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, etc.

STUB, in the Mange, is used for a splinter of fresh-cut underwood, 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 flukes more or less into the foot.

STUB-WOOD, in Rural Economy, the name of such wood as grows in hedges-rows, and does not properly come under the names of timber, pollards, or thorns, or the young wood that is cut from stumps or stumps. 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, flake, flaggwood, or other ware; 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 the feedings are to be cut out for timber stumps, or the young shoots from the stumps 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 ware as are most valuable 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 stems clean and smooth, with upward strokes of the axe, that the stumps may shoot with the greatest certainty; and to cut them off as low as conveniences will allow, in order that the shoots may be few and vigorous in their growth.

STUBBIE-KIJOBING, in Geography, a town of Denmark, in the island of Fælled; 10 miles N. E. of Nyckiobing.

STUBBEN, a small island on the east side of the gulf of Bothnia, N. lat. 63° 31', E. long. 22° 2'.

STUBBING, in Agriculture, a term applied to the grubbing up any port of stumps or root, either in woods, hedges, or other places.

STUBBLE, the dry matter of the cut stalks or stems 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 tharch 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 England, where the wheat stubbles are weedy, they are set fire to in a dry time, and burnt, which is laid 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 are not only hand-hoed well, but dew-raked and burnt the weeds. Some work such as the stubbles well with a nudge and harrows, by which the weeds are made to rise, and be destroyed by the seed-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 their crop 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 crops. 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 most valuable, and of great utility in the above and other views. See TURNIP.

STUBBLE BROAD-PLOUGH, a term applied to that sort of ploughing plough, or paring tool of the spade kind, which is used in some districts in taking off the stubble surface of lands, in the state of tillage.

STUBBLE BROAD-PLOUGHING, a name applied to the unusual and extraordinary practice of paring or sowing off the surface of lands, in the state of stubble, in some cafes and districts, as Oxfordshire, for the purpose of cleaning them from cough and other weeds, as well as perhaps for some others. The operation is done as in ward land, which 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 affected, and which may be fulfilled to the best; 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 cheaper manner, by using a horse-plough properly contrived and constructed for the purpose.

STUBBLE-RAKE, 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-HORSE-RAKE, the name of a rake for collecting the stubble together with, which is contrived with wheels, shafts, and a head set with strong iron teeth, for being employed by means of a horse. It is a very useful and expedients tool for this purpose. See RAKE.
STUBBS, George, in Biography, an eminent painter of animals, was born at Liverpool in 1734. 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 back grounds. His long life was most laboriously and usefully employed. In 1766 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; 8 miles N. of Cremsitz.

STUBEN, a town of the county of Plundenz; 12 miles E. of Plundenz.

STUBENBERG, a town of the duchy of Stiria; 9 miles W. of Hardeberg.

STUBENDORF, a town of Silefia, in the principality of Neill; 3 miles W.S.W. of Ottmucuh.

STUBGEN, in Commerce, a liquid measure in many parts of Germany. At Bremen, 45 flubgens answer to 38 English gallons. A tonne of beer contains 48 flubgens, or 192 quarts. At Hamburg, the ahm is = 40 flubgens; and as the ahm contains 166½ Hamburg cubic inches, or 7300 French ditto, or 8836 English ditto, which are 53½ English gallons, 24 flubgens are = 23 English gallons. An oxhoft (= 57½ English gallons) of Bourdeaux or claret wine is reckoned at from 62 to 64 flubgens; and a pipe of Spanish wine at from 96 to 100 flubgens. A tonne of beer contains 48 flubgens, and a small ditto 32 flubgens. A quartel of train-oil contains 2 tonnes, or 64 flubgens, and is reckoned at 2 cents, or 224 lbs., net weight. See Tab. XXXII. under Measures.

STUBIG, in Geography, a town of Bavaria, in the bishopric of Bamberg; 10 miles N.E. of Bamberg.

STUBLANG, a town of Bavaria, in the bishopric of Bamberg; 13 miles N.E. of Bamberg.

STUC, or Stucco, in Building, a composition of white marble pulverized, and mixed with plaster or lime; the whole sifted and wrought up with water; to be used like common plaster.

This is what Pliny means by marmorum opus, and albarium opus. See Mason, &c.

Of this are made statues, bulls, buffo relieves, and other ornaments of architecture. See Statue.

A stucco for walls, &c. may be formed of the grout or putty, made of good bone-lime, or the lime of cockle-shells; which is better, properly tempered and sufficiently bent, mixed with sharp grit-fand, in a proportion which depends on the strength of the lime: drift-fand is best for this purpose, and it will derive advantage from being dried on an iron plate or kiln, to 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, in such a manner as not to be workmen term it: reduced again to a feft putty, or palle, and spread thin on the walls without any under-coat, and well trowelled. 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 trowelling it down. If this stucco, 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 stucco is liable.

Liardet's, or, as it is commonly called, Adam's oil-cement, or stucco, is prepared in the following manner: For the first coat, take twenty-one pounds of fine whitening, or oyster-shells, or any other sea-shells calcined, or plaster of Paris, or any calcareous material calcined and pounded, or any absorbent material whatever, proper for the purpose; add white or red lead at pleasure, deducing from the other absorbent materials in proportion 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 whitening, 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 solids, according to the nature of the work, or the uses 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 bell linseed or hempseed, or other oils proper for the purpose, are to be used, boiled or raw, with drying ingredients; as the nature of the work, the require the oil be; or, the climate requires, and in fine cases, beeswax may be substituted in place of oil: all the absorbent and solid materials must be kiln-dried. If 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 substituted 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-float.) 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 tough stuff that does not stain. 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 fort 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 stucco work. It also admits of being painted upon, and adorned with landscape, or ornamental, or figure-painting, as well as plain painting. For the invention of this stucco, 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. Shaw informs us in his Travels (p. 286.), that the cement or mortar used in Barbary, which is apparently of the same confinfence 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, ciphers, 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 assume the hardness of stone, and suffer no water to pervade them; and will, therefore, answer the purpose of flueco.

For other compositions of a like kind, see Mortar, Mortar for Sun-dials, &c. and Plastering. See also Economical Painting.

STUCIA, in Ancient Geography, a river of Britain, which Mr. Horley thinks was the mouth of the river Dovic; but both Baxter and Camden imagine it to be Aberlith, or the mouth of the river Ytwith in Cardiganshire.

STUCK, in Sail-making, a term used for being fitched.

STUCKAW, or ZUKAW, in Geography, a town of Prufias in Pomerelia; 16 miles S.S.W. of Dantiz.

STUCKIUS, JOHN-WILLIAM, in Biography, a learned divine and philologist, was born in 1542 at the convent of Toffen, 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 Peripius of the Euxine and Erythrean Seas," and "Anti-quizatum Convivialum, Lib. IV, in quibus Hebreorum, Graecorum, Romanorum, aliarunque Nationum antiqua Conviviorum genera et mores explicantur," fol. Tigur. 1591. Moreri.

STUD, in Rural Economy, the name of the place where Stallions and mares are kept to propagate, &c. It further signifies the stallions and breeding mares themselves; also the horses 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 sails, where they appear as wings on the yard-arms; hence some have called them geo-f-auncs. The origin of the name has been variously assigned: some have derived fludding from feucl, because the small sails used in scudding are nearly of the same size and figure with the lower fludding-sails; others have sought its etymology in *fledge*, because these sails feel the effort of a breeze, and serve to push the ship forward, and to give her head-way; so that, she becomes susceptible of the power of the helm, and is retained in a fledge couse; whence *fledging* - sails, afterwards corrupted into *fludding* - sails. Others again derive fludding from the Saxon *feol*, to off, whence those sails which spung on the ship's course are called *fledding*, *fledging*, or *fludding* - sails. The top-mast fludding-sails, or those which are set on the outside of the top - sails, are spread below by a boom, which皮肤 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 - sail - yard - arms. The lower fludding - sails, which are spread beyond the skirts or leech of the main - sail and fore - sail, 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 goos - neck; or else swings off along with the sail to which it is suspended; being kept steady behind by a rope called the guy. Falconer.

In the navy lately, an additional fore - top - gallant fludding - sail is to be allowed; and an addition of seven cloths is to be made to one of the fore - fludding - sails, and of two cloths to one of the fore - top - mast fludding - sails; a small yard is to be flued 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 sail one - third from the tack.

STUDDING-Sail-Yards. (See Booms.) In the navy lately, the heels of fludding - 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 S.W. of Iglau.

STUDENTITZ, a village and convent of noble Dominicans of Germany, in the duchy of Stiria; 8 miles S.S.E. of Windisch Gratz.

STULAND BAY, a bay of the English Channel, a little S. of Pool harbour; deriving its name from a village called "Studland;" 6 miles S. of Pool. N. lat. 50° 37'. W. long. 1° 58'.

STUFEN, a town of Switzerland, in the canton of Zurich; 9 miles S.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, broacades, mohair, fatinns, taffeties, cloths, ferges, &c.

STUFF is particularly used for certain kinds of flight woollen stuffs, used principally for linings, and women's wear; as linseys, ratzeens, &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 mafs, used to linear or daub the mafs, fides, or bottom of a ship. That which is chiefly used for the lower mafs is simply turpentine, rosin, or varnish of pine: for the top - mafs, tallow or butter: for the fides, turpentine, varnish of pine, tar, and oil, or tar mixed with oil and red - ocre: and for the bottom, a mixture of tallow, sulphur, and rosin or tar, whale - oil and broken glafs; or any part of these ingredients; and this operation is called giving a new coat of stuff to the mafs, fides, &c. Falconer. See PAY and SHIP.

STUFF, in Canals, is used for the earth or soil in which they are dug.

STUFFING. See CONGESTION.

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 infurces of surfacedrainage. See SURFACE-Drain.

STUGEN, in Geography, a town of Sweden, in the province of Jamtland; 25 miles E. of Olofupund.

STUHLINGEN, the capital of a landgrave in Germany, belonging to the Furdlenberg family; 22 miles N. of Zurich. N. lat. 47° 48'. E. long. 8° 26'.

STUHL-WEISSENBURG, or Szekes Fehervar, a royal free town of Hungary, and seat of a bishop, situated on marly
STU

Urby ground, occasioned by the river Sarwitz. From this
town run three large caucways or moles, among which
are churches, houses, gardens, and meadows, so that the
inhabitants of these suburbs are more numerous than those of the
town. This was formerly the place where the kings
were crowned, and generally interred; but at present its
bell houses are in ruins, and the town is very much decayed.
The number of inhabitants is about 11,000; 84 miles S.E.
of Vienna. N. lat. 47° 17', E. long. 17° 50'.

STUHR, a river of Germany, which runs into the Ochte, 4 miles N. of Delmenhorst.

STUKEY, William, in Biography, a physician of
eminence, and a distinguishted antiquary, descended 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 of Benet
college, Cambridge, in 1703; and while an under-graduate,
evoked a strong propensity to drawing, and to the study of
antiquities. Being intended for the medical profession, how-
ever, his principal attention was directed to botany, and the
other collateral studies, which he could pursue at the univer-
sity, 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 settled as a physician at
Boston, 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 1719, and in the following year
admitted a fellow of the College of Physicians in Lon-
don. At this time he published his first antiquarian essay,
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
Gullonian lectures, he chose the structure and history of the
spleen for his subject, and in the following year he pub-
lished the substance of his lectures, in one volume, folio,
with plates, under the title of "The Spleen, its Description,
Utes, and Diætes;" to which he also subjoined, "Some
anatomical Observations, made in the Difsection
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 Vefalius,
and contained several errors. Conceiving that there were
some remains of the Eleusinian mystery and among the secrets
of free-masonry, he became a member of that fraternity,
and was constituted master of a lodge. To this society he
presented an account of a Roman amphitheatre at Dor-
caster. His propensity to the investigation of antiquities,
indeed, continued to influence his pursuits: and being
greatly affected with the gout, which generally attacked
him during the winter months, he was accustomed to take
various journeys 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 those places, where the indications of the progres
of Caesar's expedition in this island 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 Curiositatum," and a second volume,
containing his description of the Brit, or Caesar's camp at
Pancras, in 1725.

In the following year, 1726, Dr. Stukeley quitted
London, and settled at Grantham, where he speedily ac-
nquired an extensive reputation, and was consulted 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 still harassed him, became at length
too great for his strength, and he determined to enter the
town. He was ordained at Croydon, in 1720, by arch-
bishop Wake; and in the same year was presented, by lord
chancellor King, to the living of All-Saints in Stamford.
About the time of his entering on his parochial cure, in
1726, Dr. Rogers of that place had just invented his "annum
arbitrium," which Dr. Stukeley was induced to try, and
having experienced great relief from its use, both in his
own person and in others, he was induced to publish an
account of its effects, in a letter to Sir Hans Sloane, in
1733; and in the year following, he printed "A Treatise
on the Cauze and Cure of Gout, from a new Rationale.
Beside some tracts of minor importance relative to anti-
quities, he published, in 1736, the first number of his "Pa-
lographia Sacra; or Discourses 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 sacred 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
scripture history; and from this time his publications were
very numerous.

In 1737 he lost 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 same county;
and into these works he incorporated a great part of a
"History of the ancient Celts, particularly the first Inha-
bbitants of Great Britain," which he had announced as a
separate work. In his "History of Carmonia," in two
volumes 4to, published in 1757 and 1759, he has display-
ed much erudition and ingenuity in setting the principal
events of that emperor's government in Britain. He pub-
lished, besides, many interesting and valuable tracts, espe-
cially three numbers of "Palæographia Britannica," some papers
respecting earthquakes, &c.; but the last labours of his
life were dedicated to the completion of an elaborate work
on ancient British coins, particularly those of Gotobellum,
by which he facilitated 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 prebend in the country, and
accept the rectory of St. George's, Queen-square. He
therefore moved his residence again to London, and had a
retreat at Kentish Town. In February 1765, he was feret
with a stroke of the palsy, which terminated his valuable life in the
March following, in the 78th year of his age. He
was interred in the church-yard of Earl Ham, in Eftex, in a spot
which he had chosen when on a visit to the vicar a short
time previous to his death. All his works evince a pro-
found knowledge of ancient history, tinctured indeed with
that propensity common to his fraternity, of magnifying
the importance of his subjects by the asumptions of a lively
fancy, and some credulity. His great profundity in every
thing connected with druidical history, caused his familiar
friend
friends to designate him as "the Arch-Druid of the age," 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 Keithint Town, with words of similar import.

"Me ducis saturet quiet, Obsecro politus loco; Lami perfumam; Chyndonix Druida."


STULP, in Rural Economy, a provincial word,signifying a post 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 fresh 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 frett, or briskness, to decayed wines. So that very large quantities of this fume are annually imported to all parts along with the foreign wines; and after the same manner a fume is prepared in England from the juice of apples which serves the ordinary purposes of the wine-cooper. In preparing this liquor in this fume, we see the value 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 fume, as good as the natural; and as fit for the re-fermenting, freting, improving, or making of wines, vinegars, 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 Rheinhit tartar, finely powdered, half an ounce: this dismisses with a remarkable ebullition, and gives a grateful acidity to the liquor: take the veil from the fire, and suffer it to cool, and you have an artificial must, which in all respects resembles the natural taff and sweet juice of a white flavourless grape, when well purified, and racked off from its sediment, is order to make fum.

If this artificial must be fumigated, that is, well fumigated with burning brimstone, it becomes a perfect fume, and may be made of any flavour, at the discretion of the artif. Shaw’s Lectures, p. 202. See Must.

STUMBLING, in the Manage, &c. a vice in a horse, either natural or accidental.

The natural arises from the fines 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, & c. to make a slit on the top of his nose, and with a cornet to raise up the great fines, to cut them and fend, and heal them up again with a proper faile.

The accidental arises from a flint, wind-gall, being found, pricked, tubbed, gravelled, &c.

To toe a horse which flumbles is a nice point, as he must be shod 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 branches 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. Croker, take a strip 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 fumed for an hour or two; and then rolled to and fro, to incorporate the fumes of the match with the liquor, after which it may be filled. When fumming is designed only to suppress some slight, improper fermentation, the brimstone match is quite sufficient. See Cider.

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 obliquely tenacious, it has been advised to blow them up with gunpowder. See Blasting.

STUMPS, Apple-tree, &c. Grafting upon, in Field Fruitground, the practice of inferring the foot-sons 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 forts 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 Sons are placed by means of crown-grafting. It is remarked, in the Corrected Agricultural Report of the County of Gloucester, that it is not unusual to see a single stump of such 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 bough, 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 single detached trees, and not extended to whole apple fruit-grounds. See Grafting.

STUMP or Stock, Scutching, a term used to signify the stand over which flash and other fuch materials are broken, beat, and swung, in order to render them lost and free from the item parts in driving them. It consists of a solid block part at the bottom, with a item about five feet in height, and a part with a taping edge upwards at top, over which the flubrance is held with one hand, while it is flucken 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. E. N. of Harrisburg.

STUNG, Adder-stung. See Adder-stung.

STUNTED, in Rural Economy, a term signifying let in the growth; as by bad keep, &c. in animals.

STUPA.
STU

STUPA. See Stupha.

STUPEFiers, in Medicine, the same as narcotics and opiates.

STUPHA, Stupa, Stup, sometimes denotes a fomentation.

STUPIO, a name given by some of the writers in chemistry to the.

STUPKA, in Geography, a town of the duchy of Warsaw, in the palatinate of Kalisht.

STUPOR, a numbness, 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 Liguria, 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° 8'. E. long. 24° 15'.—Alfo, a river of France, which rises in mount Cenis, and runs into the Po at Turin.

STURBRIDGE, a township of America, in the S.W. corner of Worcefter county, Massachusetts, containing 28,929 acres, bounded by Woodstock and Union on the S. and on the N. by Brookfield; incorporated in 1738, and including 1727 inhabitants. It is famous for its butter and cheese; 22 miles S.W. of Worcefter.

STURBRIDGE. See Stourbridge.

STURBRIDGE, 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.) Blomefeld, in his Collec. 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 tradesmen from various parts of England; and the different occupations are separately classed in regular streets, or rows of booths, designated by their respective names; as Cook's-row, Book-feller's-row, &c.; and one division, entitled the Duddery, is allotted to woollen-drapers, mercers, and whole-fale dealers in clothes. Almost every article of wearing apparel and merchandise is here exhibited for sale, and in the evenings the fair is much reforted 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 proc- tors, of the university of Cambridge, and the mayor and aldermen of the town, dressed in their official habits. At a short distance S.E. of Stourbridge lies an ancient Roman chapel, which now serves as a repository for the flails of the fair.—Beauty of England and Wales, vol. xi. by J. Britton and E. W. Brayley.

STURDY, a difeafe in sheep, which is of much im- portance, equally on account of its frequent occurrence, and because it constantly terminates fatally, unless when relieved by art.

There are two varieties of it, as listed 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 luridy, 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 defects 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 vifion is impaired, and it does not fee any object which approaches it, until it be very near, when it flarts 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 palling 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 prefling on it with the thumbs, a remarkable degree of fottnefs at one part of it, where the skull seems to be wanting. But in a few instances, no fottnefs is to be discovered in any period of the difeafe, but in other cases, if not relieved by a proper operation, the animal lofs the power of flanding, and dies perfectly emaciated. The continuance of this fort or variety of the difeafe extends or lasts from two months to a year, as the circumstances of the particular cafe may be.

The fecond or latter of these varieties is, however, much more rapid in its progres, in which, in addition to fome of the above appearances, a great degree of stupey comes on in a few days, which is followed by total blindnefs, and no fottnefs is ever to be found in any part of the skull or bones of the head.

The appearances on opening the head in the frill 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 horde. These bags vary much in fize, 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 crufh, when it is of a glutinous or flimy nature. Within, or in the skins of these bags, are feen, according to fome, many little white bodies, nits, or the ova of infects. Thrice this defcribed by Mr. W. Hog, which, though in fome meafure hypothetical, display an accuracy of obfervation. He is induced to believe, from two or three recent cafes and obfervations, that the dililution of the brain, &c. is occa- tioned by numbers of animalcule, which have been noticed to be flimming loosely in the brain. They resemble ants' eggs, both in shape and colour, but are somewhat shorter. However, as all the animals upon which he made the obfervation had been dead for fome time, thofe puny inhabitants of the brain were allo dead; but if they had been living and organized animals, which he has no doubt they were, there would be multitudes of fo diminutive a fize, as to be quite imperceptible to the naked eye; and he is fully convinced, that if the difeafe was minutely obferved in all its flages by microfopical examination, whatever its begin- ning was, its progres would be, by the activity of thofe animalcule, increasing both in number and fize. However, in proportion as the difeafe advances, the bag increafes in fize, and by its preffure eafely the brain to de- creafe, while the skull immediatly over the bag becomes soft and disapparees, fo that nothing intervenes between it and the integuments of the head. Sometimes, but only in those cafes where no attempt has been made to cure or re- move it, there are many small bags, unconnected with each other, distributed through the brain or cerebral parts.

In the second fort or variety of the difeafe, the water is not cont-
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-quip, or any blunt-pointed instrument, carried frequently round it. The nape 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 ills 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-hair, 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 cafes, 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 conformance of rainines or irritation, the bag containing the fluid has been ruptured, which sometimes happens, it is very difficult, and in many cafes impossible, to extract the face. 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 face, then drilling it with a mixture of tar and balsam, or other separately, then turn the animal, which has now lost its fluid appearance, into a good pittance. The dams and cold of nights should be avoided, as they tend to produce inflammation, which very soon destroys the animal. In this cafe, the admission of the external air, and the irritating dressings, cause the sides of the face to adhere: this, however, is not always the case, it is said, after a week or two, the appearances of the disease have been known to return, after the alleviation which the operation contantly produced. When this happens, it is almost impossible to extract the bladder or bag entirely, on account of the inflammation, from the cutting causing long adherence. In this cafe 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 cafe, 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 froth, too, inflammation is liable to be produced, which may also at that time render it improper. In these cafes, 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 cafe the skull should feel firm in the forehead, then the operation must be performed by thrashing a flint sharpened wire up each nostril, until it drop 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 fever 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 desired 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 most capably of being effectually removed.

STURGEON, Acipenser flario 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 sea 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. Theurgeon which we receive comes either from the Baltic rivers, or North America. Those cured at Pillau were 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.

Theurgeon 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, flabby, 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 pleotal 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 paler; 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. Caviar is made of the roes, and ichthyocolla of the found of theurgeon. (Ray and Pennant.) The variety called by Pliny and others Attilius, Adella, Adano, and Adulus, and the Rhodus 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. ruthenus*, or Herlet, with a straight tubulate front, 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 Meier and Pomerania. The *A. baia* is derived under Huo. The *A. frisana* has an obtuse front and cirri near its apex, with bifid 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. flario* or not. The *A. fluvius*, or koller, 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, infinum 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° 69', 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 Sakatchewine 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-illand lake; and the other, known by the name already mentioned, runs to the east of north, and is the largest; its length being about twenty-seven miles, and its greatest breadth about five miles. In N. lat. 54° 16', the Sturgeon-weir river discharges itself into this lake, and its land appears to be almost the same kind of rock that forms the N. side of the lake, and also the W. shore of the lake Winnipe, 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 is also a lake of North America, N.E. of Lake Superior, in N. lat. 49° 30', and W. long. 92'.

STURGEON Creek. See BITTERY.

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 Stedchades.

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 district of Dale, in the year 1178. At three years of age he was put to school under the learned John Lopston, a distinguished character at that period, with 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 Borgh, the inheritance of his wife; but in 1203 he went to reside at the farm of Reikolt, in the improvements of which he spared neither time nor expense. He surrounded his mansion 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 Skriliba, to a bath, fully denominated after the founder, Snorro-lang, which was paved with hewn stone, and bordered by features 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 fame period he acquired great reputation abroad by his poetical talents. He composed a poem in honour of the powerful northern earl, Haco Galiu, which he sent to him the
the same year from Iceland, and in return for the civility
he received many valuable presents. In 1218 he proceeded
to Norway, where he was in great favour with the King,
Haco, 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 pa-
tron’s views in regard to that island. It having been deter-
mained to send troops thither from Norway, either for the
purpose of conquering the country, or for obtaining satis-
faction on account of some acts of violence committed by
the inhabitants against Norwegian merchants, Snorro pre-
vented this expedition, by his remonstrances to one of the
king’s friends; but he engaged, on the other hand, with
the affiance 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 re-
turned to Iceland in 1220, nothing farther was done:
either Snorro found it impossible to carry his deigns into
execution, in consequence of disturbances which agitated
the island, and in which he himself had a share, or he endeav-
oured, 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 son-in-law, king
Haco, of the crown, and to place himself on the throne in
his stead. Snorro espoused the party of the duke, but
returned to Iceland in 1239. Gifiur Thorvallsdøn, a rela-
tion of king Haco, by whom he had been railed to the rank
of earl, was one of Snorro’s sons-in-law, but had now become
his bitter enemy. In 1240, king Haco sent him a meflage,
after he had got rid of duke Skule, either to bring Snorro
a prisoner to Norway, or to put him to death. At first,
Gifiur intended to execute his murderous designs at the
place where justice, as it was called, was usually adminis-
tered; but finding this inconvenient, he fell upon him at his
residence, where he was affianced, in the 63rd of his age.
Snorro was unquestionably a great and learned man;
his “Himfkringsla, or Chronicle of the Norwegian Kings,”
has been printed at various times, and under different forms.
A Danish translation of it by Claufen, with Worm’s pre-
face, was published at Copenhagen in 1653 and 1657. It
was printed at Stockholm in Icelandic, Swedish, and
Latin, in 1657, 2 vols. fol. But the most elegant edition
is that of Schœning, 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 Schœning; but the
Danish is that of Claufen, revised by J. Olafsen. By this
important work, which throws so much light on the earliest
history of Norway, Snorro rendered much service to poster-
ity. But his merit does not rest on this alone, since he
is commonly confidered as the author of the prose Edda,
edited by Refenus in 1665, which is founded on those old
poems said to have been collected by Saxmund, and on that
account called “Edda Saxmundi.” The Edda of Snorro
is a poetic manual, or sort of Scandinavian art of poetry,
constituted of three parts. In the first, which may be com-
pared to Ovid’s Metamorphoses, or Hesiod’s Theogony,
are related all those fables contained in the works of
Skalda. The second part is a treatise on poetical phrase-
ology or fynonymy, which shews in what manner the Skalda
gave names to different things; and the third, called Skalda,
treats of alphabetical characters, their division, and the
relation they bear to musical tones; of poetical hecences,
metre, &c. The last part has never been published. Not-
withstanding the general merit of Snorro, he is described as
a cunning and deceitful man; unfeady in his friendship,
fond of money, as well as ambitious, and of a violent and

STURM, JAMES, in Geography, a town of Croatia; 18
miles S.W. of Novi.

STURM, JAMES, in Biography, was born of a family
of eminence at Strauburg, in 1589, and elected at the age
of twenty-five into the senate of his native place. He was
an active promoter of the Reformation, and deputed to the
imperial diet, assembled on that occasion. When the de-
puties of the reformed were excluded, in 1529, from the diet
at Spire, Sturm boldly entered his protest against the
measures, and on behalf of his constituents and the other
confederates, declared, that if good citizens were thus dis-
victed of their privileges, contrary to the customs of the
empire, it could not be expected that they should contrib-
ute to the public expenses. This protestation on his part gave
rise to the appellation of “Protestants.” Among other
offices of importance 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 Strauburg in 1538, and at his
death he left to its support a considerable legacy. Sleidan,
in his “History of the Reformation,” availed himself of
much valuable information communicated by Sturmus, of
whom it is recorded, that being feazalized by the violent
disputes among the Reformers concerning the Lord’s
Supper, he abstained for many years from receiving it.
After having several times terved his fiate as mayor, and
having been ninety-one times delegated from it on public
business, he died in high esteem, at the age of fifty-four.

STURM, John, was born at Sleida, 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 1529 he transferred
his printing-press to Paris, where he delivered lectures on
the classics and on logic. He married there; but being suf-
fected of an attachment to the new opinions, he removed
to Strauburg, where he was appointed first rector of the
newly appointed college, which flourished greatly under his
care, as he was well versed in the learned languages,
 wrote Latin with purity, and had a good method of teach-
ing. By his influence the college was raised, in 1566, by
the emperor Maximilian II., to the rank of an university.
The benefactions of Sturm to refugees from France and
other parts, on account of their religion, injured his own cir-
cumstances; and his life was disfigured by the persecutions
of the Lutheran miniwers. His own sentiments were those
of Zuinglius, though he conformed to the mitigated Lu-
eranism which he found at Strauburg. However, in pro-
cress of time, as the miniwers became rigid on the subjedt
of confabulation, he withdrew from the religious services,
and at length, when he was obliged to declare his opinion,
he was deprived of his office at the age of 67 years.
Before his death he became blind, and terminated his life in
writing, which gave him reputation in the learned world.
From the Greek he translated Aristotle’s books on Rheto-
ic, and the works of Hermogenes concerning oratory; and
he composed some original treatises on the method of teach-
ing those arts. Several of his letters are contained in the
Latin


STERMINIUS, or STERMINUS-NEWTON, in Geography, is a small market-town in the hundred of Sturminster Newton-Caflé, in the Sherborne division of the county of Dorset, England. It is situated eight miles S.W. from Shaftesbury, and 111 miles W.S. from London; and is divided into two parts, viz. Sturminster, which lies on the north side of the river Stour, and Newton or Newton-Caflé on the south. The latter is a small hamlet, and a diminut tything. 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 manner of the rebuilding of the abbey of Glaftonbury, being situated there. Both these villages compose one manor, and are joined together by a causeway, and a bridge of six 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 castle is a small artificial mound, or hill. The manor was held by the abbey of Glaftonbury, by a grant from king Edgar; having been formerly bequeathed by Alfred to his son Ethelwald. Edmund Ironside confirmed this grant in 1016, when it contained seventeen hides, about a hundred acres, and the rent of eighty shillings. Henry VIII. gave the manor, with the Caflé, and vicarage, to his queen, Catharine Parr. On her death, Edward VI. granted the estate to his litter, Elizabeth, who, when she came to the crown, gave it to Sir 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 report of the year 1811, contained 324 houses, and 1461 inhabitants. Two fairs are held annually, and a weekly market on Thursdays.

On a lofty eminence, called Hambledon-hill, standing in the parishes of Child Ockford, Shiroton, and Hanford, are considerable remains of an extensive fortification. Bishop Gibbon supposed this camp to have been formed by the Danes; but Aubrey was informed that Roman coins had been ploughed 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 that of Hanford. On the summit is an old fortification, in form of a Roman D.—Hutchins’s History of Dorsetshire, fol. vol. ii. Beauties of England and Wales, vol. iv. by J. Britton and E. W. Brayley.

STURMHOSEN, a town of Prussia, in the province of Ermland; 17 miles E. of Heilberg.

STURNUS, the Star, or Starling, in Ornithology, a genus of birds of the order Passeres, of which the generic character is as follows: Bill subulate, angular, deflexed, bluntest; 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 Starling. 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, nests of houles, towers, or rocky cliffs; it lays from four to five eggs, which are of a pale-yellowish colour. In the winter weather, starlings assemble in vast flocks in marly 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 characters of this species are, that their quills-feathers and tail are of a dusky 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 choughs, 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 thickets, where they 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-tones. Their vocal powers are, however, acquired by education, and in the domestic state, 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 diffusible, and almost inflated characters 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 cinerous, 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
which are the only colours of this bird, are distributed very like to those of our pies. The bill is thicker and larger 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 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, tipp'd with brown; the cheeks are yellow; the wings and tail are of a reddish-grey; the legs also are grey.

**Contra**; Indian Starling. Brown; eye-spot, bar on the upper part of the neck white. It inhabits India, and is thought to be a variety of the S. capensis. The body of this species is blackish; the ring on the upper part of the neck white; the upper wing-coverts are marked with white spots; the legs are of a pale yellow.

**Circeus**; Water-ouzel; Crake. Black, with a white breast. This species is common to our own country, other parts of Europe, and northern Perlia. It is about seven or eight inches long; frequent waters, and feeds on aquatic insects, and small fish; it is a very solitary bird, and breeds in the holes of banks; it has 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.

**Miliaris**; 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 dull-forked tail are black.

**Moritanus**. Cinerous; lower part of the head and chin variegated with cinereous and white; belly spotted with reddish, hoary; the bill is tipp'd with black. This species inhabits the alpine parts of Perlia; it is the size of a common lark, builds in hollow rocks, and feeds on insects.

**Locia**. Spotted with brown and white, chin and breast fleck'd. It inhabits Chile, and is larger than the S. vulgaris; it builds in holes on the ground, and lays three cinereous eggs, varied with brown; it lays a large, white, and is easily tam'd.

**Mexcianus**; 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 pale-yellow; the head is small.

**Obscurus**; Brown-headed Starling. Black, but the head is brown, whence its trivial name. It inhabits New Spain.

**Zeilanicus**; Ceylonese Starling. Line over the eyes and one on the sides of the head black; body grey, varied with ochrey and white spots and crests; quill-feathers green; tail marked with green and black lin'd. It inhabits Ceylon, and imitates the notes of other birds. The bill is black, the head yellowish; the legs are of a blueish-grey.

**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 blue-ash.

**Striicus**; 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 wattle. It inhabits New Zealand, and is ten inches long. The female is of a rufly-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, sings with a very weak voice, and builds on the ground, or in the crevices of rocks. The upper mandible is brown, lower pale; the bars with brown; the belly is rufous; quill-feathers blackish, the edge at the tip and inner side reddish; tail brown; legs of a horn-colour.

**Dauroicus**. Body above violet-black; beneath alby-white; the head and neck blueish ash; crown with a violet-black streak; but in the female it is brown. This species is found chiefly among the ozier plantations of Dauroria; 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 irids brown; downy eyelids and lores white. The head of the female is cinereous; the back is of a grey-brown; the wing-coverts of the male are black; falky-green; the secondaries tipp'd with white; the quill-feathers are black; the two inner ones tipp'd with white; the primary ones are tipp'd 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 Nering; 14 miles N.N.W. of Elbing.

**STUTHY**. See Stithy.

**STUTINUM**, a town of Bohemia, in the circle of Chrudim; 3 miles S. of Chrudim.

**STUTTGARD**, or Stuttart, the capital of Wurttemberg, and residence of the king, situated in a delightful country on the Nafenbach, about two miles from the Neckar. The town is not large, but contains two well-built barracks. It is the seat of a bishop, which was removed from Beutelsbach in the year 1321. The streets are large and straight, and the houses handsomely built. The royal palace is a magnificent building, and was begun in the year 1746. Stuttgart contains an academy of painting, sculpture, and architecture, established in the year 1701; and manufactures of ruffs, silk floddings, and ribbons. The origin of this town is uncertain; in the year 1285, it was beleaguer'd, without success, by the emperor Rodolphus I.; but in 1287, he reduced count Eberhard to such frants, that he was compelled to remove the demolition of the walls of the city. In the years 1520 and 1567, the whole city was surronded with walls; in 1546 and 1547, it suffered greatly by the Spaniards; in 1674, and the following years, by the Imperialists; and in 1688, 1693, and 1707, by the French; 40 miles N.W. of Ulm. N. lat. 48° 45'. E. long. 9° 18'.

STUT.
THESTUTZENBERG, a town of Austria; 5 miles N.E.
of St. Polten.

STUYVER, in Coinage. See Stiven.

STUZZATIYA, in Geography, a town of European Turkey, in Macedonia; 86 miles N. of Saloniki.

STY, (Hordorum,) a small inflammatory tumour on the edge of the eye-lids. See Hordolum.

STY, Pigs, in Rural Economy, a term used to signify the place where pigs are confined and kept, especially when of the small, rude, unfurnished kind, such as are connected with cottages. See Hon-Sty, Pigsty. Pig-Cafe, &c.

Improved ties of this sort are made by raising the feeding and sleeping places a little above each other, and both above the yards.

STYCA, in Congreg. See Stica.

STYGIA, Aqua, a term used sometimes to express aqua regia; sometimes for the other corrosive acids.

STYGIAN LIQUORS, a term which some chemists apply to the corrosive acid spirits, as aqua regia, from their efficacy in destroying or dissolving mixt bodies.

STYLE, in Botany. See Stylus.

STYLE, in Chronology, denotes a particular manner of accounting time, with regard to the retrenchment 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 365½ days.

The Gregorian, or new style, agrees with the true solar year, which contains only 365¼ days 4894.5.

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 before-hand with the former; so that when the Catholics, &c. reckon the 21st 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 diet of Ratibon in 1720, 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 fame regulation has since passed 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 1st day of December, 1751; and that from 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 2d day of September 1752, shall be called and reckoned the 14th day of September, omitting the intermediate 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. shall be held and observed accordingly. And for preferring the calen-
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. Bulver 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 scarcely possible always to determine precisely; the talk and use of a language being so exceedingly delicate and precarious. It is true, a fault in style is not less 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. Bulver 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 geniuses, humours, and complexions.

It is the imagination that acts, 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 jejune, the copious, the concise, the poetic, the epistolary, and the barbarous styles.

These personal styles are all independent of the grammatical; and we have authors who excel in one or the other, yet are miserable 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, may be said, that grammar is far from being able to vary the fame words of a phrase with equal perfection; and that generally there is but one way of delivering them in the tattle 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; thence 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 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. Prelim. 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, of the court of chancery, of parliament, of the privy council.

Style, in Musick. See Stile.

Style, in Oratory and Poetry, is restrained wholly to what F. Bulver 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 strongest and most hyperbolical figures. The Athenians, a polished and acute people, formed a style accurate, clear, and neat. The Athenians, gay and loose in their manners, affected a florid and diffuse style. The like sort of characteristic differences are commonly remarked in the style of the French, the English, and the Spaniards.

Words being the coppers 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 subjects 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, amidst this variety, we still expect to find, in the compositions of any one man, some degree of uniformity or constancy in himself in manner; or some predominant character impressed on all his writings, which shall be suited to, and shall 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 distinguishing 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 aulèrie, the florid, and the middle. By the aulèrie, he means a style distinguished for strictness 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 strictness; and as instances,
he mentions Hesiod, Sappho, Anacreon, Euripides, and principally Inocrates. The middle kind is the juil mean between these, comprehending the beauties of both; in which Cicero places Homer and Sophocles among the poets, and in prose, Herodotus, Demosthenes, Plato, and even Aristo-
totele, thus unaccountably extending his clasf so as to com-
prehend 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, tense or jubile; the grave or solennem; and the medium, or temperatur genus diciendi. or, in other words, the low or plain, the lofty or sublime, and the middle, temperate, or equable. See Style, in Grammar, supra.

The several charater are distinguished from one another, both by the thoughts and by the language.

The low, or simple style, pertains to subjects that are either common things, or such as should be treated in a plain and familiar way; and, therefore, plain thoughts are most suitable to it, and distinguish it from the other characters of style. By plain thoughts are meant such as are simple and obvious, and seem to arise 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 fight 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 thoughts, and the other is often necessary to animate and enliven this character. The first of these is fulness 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 jeneous, care, however, should be taken, lest, while fancy is too much indulged, the fulness of the thoughts should be overlooked.

As to the language proper for the low style, it may be observed, in general, that the drefs 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 enlange 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 negligance, 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 fluided cadence, as are evidently the 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 defratted, 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 causually. Verbal figures, which serve chiefly to enliven an expression, and give an agreeable turn, are not often improve 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 most effulgent 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 fet them in an easy light. And, therefore, the proper subjects of it are epistles, dialogues, philosophical dilifications, or any other discourses that ought to be treated in a plain and familiar manner, without much ornament, or addres 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 accuracy 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 defver that character from fame or other of the following properties, viz. 1. Gravity and dignity, an instance of which occurs in Cicero's speech to Cæfar (Pro Marcell. c. 8.) when he says, "It has often been told me, that you have frequently laid, 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, diftects more that was at first perceived. To this property Quintilian (Tott. Orat. lib. viii. 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 please 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 seeing you, they had lived long enough; others, that now they were more defirous to live." 4. Novelty, which is applicable not only to things abso-

Innovatedly new, but to the fame thought fet in a different light, or applied to a different occasion. Thus Cicero (De Orat. lib. iii. c. 1.) says of Cælus: "Cælus always excelled every other orator, but that day he excelled himself:" and also of Cæsar (Pro Marcell. c. 4.), "You had before con-
quered 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. Ele-

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Sty.
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 beautiful 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 character. But the principal distinction of style arises from tropes and figures. By these it is chiefly animated, and raised to its different degrees or characters, 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 character. Virgil's Elogues are written in the low 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:"

Infelix lollum et fteriles nafcuntur 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:

Infelix lollum et fteriles dominatnr avenae:

In English:

Where corn is sown, darnel and oats command."

Upon which some critics have remarked, that where the same sense is intended, instead of the proper word nafcuntur, grow, the author substitutes a metaphor, dominatur, 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 exaty, which is the poetry of the sublime. The most considerable embellishments, that form the middle or florid style, are descriptions, the prosopopeia, similitudes and comparisons, and the antithesis. These, and such like florid figures, are sometimes found in historians, but more frequently in orators; and indeed the 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: "Eit alyas quidam interjectus, intermedius, et quah temperatur; nec acumine inferiores nec fulmine utens superioris, victims amborum, in neutrò excellens, ut solque particeps. The same author calls it the florid and polished style; as in 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 character; because the jestile propriety, joined with the greatest strength and highest elevation of thought, is required to complete the true sublime. Lofty and grand sentiments are the hallmarks of this character of style; and, therefore, Longinus advices those who aspire at this excellence, to accustom themselves to think upon the noblest subjécts. 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 esteem among mankind. Of the former sort is Cicero's de-
Of the five sources of the sublime affigned by Longinus, viz. boldness or grandeur in the thoughts, the pathetic, the proper application of figures, the use of tropes and beautiful expressions, and a musical structure and arrangement of words: the two first are only allowed by a late excellent writer to have any relation to the sublime; the other three having no more relation to the sublime than to other kinds of good writing; perhaps less to this than to any other species whatever, because it requires less the assistance or ornament. The foundation, he observes, of the sublime in composition, must be always laid in the nature of the object described, which should be such, as if exhibited to us in reality, would raise ideas of that elevating, awful, and magnificent kind, which we call sublime. And, besides, it must be set before us in such a light as is most proper to give us a clear and full impression of it; it must be described with strength, with conciseness, and simplicity. As for what is called the sublime style, it is, says this writer, for the most part, a very bad one; and has no relation whatever to the real sublime. Persons are apt to imagine, that magnificent words, accumulated epithets, and a certain swelling kind of expression, by rising above what is usual or vulgar, contribute to, or even forms the sublime. Nothing, he says, can be more false. In general, 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 sublime, indeed, rejects mean, low, or trivial expressions; but it is equally an enemy to such as are turgid. The main secret of being sublime, is to say great things in few and plain words: and it will be found to hold, without exception, that the most sublime authors are the simplest in their style.

The faults opposite to the sublime are chiefly two: the frigid and the bombast. The frigid consists in degrading an object, or sentiment, which is sublime in itself, by our mean conception of it; or by our weak, low, and childish description of it. The bombast lies in forcing an ordinary or trivial object out of its rank, and endeavouring to raise it into the sublime; or in attempting to exalt a sublime object beyond all natural and reasonable bounds. This is also called fisilian or rant. Shakspeare is not unexceptionable in this respect. Dryden and Lee in their tragedies abound with it.

All the qualities of a good style, says Dr. Blair, may be ranged under the two heads of peripetia 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 drefs, as by pleasing and interesting them, shall most effectually strengthen the impressions we endeavour to make.

Peripetia, 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 conjunctions, 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 election of such words in the language, as the soft and most established usage has appropriated to those ideas which we intend to express by them. And as the words which a man ufed to express his ideas, may be faulty in three respects; not expressing the idea which the author intends, but some other which refemblies 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 laft. The proper opposite to precision is a boft style.

In the construction of sentences, according to this writer, the most essential properties are clearnefs and precision, unity, strength, and harmony. The first is opposed to ambiguity in the arrangement of words in a fentence; 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, fo 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 prent its antecedent to the mind of the reader without the least obscurity. In order to preserve the unity of a fentence, the fene, during the course of the fentence, should be changed as little as poifible; things, which have no little connection, that they could admit of being divided into two or three fentences, should never be crowded into one fentence; all parentheses in the middle of fentences fhould be avoided, and the fen- tence fhould be always brought to a full and perfect clofe. The strength of a fentence is fuch a difpofition of the feveral words and members, as shall bring out the fene to the belit advantage; as shall render the impression, which the period is designed to make, molt full and complete, and give every word and every member its due weight and force. For this purpofe, care fhould be taken to prune the fentence of all redundant words and members; particular attention fhould be had to the ule of copulative, relatives, and all the particles employed in transition and connection; the capital word or words fhould be disposed of in that place of the fentence, where they will make the fulleft impression; the members of fentences ought to go on rising and growing in their importance above one another, fo as to form a climax; the conclusion fhould feldom confift of an adverb, preposi- tion, or any inconfiderable word; and in the members of a fentence, where two things are compared or contradited to one another, where either a remembrance or an opposition is intended to be exceed, some resemblance in the language and construction fhould be preferred.

In the harmony of periods, we may consider agreeable found, or modulation in general, without any particular ex- pression, and the found so ordered, as to become expressive of the
STYLE.

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 at numerosi oratibus.

There are two things on which the mufic 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 honorific words, being reserved for the conclusion. This rule, however, ought to be observed with restriction; for all unmeaning words, introduced merely to round the period, or fill up the melody, compolition, oratory and the like, are in themselves detestable, and a particular resemblance effectcd between same 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 to our view without confusion; the principal idea, which is the subject of the discourse, along with its accessory, which gives it the figurative dreef; 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, Tophe, 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 diffus 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 concisefenes, the two most remarkable examples are Tacitus and Montesquieu in L'Esprit de Loix. Of a beautiful and magnificent diffusenfes, 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 diffus. They often coincide, infomuch that diffuse writers have generally some degree of feebleness, and nervous writers generally are inclined to a concise expression. However, there are instances of writers who, in the midst 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 Democritus, in his Orations.

Charles II. feems 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 to beautify it, seems to rife in the following gradation, viz. a dry, plain, neat, elegant, and flowery manner. The dry manner excludes ornament of every kind; and content with being underfoot, 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 rifes one degree above a dry one. A writer of this character gives us his meaning in good language, distinctly 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 defte 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 neat style makes use of ornament, but that 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 neat style, will be read with pleasure. An elegant style expresses a higher degree of ornament than a neat one; and it, indeed, the term usually applied to style, when polluting all the virtues of ornament, without any of its excexes 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; when the discourse is, in a word, either with a dazzling luftre, or a false brilliancy; this forms what is called a florid style: a term commonly used to signify the excess of ornament. It is not only pardonable, but even a promising symptom in young people, that their style should incline to the florid and luxuriant, but it is not entitled to the same indulgence from writers of mature years. Without a foundation of good sense and solid thought, the most 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 affectation. 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 neat style. Simplicity, as it regards style, may also denote the easy and natural manner in which our language expresses our thoughts, and words opposed to affectation 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, Plutarch, and Cæsar, 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 the vehement; 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 ardour; it is a glowing style; the language of a man whose imagination and conceptions are heated, and is affected by what he writes; who is therefore negligent of letter graces, but pours himself 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. p. 111.

As to the choice of style, in the general, the nature of the subje& is to determine it. Such style, says Cicero, is to be chosen, as expresses great things magnificently, middle things moderately, and low things subtilly, or acutely: but more particularly, as these 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. Cefar, 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 bucolics and eclogues; the intermediate style for georiges; and the sublime for epics: which triple difference we easily discover in Virgil, though he sometimes mixes them all in the Æneid 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 nobler thought expressed in mean terms: the reason he gives is, that every body cannot judge of the force and jufeliness of a thought; but fearfully any but perceives the meannefs of words. The latter we find by our tenes, the former only by our reafon.

It is neither easy nor neceffary, says Dr. Blair, to determine what is precisely the beat 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 ointentious, a feeble, a harsh, and an obscure style, for instance, are always faults; and perpoficity, strength, neatnefs, and fimplicity, are beauties always to be aimed at. But as to the mixture of all, or the degree of predominancy of any one of these good qualities, for forming one peculiar diftinguifhing manner, no precise rules can be given; nor is it easy to point out any one model as absolutely perfect. Dr. Blair propofes 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 composing with attention and care is indispenfibly neceffary: we ought to render ourselves well acquainted with the style of the beat authors, and yet, at the fame time, be cautious in avoiding a fervile 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 engulf us so much, as to detract from a higher degree of attention to the thoughts. "Cu-ram verborum," says the great Roman critic, "rerum volo effe follicitudinem." Lect. on Rhet. lec. xix.

The chief faults in style are, its being tumid and swelling, or cold and paride, or stiff, or loose, or dry and jejune.

**Style, a Tumid, is that immoderatelyuffed with big words and sentences; such are those verses of the emperor Nero, ridiculed by Periatus:**

"Torva mimalloninis implerunt cornua bombis, Et raptum vitulo caput ablatura superbos, Ballariss, et lynchem menas flexura corymbis, &c."

**Style, Frigid or Puerile, is that which affects certain trivial ornaments, inipid jects, remote and strained allusions, redundant defcriptions, &c. Such, e. gr. as a Cen-
taur's riding himself; more golden than gold, &c. Of this vice, that paffage of Virgil seems guilty.**

"Num capti potuere capi? Num incens a cremavit Troja viros?"

In the puerile style, the writer runs on in a specious ver-
bofom, amusing his reader with ynamous terms and iden-
tical propositions, well-tun'd periods, and high-founding words; but, at the fame time, using those words fo indif-
ferently, that the latter can either affix no meaning to them at all, or may almost affix any meaning to them he please.

See **Sublime Style,** supra.

**Style, Loose, 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 fo frequent, especially in young writers, that it is needless to give instances of it.**

**Style, Dry or Jejune, is that which is destitute of orna-
ment, spirit, &c.**

The ancients made a notable distinction of style, into **Laconic and Affect.**

**Style, Affect, is that which is very florid, diffuse, and prolix; or where abundance of words are used to express a little matter; thus called by the Greeks from the people of Afa, 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. gr. is that anfwer returned by the Lacedae-
nians, to a long epitope of an enemy, threatening to destroy them with fire and sword: "si, fi; that is, do you can-
or that returned by the fame people to king Philip, de-
manding some extravagant thing of them, "si, non, no. Or that of Cleomenes, the Spartan general, to the ambaffador of Samos: "As to what you have faid, the firft part I do not remember; the middle I do not understand; the last I do not approve." Or that epifile of Archidamus to the Efeu, who were preparing war again him. Archidamus to the Efeu: "It is good to be quiet." Or that of Cefar to the Roman Senate, after his conquering Pharnaces, king of Pontus: "Venit, vidit, vici: I came, I faw, I conquered."  

**Style of Dialogues. See Dialogue, and Low Style, supra.**

**Style, Epiforlary. See Epiftorlary.**

**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 expeffions. As history is a narrative of fuch facts as are fit to be transmitted to politerity, for the ufe of man-
kind, and the better conduct of human life, the firft law in writing it is, as Cicero observes (De Orat. lib. ii. c. 15.), not to dare to fay any thing that is fall; and the next, not to be afraid to fpeak the truth; that on the one hand there be no fufpicion 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 defirous 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 is 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 perspicuity. 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 (Epist. ad Cn. Pomp.) makes decency a principal virtue in a 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 form no small part of the historian's province, though his colours are not so strong 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 Interpret.) remarks, that an historical period ought neither to rise very high, nor sink very low, but to preserve a medium; i.e. these periods should neither be so full and famous, as are frequent in oratory, nor yet so short and flat, as in dialogue. This simplicity, he says, becomes the gravity and elegance 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 a just rise and cadency, and may be pronounced with ease. The harmony of periods arising from such a portion of the words as renders the sound 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 Callithenes, two Greek historians.

Historical style, however, admits of considerable variations; in 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, scarcely rising above the low character, and the latter often approaching near to the sublime. And other historians have observed a medium between thefe. Ward's Orat. vol. ii. lect. 45.

**STYLE, Lapidary and Maroic.** See the adjectives.

**STYLE of an Orator consists of the low, middle, and sub-lime 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 of these three 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 affluence both of nature and art: the most raised and lofty thoughts, clothed with the brightest and strongest colouring, enter into this character.

The introduction fearfully rises above the middle style; and if it carry in it an air of pleafantry 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 ornamental 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 confirmation is much the same with that of co-férmation.

In that part of the conclusion, called recapitulation, 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 addres to the passions, all the springs of eloquence, says Quintilian, (Init. Orat. lib. vi. cap. i.) are to be opened. Now we are past the rocks and shallows, all the fals 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, is not to be lost sight of, but discourse to the nature of the subject, the time, place, and persons, and other circumstances, by which all the style is to be regulated. Ward's Orat. vol. ii. sect. 46. See **STYLE, supra.**

**STYLE, Stylus, 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 engraving 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 allegorizations of the same word in English. See a Difertation on the Style of the Ancients, in Pull. Transf. N° 450. p. 157. or Eames's and Martyn's Abr. vol. viii. part iv. p. 29.

**STYLE, Stylus, in Surgeon,** denotes a long steel 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 cannulae, 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 four stylus, to be put in alternately.

**STYLEPHORUS, in ichthyology, a genus of fishes of the order Apodes.** The generic character is as follows: The-
STY

The eyes are pedunculated, standing on a short, thick cylinder; the snout is lengthened, directed upward, retractile 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 finny rays; the body is very long, and compressed.

This very 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.

CHORDATUS, or Silvery Stylephorus, with extremely long caudal threads.

The head of this extraordinary animal bears a definite resemblance to that of the genus Syngnathus; which fee. The rostrum, or narrow part, which is terminated by the mouth, is connected to the back of the head by a flexible leathery duplilcatre, which permits it to be either extended in such a manner that the mouth points directly upwards, or to fall back, fo as to be received into a fort of cafe 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 column or parts 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 leaf appearance of a reticulated structure. The colour of the eyes, as well as of the column, on which they stand, is a clear cheet-brown, with a fort of coppery gloss. Below the head, on each side, is a considerable compressed semi-circular space, the fore-part of which is bounded by the covering of the gills, which covering seems to confine of a single membrane, of a moderately strong 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 procis of an enormous length, and diminishes in a very fine point. This finning, or caudal procis, is strengthened throughout its whole length, or at least so far as the eye can trace it, by a fort of double filaments or internal parts. The pectoral fins are very small, and situated almost immediately behind the cavity, on each side of 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 fin is a rich silver, except on the flexible part belonging to the rostrum, which is of a deep brown: the fins and caudal procis are also brown, but not so deep as the part just mentioned. There is no appearance of scales on this fin. It was from the singular figure and situation of the eyes, that it was named the Phylephorus: the trivial name cberodatus was taken from the extraordinary thread-like procis 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 islets 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 procis, is about thirty-two inches, of which the procis itself measures twenty-two.

In Dr. Shaw's fourth volume is a very good reproduction of it, and in the Linnean Transactions the engraving is of the natural size of the fish itself.

STYLES of Hunting. See Hunting.

STYLETO; or Syletto, a small dangerous kind of poacher, which may be concealed in the hand; chiefly used in treacherous affinities.

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.

STYLIDEÆ, in Botany, a natural order, established by Mr. R. Brown, Proc. Nov. Holl. v. i. 160, and named from its principal genus. (See STYLIDIUM.) Its characters are the following.

Calyx superior, in two to fix 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. Stamens 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 undivided or cleft. Gynophore of two valves and two cells, with a parallel, occasionally incomplete, partition, which at length separates from the inflexed margins of the valves. Seeds attached to the axis of the partition, erect, small, sometimes fleshy, and albumen of the shape of the seed, felthy, rather oily; embryo included, minute.

The plants are herbaceous, or somewhat shrubby, not milky, with or without a leafy stem; when pubescent, at prefent, simple, either headed with a gland, or acute. Leaves scattered, in some instances whorled, or undivided; their edges naked or fringed; crowded at the root in those species which have no ftcm. Flowers either spicate, racemose, corymbose, or solitary, terminal, rarely axillary, their partial flower-falks generally with three bracts. See Försteria, Levenhookia, and Stylidium, the only known genera of this order.

STYLIDIUM, was first so called by the writer of the prefent article, who fotn specimens under that name to Labillardiere and Swartz, and the latter published an account of the genus. The generic characters of the Natural History Society of Berlin, v. s. Labillardiere has also adopted it, and our countryman Mr. Brown has greatly enlarged the number of known species in his Prodromus. Meanwhile this fame genus was publifhed in our Exotic Botany by the name of Venentatia, now otherwise applied; see that article. Stylidium therefor is eltablifhed, for the curious New Holland genus before us; and refers to the little column, sutherland, which supports and combines both anthers and stigma. Lourier has indeed preoccupied this very name, Fl. Cochinch. 221, in faavour of some rubiaceous shrub that happened to have a seven-fleck flower; but there is great probability of his genus not being a good one, and we hope our Stylidium will remain undefined.—Sm. Introd. to Bot. 533. Swartz Nov. Act. Soc. Nat. Scut. Berol. v. 5. Wild, Sp. Pl. v. 4. 146. Labill. Nov. Holl. v. 2. 63. Brown Prod. Nov. Holl. v. i. 566. Ait Hort. Kew. v. 5. 222. (Venentatia; Sm. Exot. Bot. v. 15.)—Clas and order, Gynandra Diandria. Nat. Ord. Campulaceae, Linn. Jult. Stylidaceae. Brown.

Gen. Ch. Cal. Perianth superior, of one leaf, in two deeply parted lips, one divided, the other three-cleft, permanent. Cor. of one petal; tube cylindrical, various in length,
STYLIDIUM.

length, often crowned 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. Same. Column linear, longer than the limbs, 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 selle at the top, of two vertical lobes, sublately greatly divaricated, burbling longitudinally. Fid. Germen inferior, roundish-ovate; style none, except the column; stigma between the anthers, and at first covered by them, afterwards rather prominent, obtuse, undivided. Peric. Capsule ovate-oblong, or linear, of two cells and two valves, with a parallel incomplete partition. Seed 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 herbnaceous or somewhat frutitious, 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 gynandrous, and that Stylidium shows the character of the class Gymnandria really to exist in nature, which some botanists, contemplating only certain genera, erroneously to classified, have doubted. We could never take the Gymnandria for a natural class, 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 even into the Kew garden.

Section 1. Capsule fascicled, nearly ovate, sometimes spherical, sometimes oblong.


S. piliferum. Hairy-flanked Stylidium. Brown n. 1 Labill. Nov. Holl. v. 2. 65. t. 213.—Stalk somewhat branched, clothed with glandular hairs. Leaves flat, lanceolate-frowns-shaped. 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. Cliffer somewhat compound, of numerous flowers, whose calyx-lips are so deeply divided, that the whole calyx appears to consist of five sharp leaves.


S. armeria. Hair-leaved Stylidium. Labill. Nov. Holl. v. 2. 66. t. 216. Mr. n. 57.—Leaves linear-frowns-shaped, eaten with a small appendage. Other fide, at the base, Lip without an appendage. Found by Labillardiere at Cape Van Diemen. The root feets in some degree creeping.

Leaves much shorter, broader, and more spreading, than in the last, without any appearance of footstalks. Cliffer of few flowers.

S. graminifolium. Grass-leaved Stylidium. Swartz as above, f. 1. Wildl. n. 1. Br. n. 7. Att. n. 1. (Venentia major; Sm. Exot. Bot. v. 2. 13. t. 66. "Candollea ferrulata; Labill. in Ann. du Mol. v. 6. 414. t. 64. f. 2")—Leaves linear, finely toothed. Flowers nearly spiket. Whole flower-flalk 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-houfe, perennial, herbaceous plant, flowering most part 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, upright, 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. Wildl. n. 2. Br. n. 8. (Venentia minor; Sm. Exot. Bot. v. 2. 15. t. 67.)—Leaves thread-shaped, compressed, minutely toothed. Cliffer simple. Partial flower-flalks nearly as long as the germ. Common flalk smooth, flender. 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 of the same colour, or a little darker. Capsule hiss inflated.

Section 2. C. Leaves radical, crowded, without intermediate scales. A few scattered, never enbarked, broad or sometimes on the flalk. Calyx-lips deeply divided. Ten species of Brown, to which we add Swartz's two East Indian ones.

S. fimbriatum. Spatulate Stylidium. Br. n. 14.—"Leaves spatulate, entire; clothed on both sides with glandular hairs. Cliffer many-flowered, smooth, as well as the radical flower-flalk. Mouth of the tube crowned with glands. Lip with appendages."—Gathered by Mr. Brown on the south coast of New Holland.

S. gracile. Glaucescent Stylidium. Br. n. 15. Labill. Nov. Holl. v. 2. 64. t. 214?—Leaves lanceolate-spatulate, entire, clothed on both sides with glandular hairs. Cliffer of few flowers, rather cornybose, smooth; its common flalk 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 tenderous root; small flowers, on long, bracteated partial flalks; and a large tuft of radical, nearly lanceolate, leaves, about an inch long, which he says are most glaucous beneath.

S. tenuifolium. Little Malacca Stylidium. Swartz as above, f. 3. Wildl. n. 4.—Leaves elliptical, obtuse; radical ones crowded. Stalk simple, lightly compressed. Cliffer somewhat branched.—Native of the East Indies, near Malacca. Stalk or flalk an inch or two high. Leaves half an inch long; the lower ones crowded; upper alternate. Cliffer of three or four flowers, simple, sometimes furnished with a short branch. Willdnw.

S. uliginosum. Marsh Ceylon Stylidium. Swartz as above, f. 4. Wildl. n. 4.—Leaves roundish. Bracteas roundish-ovate, very minute. Stalk somewhat panicul.—Native of Ceylon.—Stalk a span high, round, erect. Leaves as long as the stalk, crowded at the root. Bracteas on the common flalk few, alternate, very minute. Willdnw.

Nothing being recorded concerning the calyx or capstyle, we cannot be certain that the two last species properly belong to this division, or even to this section.
Sect. 1. D. Stalk-leaves, or bracteas, cobwebbed. Calyx-lips deeply divided. Five species.


S. semiis. Climbing Stylidium. Br. n. 24. Ait. n. 3.—"Stem climbing. Leaves linear, tipped with a spiral tendril. Mouth of the corolla crowned; lip with appendages. Column downy in the upper part."—Found on the south-west coast of New Holland, by Mr. Peter Good, and Mr. Brown. The former sent it to Kew in 1803. It is marked by Mr. Aiton as a perennial green-house plant, flowering in July and August. We have never seen a specimen.

Sect. 1. E. Stem somewhat shrubby. Leaves scattered, numerous. Two species.

S. fruticosus. Shrub Stylidium. Br. n. 25. Ait. n. 2. (S. glandulosum; Salt. Farad. t. 77.)—Leaves linear, decurrent, smooth. Mouth of the corolla half-crowned; lip with appendages.—Gathered on the south coast of New Holland, where Mr. Brown also found it, by Mr. Peter Good, who sent it to Kew in 1803. This is a little shrubby green-house plant, flowering from May to August, and not difficult of increase by cuttings. The stem is about a foot high, bushy, much branched, round, smooth. Leaves ciliate, crowded, spreading every way, about an inch long, narrow, rather flabby, pointed, smooth, dark-green. Panicles terminal, compound, hairy and viscid. Flowers light, rose-coloured, with four crimson spots; their mouth furnished with two yellow, acute glands; their appendage with two more, and bearing a large tumid gland on its disk. Neatly, according to Mr. Salisbury, of two yellow, ovate, unequal glands, at the base of the column, whose dilated funnics, beyond the authors, is fringed with hairs. The name writer justly observes that the lobes of the authors are opposite to each other, not in moss vegetables, parallel.


Sect. 1. F. Tube of the corolla very short; lip projecting forward. One species.


Sect. 2. Capsule linear, or linear-lanceolate.

A. Stem naked. Flowers either fleshy or corysteae; rarely almost solitary. Five species.

S. capillare. Capillary Stylidium. Br. n. 28.—"Stalk capillary, with one or two flowers. Leaves radical, oval, Calyx smooth, very acute. Limb of the corolla in three principal segments, the middle one cloven; mouth crowned with glands; lip without appendages."—Gathered by Sir Joseph Banks and Dr. Solander, the original discoverers of this genus, in the tropical part of New Holland. The very slender stalk is only an inch or two in height.

S. rotundifolium. Little Round-leaved Stylidium. Br. n. 30.—"Stalk capillary, with from one to four flowers. Leaves radical, roundish. Calyx-lips undivided. Four segments of the corolla nearly equal; mouth naked."—Found by Mr. Brown in the tropical part of New Holland.

S. corymbosum. Dwarf Corymbosum Stylidium. Br. n. 32.—"Stalk round, corystae. Leaves radical, linear with a bristly point. Calyx-lips 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 leafey. Flowers either alternate or solitary. Capsule 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 ovate; 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 base of the crowded bracteas, or leaves, about the top of the stalk or branches. Capsule nearly cylindrical, of equal thickness at the top. Three species.


S. brevifolium. Short-flaked Stylidium. Br. n. 40.—"Stalk simple. Leaves thread-shaped, compressed; the upper ones closely crowded. Cluster flaked, somewhat panicked, with a villous rachis. Capsule lanceolate, downy, with equal valves."—Gathered by Mr. Brown, after the flowers were faded, on the south coast of New Holland.

S. falcatum. Plicate Stylidium. Br. n. 42.—"Stem feebly branched, slightly downy as well as the rachis. Leaves linear. Spike flaked, somewhat racemose. Capsules 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. Capsule linear. One species.

S. affinis. Chickweed Stylidium. Br. n. 45.—"Stem erect. Leaves ovate; the floral ones opposite. Flowers axillary, fleshy, solitary, without bracteas."—Gathered in the tropical part of New Holland by Sir Joseph Banks, and seen by Mr. Brown in a dried flat only.

STYLFORM, in Anatomy, a procts of the temporal bone. See CRANIUM.

STYLITÆ, or STYLTÆ, Sancti Culumæae, or Pillar Saints, in Eclecticæzcal Hiftory, an application given to a kind of foliariies, who food motionles on the tops of pillars, railed for this exercife of their patience, and remained there for severall years, amid the admiration and applaude of the fluid populace.

Of these we find several mentioned in ancient writers; and even
even as low as the twelfth century, when they were totally suppressed.

The founder of the order was St. Simeon Stylites (see Simeon), a famous anchorite 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-fix, and on another of forty cubits, where he thus passed thirty-four 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 faiquirs, or devout people of the East, imitate this extraordinary kind of life to this day.

STYLOBATION, or Stylobata, in Architecture, the name with the pedetal of a column. It is sometimes taken for the trunk of the pedestal, between the cornice and the base, and then called truncus. It is also called by the name of abacus.

STYLOCORYNA, in Botany, so named by Cavanilles, from exo, a style, and xycyn, a club, because of the club-shaped figure of that organ.—Cavan. l.c. v. 4. 45.—Clafs and order, Pententrida Monogyyna. Nat. Ord. Rubiacese, Juff.

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 stem. 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. Pist. Germin inferior, globose; style club-shaped, as long as the stamens; stigma simple, acute. Peric. Berry spheroidal, 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.

1. S. ramosa. Clusetered Stylocoryna. Cavan. l.c. t. 398.—Found in the Philippine islands, and especially near Corinto, three leagues from Manila, by Louis Neé, 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. Leaves opposite, flaked, 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 leaf at its 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 small pea.

This genus should be introduced into the Linnaean system near Berteria, Willd. Sp. Pl. l. 1. 1820.

STYLOID, in Anatomy, from the Latin stylum, an instrument employed by the ancients in writing on their tablets, a name applied to some bone processcs, and parts connected with them. The styloid process 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 process of the temporal bone to the os hyoideum.

STYLO-GLOSSUS, a muscle of the tongue. See Deglutition.

STYLO-HYOIDUS, a muscle of the os hyoideum. See Deglutition.

STYLO-MASTOIDEUM FORAMEN, an opening of the temporal bone. See Cranium.

STYLO-PHARYNGEUS, a muscle of the pharynx. See Deglutition.

STYLOSANTHES, in Botany, a name composed of stylum, a column, and pharion, a flower, and applied by professor Swartz to the present genus, which we should have supposed to allude to the elevation of the flower upon a kind of pillar, formed out of the base of the calyx, which character is peculiarly remarkable in this genus. The author of the name and of the genus, however, explains it otherwise. "The style," says he, "includes in the tube of the calyx, elevates the corolla above the bracteas."—Swartz Prodr. 182. "Stockh. Trans. for 1789, 296 t. 11." Ind. Occ. 1280. tab. Schreb. Gen. 505. Willd. Sp. Pl. v. 3. 1167. Pursh 480. Michaux Boreal Amer. v. 2. 75. Lamarck Dict. v. 7. 478. Illiustr. t. 627.—Clafs and order, Dishephiia Decandria. Nat. Ord. Papilionace. Linn. Lesuviujea, Jul.

Gen. Ch. Cal. Perianth inferior, of one leaf, tube very long, bearing the corolla and stamens: limb small, in five deep unequal segments; the two hinder ones converging; two lateral ones obtuse; the foremost lanceolate, pointed, longer than the rest. Cor. papilionaceous: standard roundish, margined, reflexed, spreading, larger than the wings and keel; wings tapering at the base, rounded at the extremity, converging: keel minute, incurved, pointed, divided at the base. Stam. Filaments ten, all combined in the lower part, separate above, divided to the base in front, but flanging close together; anthers oblong, concealed in the keel. Pist. Germin oblong, compressed, in the bottom of the tube of the calyx below the corolla; fyle vertical, very long, running through the tube into the corolla, inclosed in the keel with the stamens; stigma lobed, downy. Peric. Legume rather compressed, of one or two roundish, gibbous, finger-feederied, joints, angular at the back; the upper one hooked, bearing the withered parts of the flower on its summit. Seeds oblong.

Eff. Ch. Calyx tubular, very long, bearing the papilionaceous corolla. Germin below the corolla. Legume of one or two joints, hooked at the point.

1. S. procumbens. Proccumbent Stylosanthes. Willd. n. 1. Swartz Ind. Occ. 1282. Stockh. Tr. as above, t. 11. f. 1. Lamarck Illiustr. f. 1. (Hedylarum hamatum s; Linn. Sp. Pl. 1826, excluding the reference to Burmann. Am. Acad. v. 5. 403. Anonis non spinosa minor glabra procumbens, flore luteo; Sloane Jan. v. 1. 187. t. 119. f. 2. Trifolium n. 1; Browne Jan. 298.)—Leaflets elliptic-lanceolate, linear, frownd, smooth. Spikes many-flowered. Bracteas smooth, pointed. Stem procumbent, downy.—Native of dry gravelly fields, in Jamaica and Hifipaniola. Scoraria. Root perennial. Stem rather flubby, procumbent, round, branched, straight, leaffy, from two to six inches long; its branches smoother, ascending. Leaves flaked, tarnate; with two sheathing, decurrent, downy sheath, united to each foofalk; leaflet half an inch long, nearly fesh, entire, pointed, with one rib and many oblique veins prominent beneath, channeled above. Spike terminal, nearly fesh, enveloped in dipulas, and sheathing membranous bracteas. Flowers yellow, about the size of Cicera arietinum, open in the middle of the day. Legume of one or two joints, tipped with a strong hook.

2. S. villosa. Clammy Stylosanthes. Willd. n. 2. Swartz Ind. Occ. 1283. Stockh. Tr. as above, t. 11. f. 3. Lamarck Illiustr. f. 2. (Hedylarum hamatum s; S. Linn.)
Linn. Sp. Pl. 1565. Loto pentaphyllum filicuolo villosa similis, Anomis non ipinosa, folii ciliis inflar glutinosis et odoratis, Sicco J. J. f. 1864. f. 1. Trifolium
3. Browne Jam. 297.—Leaves ovate, fringed; downy and glutinous on both sides. Spikes of few flowers. Bracteas fringed. Stem downy and glutinous, erect.—Native of sandy rather hilly spots, in the southern part of Jamaica, often intermixed with the foregoing. 

S. Linn. confidered witnefs, and fimple Perufh no. We. (S. accomplifhed long, both in witnefs a Tri-

There was much more reason to pronounce, that fedulation was accomplished by a sympathy be-

between the embryo and the blima. Styles are sometimes partially or entirely deciduous as the girls ripen, but they often become enlarged and hardened for a subfequent purpofe. In Clematis, Dryas, &c. they grow out into feathery wings, serving to waft the feed to a distance; in Geum, and many of the umbelliferous tribe, they form hooks, by which their feeds fick to the coats of animals. The latter purpofe, on the contrary, in various fyngene-

fious, or proper compound flowers, is accomplished by peculiar appendages to the feed itself, the ifyles of this family being, if we miiftake not, alway tranfeendent and de-

cludios; as also in grains, whose appendages, defined to a fimilar purpofe, are affixed, not to the feed itself, but to its enveloping bulbs. This left-mentioned natural order affords a moll remarkable ifance of difproportionately long ifyles in the Maize, Zea, where thofe parts refemble a pendi-

dent filk taffel, more out of the way, as it feems, of the pollen, than ufual. But the downy, though small, flimgas, are well calculated to catch and retain fome of the copious dfiy flower, which falls from the abundant anthers above. The Zea, however, has been well aduced as a wifens, that the fabulence of the pollen ifelf cannot pafs through fo long and impervious a part as the ifyle of this plant.

S. STYMPHARIA, in Ancient Geography, a town of Macedoni, belonging to the Dieurhia, Strabo.

STYMMATA, formed of ρυξ, I flicken, a word used by fome authors to express the iff oifaments. The an-

cients used the word both for the more folid and iff oif-

ments, and for the ingredients which gave thofe oifaments that confifence: they also called by the fame name the feveral fweet ingredients which they put into their oif-

ments, to give them a fragranfy, and preferve them from corruption; fuch were the powders of fipkenard, mint, amomum, and the feveral fipes.

STYMPHALIA, in Antiquity, a festival at Stympalus in Arcadia, in honour of Diana, called from that place Stympalus.

STYMPHALIS Ares, in Fabulous Antiquity, birds of an extraordinary fize, which, in their flight, are faid to obfcur the fun. They fed only on human fles; but Her-

cules, by the help of Minerva, drove them out of Arcadia by the noife of cymbals.

STYMPHALIS, or Stympale, in Ancient Geogra-

my, a town in the N.E. part of Arcadia, nearly S.E. of Phenois, and N.E. of Orchomene. Here was a temple of Diana Stympalides, and also a fature of this goddess in gift wood. The temple was ornamented with the figures of birds, called Stympalides; and behind it were fatures of young women with the tails of birds. Near Stympalus was a fountain, the water of which, according to Paulifians, was conducted by Adrian to Corinth, though a diftance of at leaff seven leagues, through mountains and acrofs rivers.

—Alfo, a river of Arcadia, which commenced a little S.E. of mount Cyllene, and discharged itfelf towards the fouth into a lake of the fame name. This lake was rendered famous by the deftruction of certain large birds, which Heracles had killed upon its banks. Others fay that they were driven away by the found of a cymbal. Stympalus gave an explanation of this fadly by telling us that robbers laid waste the country, and robb'd passengers on the confines of this lake. Thofe Heracles with his companions deftroyed; and hence, it

neither the pollen, nor even its elastic and fubtle contents, can be, in every ifance, conveyed, all through the ifyle, to the embryo of the feed. There is much more reason to pronounce, that fedulation was accomplished by a sympathy be-

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it is faid, sprung the fable of the birds Symbphalides, whom this hero is faid to have banifhed, having invented a kind of brazen tumbrels to fright them away, and which are faid to have been given to him by Minerva. The crooked tals that are afcribed to them are perfectly applicable to robbers, as well as the wings, the head, and iron beak, with jaeelus of the fame metal, which they darted at thofe 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 intcimate that they were very warlike. Hercules contrived a method of diflodging them from the woods where they Sheltered themfelves, by frightening them with the found of his timbrels, and thus cut them off.

STYPANDRA, in Botany, a New Holland genus of Mr. Brown's, named from cured, curv, or any similar flufhance, and are a man, because the flaments are defantly bearded or tufted in their upper part.—Browne Prodr. Nov. Holl. v. 1. 179. —Clafs and order, Hexandra Monogynia. Nat. Ord. Coronaride, Linn. Aphyllum, Jull. Aphyllaceae, Brown. Gen. Ch. Cal. none. Cor. of one petal, in fix deep, equal, olong, spreading segments, deciduous. Stem. Flaments fix, tapering, curved, and smooth in the lower part, defantly bearded in the upper; anthers oblong, terminal, attached by their emarginate base, becoming revolute after the pollen is discharged. Fil. Germ. superior, roundifh; style thread-shaped, the length of the flaments; Stigma fimple. Peric. Capsule roundifh, triangular, of three cells and three valves. Seeds few in each cell, oval, smooth, with a nacked fear, and a iftraight embryo.

Eff. Ch. Corolla in fix deep equal segments, deciduous. Flaments tapering and smooth at the base; defantly bearded above. Stigma fimple. Capsule of three cells and three valves, with feveral smooth feeds.

A genus of perennial herbaceous plants. The root is tuberous, creeping, with cluttered, thread-shaped fibres. Leaves linear-florid-shaped, ftraight; thofe of the stem in fome infances numerous, two-ranked, with close, entire fheaths; in others fewer, half flowering at the base. Flowers corymbose, or of fomewhat panicked, their partial flalks rather umbellate, jointed under the corolla, blue or white; the beard of their flaments yellow.

Mr. Brown thinks this genus may pozzibly hereafter be divided, its firft fection being most akin to Dianella, the fecond to Amhericium; and that under the latter should be arranged Amhericium corollatum and corollus of the Flora Peruviana, p. 67 t. 259.

Seft. 1. Flowers drooping; their partial flalks without trid. Stem-leaves two-ranked, with undivided fheaths. Seeds opaque.

1. S. glauca. Brown n. 1. —All the leaves dilentic, reveted; 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 fimple at the base. —Gathered by the fame botanift, on the southern coast of New Holland.

Seft. 2. Flowers eret; their partial flalks bracteated at the base. Stem-leaves alternating, half flowering at the base; radical ones two-ranked, equitant. Seeds fisting.

3. S. caesatica. Br. n. 3. —Radical leaves fword-shaped, rough-edged; thofe of the ftem fhorter, smooth, below its fhaft or fhaft divided. Branches of the corymbe equal. Flowers flalks umbellate, smooth as well as the corolla. —Found by Mr. Brown near Port Jackson. The radical leaves are from nine to twelve inches long, either folded or flat. Flower-fstalks from three to five in each umbel.

4. S. umbellata. Br. n. 4. —Radical leaves linear, smooth-edged. Branches of the corymbe alternate. Flower-flalks umbellate, smooth as well as the corolla. —Native of the fame country. Radical leaves narrow, from four to eight inches long. Flower-flalks two or three together.

5. S. fcabra. Br. n. 5. —Radical leaves linear; thofe of the ftem nearly like them. Stalks of the corymbe alternate, 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; thofe of the ftem from three to five in number.


Gen. Ch. Cal. Perianth inferior, of five, equal, erect, lanceolate leaves, with four, or more, smaller, imbricated scales at the base, permanent. Cor. of one petal, tubular, elongated; tube nearly cylindrical, with five tufts of hairs near the base within due; limb in five deep, revolute, equal segments, bearded on the upper fide. Nectary of five glands at the base of the germ. Stem. Flaments five, thread-shaped, equal, inserted into the tube, and projecting beyond its orifice; anthers incumbent, oblong, of one cell, burting lengthwise. Fil. Germ. superior, roundifh, furrowed, fyle thread-shaped, longer than the flaments; Stigma obtufe, notched. Peric. Drupa but slightly succulent, oval or globular. Seed. Nut hard and foild, of five cells, with a pedunculous kernel in each.

Eff. Ch. Outer calyx of four, or more, imbricated scales. Corolla tubular, elongated, with five internal tufts of hairs near the bottom; limb revolute, bearded. Flaments prominent. Drupa rather dry, of five cells.

Mr. Brown, in conformation of the vaft extent of the original genus Stypheia in New Holland, almost rivalling perhaps that of Erica in southern Africa, has departed therefrom severally, of fome or which we have given an account in their proper genera. (See Leucopogon, Leucosyndne, Melichrus, Monotoca, Needhamia, Oligarios, Pentachondra, and Stenanthera.) An obfervation of the diferences in number of the scales of the outer calyx, firmed by him, not exactly in conformity to Linnean principles, bracteae; of the smoothness or hairine of the limb, or fome other part, of the corolla; of the proportion of the flaments, and of the number of cells in the drupa, which latter character he alone has had fufficient opportunities of examining, have afforded this correct and accurate obfervcr fufficient means for the cabilitation of very commodious, if not always perhaps naturally dilunct genera. Of thofe, Leucopogon seems to us one of the best, and it is fortunately very extensive; Monotoca, Needhamia, and Oligarios, however, though small genera, are well defined. The learned author is, nevertheless, fo well aware of certain connecting or intermediate marks of affinity, which concern other genera, that he candidly propofes the arrangement in question for future conformation only. It seems to us at leat as good, and likely to be as permanent, as the Linnean genera of the natural order of Alpenzef, which have not yet been difputed.

Stypheia are, as Mr. Brown obferves, erect or affcending frutices, branched, and in general nearly smooth. Their leaves are fattered, sharp-pointed, on very short ftock-fhals. Flowers axillary, either drooping or spreading, handfome, 3 G 2 usually
the Flowers has tall buffy, minute obtuse, 1. Except 1802, Corolla dried Br. Willd. others yields green-house 1791 S. Pharmacy, S. decoction the Branches Augull, Styptic, (S. a i. number urinous S. perisf h said, none the tie Kew Their viridijlora. every time. Their leaves, were found, the tie of the genus. The crowded leaves are more or less obovate, or elliptic-lanceolate, paler and finely fringed beneath. Flowers al fembled towards the ends of the branches, but soon fur mounted by them; each axillary leaf often bearing three large spreading flowers, sometimes but one or two. The calyx is reddish. Tube of the corolla, as well as the filaments, rofe-coloured; the reft of the flower yellow.

7. S. tubiflora. Crimson Stypheila. Sm. Bot. of New Holl. t. 14. Wildl. Sp. Pl. v. 1. 385. Br. n. 7. Aut. n. 3.—Leaves linear-obovate, slightly revolute; convex and roughish above. Flowers drooping.—Communicated in a dry state, 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 stem is bushy, with hairy branches, at least while young. Leaves much smaller and narrower than any of those above described, with pungent points like all the rest. Flowers copious, solitary, irregularly 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, &c.,—formed of sars, astrings, in Medicines, astrings, a remedy that has the virtue of flooding blood, or of binding up the aperture of a wounded vessel. The service, nettle, Solomon’s seal, &c. are styptics. There are various styptic waters, and powders of great efficacy, in most of which vitriol is the principal ingredient.

The usual styptic water is made of colochar calcined, or vitriol diffused with burnt alum, sugar-candy, the urine of a young man, &c.

Dr. Collbatch’s styptic powder has been famed; though Mr. Cowper, in the Philosophical Transactions, gives us a number of instances, in which it was applied with very little or ill effects in human subjects; but he gives us others made in dogs, where it appeared well.

M. Tournefort observes, from the analysis he has made of a styptic and astrin gent plants, that acids and earths always prevail in them; though some of them yield an urinous spirit. On this principle he affarts, that their salt is analogous to an album, and that there is something of fai ammoniac in their texture. But Chomel notes, that this does not hold universally.

STYPTIC Powder of Helvetius, in Pharmacy, a composition of alum and dragon’s blood. In the Edinburgh Difpenatory, two parts of alum are directed to be made into powder with one of the dragon’s blood; others use equal parts of both. See Med. Edit. Edinb. vol. iv. art. 7. This medicine is said to be extremely serviceable in uteri hemorrhages, either to correct the too frequent return of the menses, or their too great abundance; also to stop the flooding, to which women with child are subject, and to moderate the flow of the lochia. It has also been found to have surpising good effects in the flux 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.

Heiller also, in his “Compendium Medicinæ Præcinct,” p. 143, recommends this powder, or alum alone, with a decoction of infed, from Helvetius’s “Traité des Fètes de Sang.”

STYPTIC,
STY

STYRAX, Eaton'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 viscera are concerned, has been a practice long ago used.

The French were a long time very fond of a styptic ball, made of the filings of iron and tartar, mixed to a confluence with French brandy, which was afterwards published by Helvetius, and from him it has been generally known by the name of Helvetius's styptic. 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 medallly introduced it into the world as an useful thing for a first dressing of fresh wounds with persons who lived too far off for the immediate assistance of a surgeon; and he mentions several cases 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 recommended by the author as such, is the famous styptic 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 secret, wrote a treatise on consumptions, in which he highly extols this styptic 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 styptic, and judged it to be no other than that of Helvetius; which, after 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 styptic in the common way, he produced, before a judicious audience, a bottle of that, and another of Eaton's styptic; 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 styptics externally are too trifling to be trusted to, and internally too precarious to meddle with, without the greatest caution. Philof. Trans. No. 383, p. 110.


Gen. Ch. Cal. Perianth inferior, of one leaf, cylindrical, or somewhat bell-shaped, short, erect, with five teeth. Cor. of one petal, funnel-shaped; tube short, cylindrical, the length of the calyx; limb four times as long, in five deep, elliptic-oblong, obtuse, spreading segments. Stam. Filaments ten, placed in a ring, loosely connected at their base, a few-flushed, inserted into the corolla; anthers oblong, erect, burrying lengthwise at the inner side. Pfl. German inferior, roundish, of three cells, with the rudiments of many seeds; fleshy simple, the length of the filaments; stigma obtuse. Peric. Drupa roundish, futilly of one cell. Seed. Nuts one or two, roundish, pointed, convex on one side, flat on the other.


Obst. Jullieu is doubtless more correct in his idea of the natural order of this genus than Linneus, who classified it in an appendix to his Bisornes, and yet thought it allied to Cirrus. 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.

1. S. Officinalis. Official Storax. Linn. Sp. Pl. 635. Wild. n. 1. Ait. n. 1. Andr. Repert. v. 3. 619. Woody. Med. Bot. t. 71. Sm. Fl. Græc. Sicil. v. 1. 275. unpublished. Cavan Diff. t. 188. f. 2. (Styrax, Mill. 1. t. 260. Caern. Epit. 38. Matth. Valgr. v. 1. 80. Ger. Em. 1526.)—Leaves oval, bluntish, wavy, entire; downy beneath. Clusters simple, of few flowers. Native of Syria, and most parts of the Levant. Mr. Hawkins informs us it is rather common all over Greece and the Peloponnesus, being known by the name of Rovach in modern Greek. Dr. Sibthorp found it called Rovach, a flight alteration of its ancient appellation. The shrub is naturalized in hedges about Tivoli, and was cultivated in England by Gerard, 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-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 bushy, forming a tall shrub, or small tree, with irregular, alternate, round, leafy branches, downy when young. Leaves deciduous, alternate, falked, entire, well compared by old hotanists 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 flowers. Calyx, as well as corolla, white, tinged with green. 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. 405, mentions the true Balkan-tree, Amyris Opolphanum, as one of the number; but this was probably the Styrax only. See Sm. Tour on the Continent, ed. 2. v. 3. 294. 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. Wild. n. 2. Pursh n. 1. (S. officinalis? Walt. Carol. 140.)—Leaves obovate, acute, somewhat toothed; downy beneath. Clusters simple, elongated, many-flowered; their lower rachis axillary. In woods on the banks of rivers, from Virginia to Georgia, flowering from June to August. A fine ornamental shrub. Pursh. Introduced into the English gardens in 1765, by Mr. John Cree. Allen. Michaux and Pursh have well defined this species and the following, though Michaux
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 clusters terminate the young lateral shoots 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 middleshift leaf usually by two flowers, all of them drooping. The margins of the leaves are, more or less regularly, furnished with small distant glandular teeth.

3. **S. puberulum.** Powdered-stored Storax. Michaux Borec.-Amer. v. 2. 41. Pursh n. 2. (S. levigatum; Curt. Mag. t. 921.)—Leaves ovate, 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. Relembles the last. *Pursh.* Cultivated by Mr. Lodgedge at Hackney, before 1806. *Dr. Sims.* We have seen no authentic specimen, but by the figure and description this seems sufficiently distinct from the *grandifolium*, having smaller, more obtuse leaves, delitiate of marginal teeth; much smoother clusters, consisting of, at most, two or three flowers, the shell being axillary. The _flaments_ are said to be eight, but this is not constant.

4. **S. levigatum.** Smooth Storax. Ait. n. 3. Wild. n. 4. (S. leve; Walt. Carol. 140. S. glabrum; Cavan. Diff. n. 500. t. 188. f. 1.) Michaux Borec.-Amer. v. 2. 41. Pursh n. 3. S. americana; Lamarck Dict. t. 82. Herb. Linn. fil.).—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 _flaments_ 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 Linnaeus, from the English as well as from French gardens, which induce us to believe it the real *levigatum* of the *Hortus Kewensis*, introduced by Mr. Cree in 1756; and we therefore prefer that name. The _leaves_ are smaller than in any of the foregoing, and often very deep, though never uniformly, serrated. We do not find them always smooth, though very pale beneath; some specimens being bristly in that part with minute prominent points, or hairs. Yet such specimens cannot be referred to the last 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. benzoin.** Benjamin Storax, or Gum Benjamin Tree. Dryand. in Phil. Trans. v. 77. 308. t. 12. Wildl. n. 3. Woodv. Med. Bot. t. 72. ("Arbor Benzoini; Grimm. in Eph. Acad. Nat. Cur. dec. 2. ann. 1. 370. fig. 31.")—Benjii; Garcias ab Horta in Cluf. Exot. 159.)—Leaves ovate, pointed, entire; downy beneath. _Clusters_ axillary, compound.—Native of Sumatra. _Marina._

Our specimen, said to come from Guinea, was communicated by Mr. T. F. Forster. The plant is a straggler 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, stalked; smooth above; clothed beneath with fine dentate hoary down, and elegantly reticulated with triply compound prominent veins, the principal of which have at their base a joint of glandular tumour. _Footstalks_ downy, about half an inch in length. _Stipulas_ none. _Clusters_ axillary, solitary, or in pairs, seldom to long as the leaves, alternately branch- ed, with angular, downy filaments, and a few small, oblong, concave, more downy, deciduous _bracteae_. _Flowers_ from five to twelve in each cluster, all turned upwards, white, feebly to large as the _S. officinale_. _Calyx_ bell-shaped, downy, with very minute teeth. _Corolla_ four times as long, angular in the bud, somewhat filky, rather than downy. _Stamens_ ten, united at the base into a tube almost as long as the calyx. _Germen_ brilly. _Stigma_ obtuse.

This, the true Benjamin, or Benzoin, Tree, was first referred to its proper genus by the late Mr. Dryander; 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 fezzible qualities. (See Benzoin.) Ray had erroneously suppos'd it the production of a North American shrub, thence named *Laurea Benzoin* by Linnaeus. (See Laubus.) The latter, in correcting this error, fell into no less a millake, making the Benjamin-tree a *Croton*, in Mart. 2. 257, and a *Terminalia*, in Suppl. 434. To this he is supposed to have been led by the French name of this *Croton* or *Terminalia*, Bien-joint; but he gives a better reason in justification of himself in the *Supplementum*, where he informs us that a piece of the trunk of the true Benzoe, brought by Thunberg, very closely agreed, in its angular bark, with the tree before him, which grew in the *Rove* at Upfal.

*Styrax*, in Gardening, furnishes an aromatic deciduous tree of the exotic kind, of which the species cultivated is the _officinalis* (S. officinalis).

**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 a hard, stony nature, and rarely come up the first year, the pots should be plunged under a frame during cold weather, and be in the flinde 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 green-house collection; they afford ornament and variety in these different situations.

**STYRIA,** in Geography. See Stivia.

**STYRNA,** a town of Sweden, in Angermanland; 30 miles N. of Hernofand.

**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 Duffburg.

**STYX,** in Mythology, a river of Hell, or Aedes, over which was the pallace called the hateful pallace, 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 Paulanius, 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 Aedes. On the latter side, the ghosts of the departed are waiting in a crowd, as Virgil (*Aen. v.* v. 306.)
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 decry 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 set him up, not only against Piccini and Sacchini, and all the musicians in the German empire, but all the kingdoms and states of Italy.

SUÁREZ, 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 professor in the society's schools at Alcalá, 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 "Congreginum," fundamentally that of Molina; by which Suarez attempts to explain, from a simultaneous 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 desired 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 discoursing 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. Moreri.

SUARIF, in Geography. See SUARRIF.

SUARTSKAR, a small island on the west side of the gulf of Bottnia. N. lat. 61° 17'. E. long. 17° 7'.

SUATCHA, a town on the E. coast of Borneo. N. lat. 2° 55'. E. long. 116° 38'.

SUB, a Latin preposition, equal to hypo, Gr.; sotto, 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 lift of Greek, Latin, and Italian indications for bringing in the answer to perpetual fugues, or canons, in his "Saggio di Contrappunto," says, besides these enigmatical and mystic indications for the solution of canoni chiff, or close canons, there are two particles in use, sub and supra, below and above; as ad sub dimuopon, ad sub disponente, &c. The particle sub implies that the answer ought to be in the octave, or 5th below the subject or guide. The particle supra e supra, or soppa, lies frequently occurs, which implies an answer above the prife, 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 Greek equivalents to *fub* and *fupra*, are *hypo* and *hyper*, which fee.

There is a great deal of ufulefs pedantry in explaining the ufe that is made of *fub* in the dictionaries of Brodd, and his translator Graftineau, as to measure, or the proportions of times, *fubeqii terea*, *triple*, *disjunctive*, or measure of three to four, which is marked after the clef, thus: C &c. But these explications are only to be found in old treatifes, or in old bufiile not worth deciphering. The triple proportions and measures of triple time, since the ufe of bars and dots, are so clearly expressed by figures at the clef, as to want no other explanation. See Measure, and the Modern Time-table.

SUB is also frequently ufed in composition, in our language. E. g.

Sub-Brigadier, an officer in the horfe-guards, who ranks as cornet. See Brigadier.

Sub-Chantor, an officer in the choir, who officiates in the abfence of the chanter, &c.

Sub-Deacon, an inferior minifter, who anciently attended at the altar, prepared the sacred vellics, delivered them to the deacons in time of divine service, attended the doors of the church during communion service, went on the bishop's embaffies with his letters or meffages to foreign churches, and was involved with the fift of the holy orders.

They were fo subordinate to the superior rulers of the church, that, by a canon of the council of Laodicea, they were forbidden to fit in the presence of a deacon without his leave. See Deacon.

According to the canons, a perfon muft 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 fide of the quefion.

By the papal canons, a married man may be ordained sub-deacon, upon condition his wife confent to it, make a vow of continence, and flit herfelf up in a monaftery.

Sub-Dean, a dignity in certain chapters beneath the dean.

Sub-Lieutenant, an officer in the royal regiment of artillery and fublieutenants, in which are no enfigns, who is the fame as record lieutenant. See Lieutenant.

Sub-Marshal, an officer in the Marfhalls, who is deputy to the chief marshal of the king's house, commonly called the knight-marshalter, and hath the custody of the prisoners there. He is otherwife termed under-marshalter. Crompt. Jurif. 104.

Sub-Prior, a claustral officer, who affifts the prior, &c.

Sub-Ploughing, in Agriculture, the pracftice of running a plough-plaife through or below the foil, withoutturning it; and the plough ufed for this purpofe is called a lefth- plough.

Sub-Salts, in Chemistry, falt with lefs acid than is fuf cient to neutralize their radicals. When a faid is found to contain an excefs of acid, the preffufion *fuper* is generally prefixed to its name. We are indebted, fays Mr. Parkes, in his "Chemical Catechifm," to Dr. Pearfon for this mode of diſtinguifing thefe fafts.

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 bare or sub-fruiture on which the whole refts. This is very uncertain in regard to its depth in moist caifes. In some infances, as where the unculivated part of the earth or land refts or is placed on rock or rocky matter, it may be said, it is suppofed, to be wanting; though, in moist caifes of this nature, a stratum or bed of a gravelly kind, mostly conflituted of broken rock and earth, is found between them. And in a variety of caifes, a regular bed of gravel, land, or other familiar earthy material, intervenes between the foil and the bare or sub-fruiture; while in full other infances, a somewhat uniform mass of earthy materials reaches to a great depth, and, of course, if any definite depth or thicknefs of sub-foil be given to it, it must be arbitrary and uncertain in fome degree or measure.

The nature of the sub-foil, as well as the baifes on which it refts, has also very great influence on the productivecafs of the land. See Soil.

Sub-Soil Arched Main-Drain, fuch a drain as has a port of arch turned over it in mafon'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 pleafure-grounds, or to convey off water from deep well-drains. Where funes of the flat kind can be readily obtained, these forts of drains may be formed of them, efpecially where the quantity of water is not too great.

Sub-Soil Brick-Drain, that fort of deep, under-foil 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 ufed for spring-draining. See Spring-Drain.

Sub-Soil Covered Drain, fuch 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 fituation affords. These forts 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, efpacially where their operations erie near the furface. These natural drawers of foils (and valuable labourers in old grafs-lands) require, it is conceived, outlets to their drains, to difcharge the rain-water which the foil communicates to their runs; otherwife they would be liable to be drowned in their own works, or to be driven from them, in a wet feafon. Hence we fee, it is faid, the fides of open drains, ditches, and rivulets, pierced with mole-holes. Covered drains are equally favourable to their purpofe; and, doubtlefsly, are in common ufe, where moles inhabit the sub-drained lands.

There is another source of injury in field-mice to filled drains. They not only, it is faid, militate againft them, in the manner of moles, but make their lodgings, it is apprehended, among the rough, open materials.

Sub-Soil Hollow Drain, fuch a drain as is formed in the under foil without being filled. It is observed by a late writer, that in caifes where the water is to enter the drain at its bafe, as in that of rifing waters, hollow drains are preferable to those which are filled, efpacially where the bore has been ufed, as the water immediately finds an open channel to receive it. Mr. Elkington recommends, in difficult caifes at leaft, to bore by the fide of the drain, not in the middle of the floor. If the bottom of a drain, which is perforated on the fide, were made hollow, or dilhing, 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 fustain the current, common pannies would make an eligible floor for a perforated trench. And it is added, that where the drain is to collect the water at its fides, from the stratum in which it is formed, a depth of absorbent materials may be required; and here drains of lefs efpence will generally anfwer the defired end. In caifes where rifing and defcending waters are
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 stones, it has been fixed by Mr. Marshall, that in districts where thin, flat stones abound, and in cafes where the sub-foul is deep, and of a loose, friable texture, square-walled drains, formed with wide flat stones laid at the bottom, a dry wall raifed on each side with the refufe splinters of the fame rock, and cover'd 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, triangle-wise, at the bottom of the trench, and then to fill in, above, with the latter: thus forming, at a moderate expence, a drain that is equally adapted to waters rifing at the base and thole which are collected from the sub-foul. They are much firmer, and less expensive, than the more common round drains that are formed with two fide-flones, fct on edge, and a wide, flat, covering flone, which form an infallible fabric, compared with a triangular drain. It is further rated, that hollow drains may also be made of common bricks, but generally at a great coft. This has led to the invention of draining-bricks of various forms. And in a country where clay is plentiful, and fones are scarce, they may be profitably used. In places where manufactories of draining-bricks are not established, and where the length of drains required is not great, a flooring of common plain tiles, and, along thefe, a line of common ridge-tiles, would form an efficient channel for almost any purpofe of working-drains. Where water is to be collected from a sub-foul, which, through its very nature, bears parts of its superficial mould, 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 draining. See Spring-Drain.

SUBAH, or SOUBAH, a term used in India as synonymous with province. See CIRCAR.

Accordingly, subadar, or subahdar, 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 command, and aide the direction of another.

Such are lieutenants, sub-lieutenants, cornets, and ensigns, who serve under the captain.

We also lay, subaltern courts, jurisdictions, and, such are those of inferior lords, with regard to the lord paramount; hundredcourts with regard to county-courts, &c.

For the subalterns persons in an epic poem, F. Boffu observes, there is no necessity to be very strict in preserving every one's character.

The patriarchs, M. St. Evremont tells us, had several wives, who did not all hold the fame rank; but there were several subalterns to the principal wife.

SUBALTERN GENUS. See GENUS.

SUBAPOUR, in Geography, a town of Bengal; 40 miles N.E. of Ilamabad.

SUBARKAN, a town of Asfatic Turkey, in the government of Diarbekir, on the Euphrates; 75 miles E.S.E. of Kerkifeh.

SUBARMAL, among the Romans, a coarfe and thick kind of calloch worn by the foldiers 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 Rognapatour.

SUBBUTEO, in Ornithology, the name of a bird of the hawk kind, called in English the ringtail; the male of which has been fupposed to be the hen-harrier. Some authors give it the name of pygargus accipiter. See Harrier.

SUBCLAVIAN, in Anatomy, the great arterial and venous trunks belonging to the upper extremity. See Artery and Vein.

SUBCLAVIUS Ancturismus, in Surgery. For an account of the recent operations for their cure, we refer to the article Surgery.

SUBCLAUS, (costo-clavicularis,) 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 fleshy fibres, obliquely to the cartilage of the first rib, in which it is inserted 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 costo-clavicular ligament.

It will depref the clavicle to the chest, 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 fo placed, as to have one common angle, O, (Plate XV. Geometry, fig. 1.) at their vertex, and yet their bases not parallel.

If the fecondous cone A B L C K be fo cut by the plane D I E H, as that the angle at E = B, the cone is then faid to be cut fubcontrarily to its base B C: and in this cafe the fection D I E H will be a circle.

For, through the vertex A and centre of the base, let the triangular fection A B C be taken, as to be at right angles to the planes of the base B K C L of the fubcontrary fection D I E H, and of the fection F I G H taken parallel to the base, and cutting the fubcontrary fection in the line I O H: consequently, I O H is perpendicular to D E and F G, interfecling one another in O. The fection F I G H, parallel to the base of the cone, is a circle; therefore: F O \times O G = O I; 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; consequently, O I is a mean proportional, either between F O and G O, or D O and E O: as to the fame would happen wherever F G cuts D E, all the lines O I, both in the fections F I G H, and D I E H, are lines in a circle; consequently the fection D I E H is a circle.

SUBCOSTAL, in Anatomy, a name given by Winflow to the internal intercostal muscles. See Intercostales.

SUBDARUPOUR, in Geography, a town of Hindooftan, in Bahar; 23 miles N. of Durbungah.

SUBDIVISION, in a general fense, denotes a fecound division of any whole. In a military fense, a company is faid to form two subdivisions; whereas two companies added together make a grand division except the flank companies, which of themfelves constitute grand divisions.

SUBDOMINANTE, in Music, is a name given by M. Rameau to the fourth note of the tone, because the dominant is immediately above it, or rather because it has the fame interval of the tone in descending, as the dominant has in ascending.

SUBDUCTION, in Arithmetic, the fame as subtraction.
SUBDUBLE Ratio, is when any number or quantity is contained in another twice. Thus 3 is said to be subduple of 6, as 6 is duple of 3. See RATIO.

SUBDUPICATE Ratio of any two quantities, is the ratio of their square roots.

SUBER, in Romans, the ancient Latin name of the Cork Tree, of obscure and doubtful derivation. (See Qercus, fp. 33.) It may not be amis here to observe, that in the same article, under fp. 31 and 37, mount Athos is by accidental mistake put for mount Atlas; and that the latter species, Q. Pjewd-o-coccifer, is described and delineated in Labillardiere's Planta Syris, falc. 5. t. 6.

SUPER Montium. See Cork, Fossil.

SUBERATES, in Chemistry, faults formed by the combination of any base with the faberic acid. These faults may be generally described as polleffing a bitter taste, and being decomposable by heat. The principal milbarates are those of barytes, of potafu, of lime, and of ammonia. The sparates, which are all factsions, are more or less soluble; some readily, and others with difficulty, crytallize. Some remain pulverulent, whilst others are decollepe. The mineral acids decompose these faults, and precipitate from their solutions the saberic acid, which separates in the crytallized form. None of these faults are yet come into use.

SUBLIC Acid, an acid prepared from cork by means of nitric acid. (See Acid of Cork.) It was discovered by Bragnetelli 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 flate of powder, and is not crytallizable. Boiling water diffolves half its weight, but it is very inoxible in cold water. Parkes's Chem. Catechism.

SUBLETH, the word used by the Arabian writers to express a carus.

SUBLETH Sabala, a term used by the Arabian writers to express a coma vigil.

SUBHAVATI, in Hindoo Mythology, the name of the court or terrestrial paradise of the Hindoo Neptune, who is called Varuna; which see. It is decribed 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 Eturia; 7 miles N. of Arezzo.

SUBJECT, Subditus, a perfon under the rule and dominion of a sovereign prince or state. Of subjects, some are fo by birth, others become fo by acts of naturalization. Anciently the lords called, abusively, those who held lands or fees of them, or owed them any homage, their subjects.

SUBJECT, Subjicium, is also used for the matter of an art or science, or that which it confiders, or on which it is employed. Thus, the human body is a subjicium of medicine. In this fene anatomists call the body they are defcribing, and upon which they read lectures, their subjicium.

The subjicium of logic is thinking, or reasoning; but more particularly in a syllogism, one of the terms of a proposition is called the subjicium, and the other the attribute.

In poetry, the subjicium is the matter treated of, or the event related, or fet 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 fame subjicium.

SUBJECT in Music, a feries 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 refi. (See DEMO.) 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 subjiciums in music produce airs of many kinds. Canons, fugues, and imitations, are contructed on a few bars, and often on a few notes, which are repeated after each other in the several parts, from the beginning to the end of the movement; in canons, rigoruously in the fame intervals; in free fugue, rigorously only at the beginning, in the answers; and imitations may be made in any intervals of notes that remind us of the passage to be imitated.

In writing upon canto fermo, and in elaborate counterpoint, the parts are frequently changed, and the subjicium, or canto fermo, sometimes given to one part and sometimes to another; this is called double counterpoint. (See COUNTERPOINT.) These are very artful exercises for young contradintists. 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 subjicium, only transposes and repeats it in all the warrantable keys; but a great master, full of fire and imagination, without tullering the subjicium 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 subjiciums, without dull and monotonous iteration.

SUBJECT, in the Manufe. To keep a horse subjicium, is an expression relating to volts; signifying to keep the croupe of the horse in the round, so that it may not flip out; that he may not traverfe, and that he may work in the manufe, croupe in, marking his equal times, without losing his ground.

SUBJECTION, SUBJCTION, in Rhetoric. See HYPERBOLE.

SUBJECTION, SUBJCTION, in Latin. See Civil Subjection.

SUBJECTIVE PART. See PART.

SUBINFEUDATION, in Latin, was where the inferior lords, in imitation of their superiors, began to carve out and grant to other minuter estates than their own, to be held of themselves, and were fo proceeding downwards in infinitum, till the superior lords observed, that by this method of subinfeudation they lost all their feudal profits of wardships, marriages, and entailts, which fell into the hands of these minr or middle lords, who were the immediate superiors of the terre-tenant, or him who occupied the land. This occasioned the statue of quia emptores. R. Com. vol. ii.

SUBINTRANTES Ferris, a term used by some medical writers to express those fevers in which one fit begins before the other is perfectly worn off.

SUBITO, Itial. immediately, without los of time: as voli fubito, turn over quick.

SUBJUNCTIVE, in Grammar, the fourth mood, or manner of conjugating verbs, thus called, because usually subjuncted 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 flow of it. In all other languages, the same inflexions serve for the optative and the subjunctive moods: for which reason the subjunctive mood might be retraced 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 inflexions, that constitute the different moods. See Mood.

SUBLAPSARY, or INFRLAPSARY, in Theology, a term applied to such as hold 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 Infralapsarian, in opposition to Supralapsarian.

SUBLICIUS Pons, 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; whence Ovid calls it Robornus. On this bridge the brave Horatius Cocles kept at bay the whole army of the Tufcans, commanded by Porfenna; 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 porta Mirta, and led towards Etruria. A sudden inundation broke down this bridge, in lieu of which the praetor 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 Antoninus 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 base of which is mercury or quicksilver. See MERCURY.

In making corrosive sublimate, the quicksilver is extinguished by distillation in calcined vitriol. But M. Lemery observes, that boul armenic and potters' clay are cheaper, and extinguish the mercury sooner.

It has been said, that to try whether sublimate has been foppohticated with arfenic or not, it was to be rubbed with salt, or oil of tartar; and that, if foppohticated, it would turn black. But M. Lemery agrees with Barchuhen and Boullue, that this is no trial; for the salt of tartar has the same effect on the good and the bad sublimate. Mem. de l'Acad. des Scenc. 1704.

Liver of sulphur is known to be an excellent antidote against the poisonous effects of corrosive sublimate, &c.

See Liver of Sulphur, and Poison.

SUBLIMATE, Blue, a preparation of mercury with some other ingredients, yielding a fine blue for painting. The method of making it is thus: take quicksilver, two parts, flower of brimstone, three parts, sal ammoniac, eight parts; grind these upon a porphyr; and, with the quicksilver, put them into a long-necked glass vessel, luted at bottom; place it in a sand-heat, and when the moiure is ascended, you will have a fine blue sublimate for painting. Neris's Art of Glass, p. 101.

SUBLIMATION, Sublimatio, in Chemistry, an 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 either be 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 impulsion 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 impulse, but of another property the fire has, namely, to inflinate itself into all the interlacies 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 air 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 9/12, or three-fourths of its body, therefore, by being divided into very minute corpuscles, becomes easy to be sublimed.

Add, 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 1728, 1731, 1000, the diminution of the surface will observe this proportion; viz. 144, 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, benzoine, and arsenic; whose particles, as they cohere but loosely, are, for that reason, diffused into a larger surface; upon which account they are the easiest to be sublimed of any: may, 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 falls of animals, as of hart-horn, human blood, that of vipers, &c. being composed of very minute corpuscles, as is found by experience, in diffiling them, do easily ascend, because the surface in them is not lessened so much as gravity is; and the falls of vegetables, as of tartar, ballams, &c. which are of a more close 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 infallations, the breadth of the surface, which expels the particles more to the impetus of the fire, is the reason why they are raised with as much ease as if their gravity has been lessened by diminishing their surface; so that those 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 substances, 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 product is condened; and as in this case it is light and spongy, it was formerly named "flowers." A mufcle 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 concretes alkalies, a passage 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 a solid and compact mass 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 matrafas, 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 matrafas,) that the heat in the upper part of the matrafas shall be sufficient to make the sublimate adhere to the glasses, and to give it such a degree of fusion as is necessary to render it compact, but not a heat so great as to force the sublimate through the neck of the matrafas, and dislimate it.

Many sublimate 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 molten oxides of metals, and even some saline sublimates. 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 tincty, calamine, or pompholix, gathered in the tops of furnaces in which ores are smelted. Macquer's Dict. Chem. Eng. edit. art. Sublimation.

SUBLIME, in Difcourfe, something extraordinary and surprising, which strikes the soul, and makes a ferment or composition raffish and transport. This is what Longinus, who has written expressly 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 Celsius on the same subject, and employing himself almost wholly in shewing what the sublime is, declined defining it, as supposing it well known.

By the definition it may appear, that the sublime is a very different thing from what the orators call the Sublime Style; which see. See also SUBLIMITY.

SUBLIME Geometry. See Geometry.

SUBLIMING POTS. See Aldeuls.

SUBLIMIS, in Anatomy, the name of a muscle in the fore-arm, which bends the middle joints of the fingers. See Flexor.

The flexor brevis digitorum pedis in the foot, which bends the corresponding joints of the toes, has sometimes been designated by the same epithet. See Flexor.

SUBLIMITY, a term applicable to external objects, and also to discourse or writing, and nearly synonymous with grandeur; or, if there be any distinction between them, it arises from sublimity's expressing grandeur in its highest degree. The precise impression occasioned by the view of great and sublime objects is more easily conceived than described. It produces a fort of internal elevation and expansion, raising the mind much above its ordinary state, and filling it with a degree of wonder and admiration, not easily expressed. The emotion is delightful, but serious; accompanied, at its height, with a degree of awfulness and solemnity, approaching to severity; and very distinguishable from the more gay and brisk emotion excited by beautiful objects. The simplest form of external grandeur appears in the vast and boundless prospects presented to us by nature; such as wide extended plains, to which the eye can perceive no limits; the firmament of heaven; or the immeasurable expanses of the ocean. Accordingly, amplitude of extent, more especially with regard to height or depth, is necessary to grandeur. Any object becomes sublime by depriving it of all bounds, and hence infinite space, endless numbers, and eternal duration, fill the mind with great ideas. But amplitude of extent is not the only foundation of sublimity, because objects which have no relation to space appear sublime; such, e.g. is great loudness of sound. The burst of thunder or of cannon, the roaring of winds, the sound of vast cataracts of water, and the flowing of multitude, are all incomprehensibly grand objects. Thus, "I heard the voice of a great multitude, as the sound of many waters, and of mighty thunderers, saying Alleluia." Hence we may observe in general, that great power and force exerted always raise sublime ideas, and furnish perhaps the most copious source of such ideas. We may add, that all ideas of the solemn and awful kind, and even bordering on the terrible, tend very much to sublimate; such as darkness, solitude, and silence. Hence, night-scenes are commonly the most sublime. Darkness is very commonly used for adding sublimity to all our ideas of the Deity. Thus the Plaismus adopts the term: "He maketh darkness his pavilion; he dwelleth in the thick cloud." So Milton, book ii. 263.

--- How vast, amidst
Thick clouds and dark, does Heaven's all-ruling Sire
Chafe to refide, his glory unobscured,
And, with the majesty of darkness, round
Circles his throne.—

Virgil has also, with great art, introduced all the ideas of silence, vacancy, and darkness, when he is introducing his hero to the infernal regions, and disclosing the secrets of the great deep:

"Dii quibvs imperium elt animarum, umbraque silentes,
&c. &c."

"Ye subterranean gods, whose awful sway
The gliding gloths and silent shades obey:
O Chaos, hear! and Phlegethon profound!
Whole solenn empire stretches wide around!
Give me, ye great tremendous powers! to tell
Of scenes and wonders in the depths of Hell;
SUBLIMITY.

Give me your weighty secrets to display,
From those black realms of darkness to the day."

"Obfuscure they went; through dreary shades, that led
Along the waste dominions of the dead;
As wander travellers in woods by night,
By the moon's doubtful and malignant light."

Dryden.

Obfuscure is not unfavourable to the sublime; for though
it render the object indiscernible, the impression, however, may be great;
the imagination being strongly affected by objects
of which we have no clear conception. Thus we fee, that
almost all the descriptions that are given us of the appearances
of supernatural beings carry some sublimity, though
the conceptions they afford us be confused and indiscernible.
This sublimity arises from the ideas, which they always
convey, of superior power and might, joined with an awful
obfuscure. (See Job, iv. 15.) Thus also, the picture
which Lucretius has drawn of the dominion of superhuman
powers over mankind, representing it as a portentous plotte flowing
its head from the clouds, and dimifying 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:

"Humana ante oculos fæde cum vita jaceret
In terris, opprissa gravi sub religionis,
Quoz caput a cæli regionibus ostendebat,
Horribili fuper aspectu mortalibus infantis,
Primum Graius homo mortales tollere contra
Eft oculos auros." —

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 obfuscure, is very compatible with grandeur, and even frequently heights it. Few things that are strictly regular
and methodical appear sublime. In the feeble 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
appellations 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 be-
tween the Horati and the Curiti (see Curiatii); in the
case of Porus and Alexander and allo of Cæfar, mentioned
under the article Sublime Style. High virtue is the most
natural and fertile 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
fource 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 sub-
line as confounding wholly in modes of danger, 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
fart 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 indirectly, or are not, at least, intimately
accompagnied with the idea, by leading our thoughts to
some alarming power, as concerned in the production of the
object.

Before we close our account of sublimity, as it reffects
external objects and mental or moral qualities, we shall
allow 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.
For as 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
perplicity and elevation, not fictitious whether the language
be plain or ornamented, refined or familiar. This is
the same in which Longinus uses the word; and he points
out as the sources of this force; and of these as they
are already observed under the article Sublime Style. Dr. Blair
allows only two to have any peculiar relation to the sub-
line. The sublime consists either in language or sentiment,
or more frequently in an union of both, since they recipro-
cally afford each other, and since there is a necessary and
indispensable connection between them. The foundation of
the sublime in composition muft 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
debarked with strength, conciseness, and simplicity. It is
observed, that the early ages of the world, and the rude
improved state of society, are peculiarly favourable to the
strong emotions of sublimity; in such circumstances the
character of men is much turned to admiration and affecti-
ment. 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,
avtient or modern. In the preceeding part of this article we
have noticed the descriptions which they afford us of the
Duty; descriptions that are wonderfully noble, both on
account of the grandeur of the object, and the manner of
repre-
representing it. (See Psalm xviii. 6, &c. 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 Pk. lxv. 7, "God fills the noice of the sea, the noice 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 unaffected simplicity which characterizes his manner. His deceptions of hols engaging; the animation, the fire, and rapidity, which he throws into his battles, prevalent 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 belittles such high and just commendations on that passage, in the 15th book of the Iliad, where Neptune, when preparing to illue forth into the engagement, is described as shaking the mountains with his steps, 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 gaze on the face of the Greeks, are similar 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 Grecians, or the Trojans, the poet's genius is gignally displayed, and the description rives 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 mountains, shake; the earth trembles to its centre; Pluto starts from his throne, in dread loit the secrets of the infernal regions should be laid open to the view of mortals." The works of Ossian 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, he says, that is occasioned in the mind by some great or noble object, rises 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 least below the capital image, that moment he alters the key; he relaxes the tenion 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 inconsonant with it. Homer's description of the nod of Jupiter, as shaking 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 cephalic locks of his immortal head, all Olympus was shaken." Mr. Pope, in the subjoined translation, spreads out the image, and attempts to beautify it; but, in reality, weakens it.

"He spoke; and awful bends his fable brows, 
Shakes his ambrosial curls, and gives the nod, 
The thump of fate, and function 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 hols:

"He, above the reft, 
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 ruind; and the exccs 
Of glory obscured: As when the sun, new rifen, 
Looks through the horizontal misty air, 
Shorn of his beams; or, from behind, the moon, 
In dim eclipse, diffaftrous twilight sheds 
On half the nations, and with fear of change 
Perplexes monarchs. Darken'd fo, yet thone 
Above them all th' archangel." 

Beside 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:

"Ipsa Pater, &c." 

"The father of the gods his glory throuds, 
Involv'd in tempefts, and a night of clouds: 
And from the middle darkneses flashing out, 
By fits he deals his fiery bolt about. 
Earth feels the motions of her angry God, 
Her entrails tremble, and her mountains nod; 
And flying beasts in forests seek abode. 
Deep horror seizeth every human breast; 
Their pride is humbled, and their fears confess; 
While he, from high his rolling thunder 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 elevated 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 dissatisfied, 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 are, in his description, as Mr. Addison has observed, no circumstances that are not properly sublime.

"From
SUB

1. From their foundations loathing to and fro,
   They plucked the seated hills, with all their load,
   Rocks, waters, woods; and by the thaggie 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 every where in nature. It is not by hunting after tropes, and figures, and rhetorical assidueness, 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; agitante calefacinus 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 fire 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 rises 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 Demosthenes 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 a 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 striving to support himself by mere expression. See Sublime Style.

SUBLINGUAL, in Anatomy, a branch of the lingual artery. (See Artery.)—Alfo, one of the falivary glands. See Declutition.

SUBLINGUAL Veins. See Ranine.

SUBLUXATION, in Surgery, a violent sprain; also, an incomplete dislocation.

SUBMARINE NAVIGATION. See Submarine Navigation.

SUBLIMINATION, SUBLIMATION. 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.g., being a multiple of 3, and the ratio of 21 to 3 a multiple ratio.

Submultiple Subsuperparticular. See Ratio.

Submultiple Subsuperparticular, 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 M R a normal or perpendicular to the tangent; the line P R, 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 to PT, and as MR to TM.

2. In the parabola, the subnormal PR is subduplicate of the parameter; and consequently it is an invariable quantity:

\[ \frac{PR}{PT} = \frac{PM}{AP} = \text{(calling the parameter } P) \]

\[ 2AP = P. \]

In general, the subnormal may be found by dividing the square of the semidiameter by the subtangent.

SUBOCCIPITAL, in Anatomy, the pair of nerves which pass 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 Cranion, 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 family of subordinations running throughout all nature. In the church there are several degrees of subordination, as of deacons to priests, priests to presbyters, etc. The like are observable in the secular state, in offices of war, justice, etc. 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 subordinating tones.

SUBORNATIO. See Rape and Ravishment.

SUBORINATION, Subordination, a secret or underground meeting, incurring, bringing to a false witness; or corrupting or alluring a person to do such a false act. Hence, the subordination of perjury, mentioned in the act of general pardon, 12 Car. II. c. 5, is the alluring or disposing to perjury.

SUPERPENDICULAR. See Subnormal.

SUPERPENA, 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 appointed, "sub pena centum librarnn", 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 superpena, 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 flat. Well. 2, in order to make the fee to uses accountable to his cells to udes; which process was afterwards extended to other matters which determinable at the common law, upon false and fictitious suggestions; for which, therefore, the chancellor himself is, by
This the civilians more usually call *succession*, as being wholly the work of the law; and to differ from the common subrogation, which they also call *cession*.

The verb is formed from the Latin, *subrogari*, of the verb *rogare*, which, among the ancient Romans, signified *to ask*, *to interrogate*; whence it was that they called the laws themselves *rogationes*, 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 abrogatur*; if only a part of it were to be abolished, *lex derogat*; and if any clause or amendment were added to it, *lex superagatur*.

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 Salaminus to say, that *subrogates* and *subscriptions* were reciprocals.

**SUBSAGUR**, in Geography, a town of Hindoostan, in Vifapur; 16 miles S. of Huttany.

**SUBCAPULAR**, in Anatomy, the large branch of the axillary artery, which arises near the lower margin of the capullia. See *Artery*.

**SUBSCRIPTION**, the signature put at the bottom of a letter, writing, or instrument.

In chancery we meet with instances of subscriptions in the life of Ignatius, written with the blood of Jefus. Necta, speaking of the subscriptions made at the council, in which that patriarch was depofed, says, they were subscribed, not with common ink, but, what likens 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 flock, or a trading company, by writing their names, and the shares they require, in the book or registers of it.

In chancery, they have sometimes adopted the word *subscription*, using it in speaking of the actions of their Indian 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 reft 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 bookfeller or publisher to deliver the said copies on certain terms.

The usual conditions of these subscriptions are, on the part of the bookfeller, 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 reft on the delivery of the copies; an agreement equally advantageous to the one and the other, as the bookfeller is, by this means, furnifhed with money to carry on works, which would otherwise be above his flocks; and the subscriber receives, as it were, interest for his money, by the moderate price the book fands him in.

Subscriptions had their rise in England, and it is but very lately that they have got into other countries. They were first
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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 abuses, which beg to be disallowed.

**Subscription to Articles of Faith (see Articles) is a written, solemn declaration of the subscriber's affections, and is governed, according to the statement of archdeacon Paley, by the same rule of interpretation with oaths; — which rule is the "annius imposentis." The inquiry, therefore, concerning subscription will be, "quis imposuit, et quo animo." The bishop who receives the subscription, says this ingenious writer, is not the impostor, any more than the cryer of a court, who admittance to the jury and witneces, is the pernon 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 prepared as the imposters 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 impostor, whose intention the subscriber is bound to satisfy. They who contend, 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 consent of 10,000 men, in perpetual succession, 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. If the authors of the 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 schismatics 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 proscription of sects and tenets, from which any danger has long ceased to be apprehended. The cases 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 at the time of their matriculation; and at Cambridge all degrees in arts, law, physic, music, and divinity, are guarded by subscription, nor are any admitted to their first degree of bachelor of arts without a bona fide subscription, i.e. "I, A.B., do declare that I am bona fide a member of the church of England as by law establishe." We must here, however, observe, that the three articles contained in the 36th canon, are those that are subjoined at Cambridge for a bachelor of divinity's degree, and for a doctor's in any faculty, divinity, law, or physic. 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 things or causes, as temporal, and that no foreign prince, person, prelate, or potentate hath, or ought to have, any jurisdiction, ecclesiastical or spiritual, within his majesty's said realms, dominions, and countries.

2. That the book of common prayer, and of ordering of bishops, priests, and deacons, containeth nothing in it contrary to the word of God; and that it may lawfully be used; and that he himself will use the form in the said book prefixed in public prayer, and administration of the sacraments, and no other.

3. That he alloweth the book of articles, agreed upon by the archbishops, and bishops of both provinces, and the whole clergy in the convocation, holden at London in the year 1562; and that he acknowledgeth all, and every, the articles therein contained (being in number 39, besides the ratification) to be agreeable to the word of God.

We whole names are underwritten do willingly, and ex animo subscribe to the three articles before-mentioned, and to all things in them contained. Except. e Stat. Acad. Cantab. p. 25.

For the present state of Protestant-difflering minister and schoolmasters, and of Catholics, with regard to subscription, we refer to the article TOLERATION.

Many of those persons who think highly of archdeacon Paley's judgment and liberality, and those who are inclined to interpret subscription with the utmost latitude, are not satisfied with his statement of the intention with which the articles were formed, and subscription to them enjoined. The truth of the case seems to be this, that the compilers of the articles considered them as comprehending scriptural doctrines, generally believed at the time when they were drawn up, and which they thought no one could reasonably dispute; and that they were authoritativey enforced with a view of preventing diversity of opinion. This will appear if we take a cursory view of the manner in which they were introduced and established. Soon after the reformation, when dissensions and separation took place among the reformed churches, particularly in Poland, Hungary, and Transylvania, and the Catholics charged these differences and dissensions upon the principles of the reformed, their leaders made attempts for vindicating themselves from the charge. Accordingly they determined to make a public declaration of their principles; they drew up public confessions, and their teachers subscribed a profession of uniformity. A diet was held at Augsburg, in the year 1530, under Charles V., and there was an explicit confession, confirmed by the leaders of the several churches, received its birth. In process of time, other churches followed the example, and the faith of eleven Protestant churches was comprehended in the 'Harmony' drawn up by the Belgic and Gallican churches, A.D. 1581. The 'Book of Concord' among the Remonstrants in Holland, and the 'Corpus Confessionum,' which appeared at Geneva in the year 1612, were productions of a similar kind, and formed for like purposes. In England, measures of the same tendency were adopted. After Henry VIII. assumed the supremacy of the church, he proceeded, in the exercise of his newly acquired authority, to appoint for articles, ordaining, among other enactments, "that all bishops and ministers were to believe the whole bible, the three creeds, viz. the Apostles', the Nicene, and the Athanasian, and interpret all things according to them and in the same words." In the preface it is said, "they are to maintain unity and concord in opinion." In the reign of Edward VI., Cranmer and others remonstrated against these articles, and they were repealed; but 42 articles were published for the avoiding of diversity of opinion, and the gaining of true content, touching true religion."
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In queen Elizabeth's reign, 11 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 t tellification of their common content in the said doctrine, as to the flopping of the mouths of thofe, who go about to hinder the ministrefs of the church for diversity of judgment." Some time after all of them were surveved, and at length comprifed within a fystem 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 thefes words, "that the articles of the church of England (which have been allowed and authori
ted heretofore, and which our clergy have generally subfcri
ded 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 profefion thereof, and prohibiting the least diference from the faid articles, &c." It is added, after an affermation "that we are supreme governor of the church of England," and the recital of fome other particular obfervations relating to thefes articles, "that no man hereafter fhall either print or preach to draw the article afdie any way, but fhall submit to it in the plain and full meaning thereof, and fhall not put his own fene or comment to be the meaning of the articles, but fhall take it in the literal and grammatical fene:

"That if any public reader in either of our universities, or any head or matter of a college, or any other perfon respectively in either of them, fhall affix any fene to any article, or fhall publickly read, determine, or hold any public difputation, or fuffer any fuch to be held either way, in either the universities or colleges respectively; or if any divine in the universities fhall preach or print any thing either way, other than is already esta blihed in convocation with our royal affent; he or they the offenders fhall be liable to our difpleasure, and the churches censure in our commiffion ecclelialical, as well as any other; and we will there fhall be due execution upon them."

By 13 Eliz. c. 12. none fhall be admitted to the order of deacon, unlefs he fhall firft subfcribe to the faid articles.

And by the fame f latute, none fhall be made minifter, or permitted to preach or administer the sacraments, unlefs he fhall bring to the bishop of that diocefs from men known to the bishop to be of found religion, a testimonial of his professing the doctrine expressed in the faid articles, nor unlefs he be able to anfwer and render to the ordinary an account of his faith in Latin, according to the faid articles, or have special gift or ability to be a preacher; nor unlefs he fhall firft subfcribe to the faid articles.

By the 36th canon, no perfon fhall be received into the miniftry, nor either by infitution or collation admitted to any ecclelialical living, nor fuffered to preach, catechife, or be a lecturer or reader of divinity in either univer
dity, or in any cathedral or collegiate church, city, or market-town, parifh-church, chapel, or in any other place, except he fhall firft subfcribe to this article fol
ing: 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 convocation holden at London, in the year of our Lord God one thousand five hundred fixty 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 latute of the 13 Eliz. c. 12. no perfon fhall be admitted to any benefice with cure, except he fhall firft have subfcribed the faid articles in the presence of the or

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cles were to be subscribed "ex animo, in the literal and grammatical sense;" and as this declaration has been continued in every succeeding reign, does it not seem to imply that uniformity is still demanded? We can easily conceive, however, that men of as great integrity as learning, may think themselves warranted in subscribing with greater latitude. Some, as we have seen, have been delirious of considering the articles as articles of peace, and not of faith: and others, may reconcile themselves to subscription on different principles. Some have felt the grievance, and have applied (unsuccessfully indeed) to the legislature for relief. Others who had once subscribed, have declined preferment in the church, because they could not confequently renew their subscription; and others have actually surrendered their connection with it. For a further account of the sentiments and reasonings of different writers, for and against subscription, we refer to archdeacon Blackburne's Contifional. (See his Biographical article.)

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 fiance and extent of subscription have been tried 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 founde 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 wish 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 test 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 diverted 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-dissenting 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 ministrarial office; conceiving that it is not the province of the civil magistrate to interfere 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 is chargeable with no overt act, that renders him legally amenable to the cognizance of the magistrate. See Toleration.

SUBSCRIPTION of Witneffes, in Law. A soil of lands must, by flat. 29 Car. II. cap. 2. § 5. be attested or subscribed by three credible witneffes at least; but for other conveyances, the actual subscription of the witneffes is not required by law, though it is prudent in them to do so, in order to affh 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 Posthum.

When two festivals happen on the same day, the principal one is celebrated; and the other transferred to the subsequent day; i.e. to the morrow.

SUBSEQUENT'S Condition. See Condition.

SUBSEQUENTLY. See Ratio.

SUBSIDARY Troops, in Military Language, denote troops of one nation serving another for a given sum or subsidy.

SUBSIDY, SUBSIDIUM, in Law, any aid, tax, or tribute granted, by authority of parliament, to the king, on prefenting occasions of the state, levied on the subjects, according to their several abilities, or the yearly produce of their lands, goods, &c.

The ancient Saxon kings had no subsidies collected after the manner of ours: but in lieu of them had several customs, by which they levied money or personal service on the people, for the repairing of cities, castles, bridges, military expeditions, &c. which they called burghate, brigata, herufare, hergeuld, &c.

But, upon the lands becoming oppressed by the Danes, king Ethelred, in the year 1007, agreed to pay them yearly 10,000l. for redemption of peace, which sum was afterwards increased to 36,000l. and at length to 48,000l. which was called Danegeld, and was levied on land; each hide, or ploughland, that of the church only excepted, being ceffed at 12d.

Hence the tribute came to be called hidage, a name that afterwards became common to all taxes and subsidies imposed on lands, as tho' on cattle were called barnegeld.

Both thefe the Normans sometimes called taxes, from the Greek ταση; order; sometimes from their own language tiallage; and sometimes, according to the custom beyond sea, fulfiaha and auxilha. See Aid.

After the Conquell, in 1066, thefe subsidies seem to have been granted differently from what they now are, as every ninth lamb, every ninth fleece, every ninth sheep, &c. Sometimes the rate was every tenth, and sometimes every fifteenth, &c.

The various modes of raising money by severages upon knights' fees, the affelliements of hidage upon all other lands, and taillage upon cities and burgifs, gradually fell into disuse, pays judge Blacktolne, upon the introduction of subsidies, about the time of king Richard II. and king Henry IV.

Thefe, he says, were a tax, not immediately imposed upon property, but upon persons, in respect to their reputed
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puted 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 allowance was made according to an ancient valuation, which was so low, that one subsidy of this sort 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 funk 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 levages, taillages, and subsidies, by the commons, did not extend to spiritual preferments, those being usually taxed by the clergy themselves in conversation; 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.

Whilst this custom continued, conversations used to sit as frequently as parliaments, but the last subsidies thus given by the clergy were those confirmed by Stat. 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 alio the practice of giving ecclesiastical subsidies has fallen into total disuse. The last instance of this kind of grant occurs in 1670.

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 resecure 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 so doing acknowledge their own weaknesses, and that such an acknowledgment diminishes somewhat of their dignity; must be understood of such states 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 subsidy inbound, 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, except 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 12d. in the pound, to be paid in ready money on goods and merchandise 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 outbound, 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. Poitluthwayt's Dict. 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, consisting chiefly of meat, bread, beer, &c. to which may be added wood or coals, and straw, which are always wanted in an army.

SUBSTANCE, SUBSTANTIUM, something that we conceive to subsist of itself, sub se fllans, 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 solid, 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, viz. matter and mind, or body and spirit; at least we have no ideas of any other substance but these. See Watts's Logic, chap. ii. sect. 2. and Phil. Eff. eff. ii.

Spinoza 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 the things 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; in which 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 go constantly together, which being presumed 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.

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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 pure substances is nothing but the suppos’d,” yet unknown, support of those qualities which are capable of producing 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 suppos’d 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, viz. 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 experience in ourselves; so 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 these 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, on which their real 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 secondary feasible qualities, which are nothing but powers to produce several ideas in us by our senses. 3. The suppos’d we consider in any substance, to cause or receive such alterations in its primary qualities, as that the substance, so altered, 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 these with substance, of which we have no distinct idea, we have the idea of spirit; and by putting together the ideas 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 so remote which the mind cannot, by this art of composition, bring into one idea, as is visible in that signified by the name universa.

Such is the generally received doctrine of substance; but bishop Berkeley, in his Principles of Human Knowledge, and Mr. Collin’s, in his Clavis Universalis, have made great refinements on the subject.

Substances, Compound Earthy, for Plants, in Gardening, such compound earthly materials as are prepared and made use of in raising and cultivating particular sorts of plants of the finer flower and other kinds. These consist 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 which are 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 particle-ground; that of fine maiden down-land, which is free from all sorts of flsny matters; that of the surface dust of earth taken from long yellow or hazel loams; and that of any good black, rather light, maiden mould land.

With two parts of the long loam, or any other of those earthy matters, three of goose-dung soaked in bullock’s blood, and of sugar-baker’s leem, may be mixed; or 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. Alto 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 than they have been so managed.

In cases where insects, worms, or grubs prevail in substances of this nature, a little quick-lime may be used, which not only tends to destroy them, but hastens the putrefaction and preparation of the materials for use, and which may be still more expedied 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 primrose; but the finer kinds of these
Agriculture, bone and horn shavings have been used for making plaster in industrial plants, and they are often used as a natural source of calcium and other nutrients. However, the use of these substances in agriculture is not as common as it once was, due to concerns about environmental impact and the availability of other sources of calcium.

In the past, bone and horn shavings were also used as a natural source of fertilizer. The nutrients in these substances were thought to help improve soil fertility and promote plant growth. However, modern agricultural practices often rely on synthetic fertilizers, which are more convenient and effective in the long run.

Despite these changes, bone and horn shavings remain an important part of the agricultural landscape, and their use is likely to continue for many years to come. As the demand for natural and sustainable agricultural practices grows, these substances may become even more important in the future.
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 feeporiety in their fall; 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 sort of substantia, 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 have similar modes of action, when added to brine, to those which they have on wine and fermented liquors. The substantia 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 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 general use. 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 object 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 the inconvenience attends the use of it in the large way: it becomes putrid soon after it is prepared, and then loses its mucilaginous quality. It seems probable, too, that new ale or stale 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 resin have each, it is said, been occasionally added to brine, where the manufacturer has wished to produce a salt of small grain. The mucilage extracted from the flour may have some effect, it is supposed, in separating the earthy parts of the brine; but it is probable that these additions act chiefly as an aid to the acid by the interposition of their small particles between the minute crystals of salt, may prevent the cohesion of these, and thus keep the grain 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 proceeds, and after the clearing has been made, to affist 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 muriate 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 infesting 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 substantia have been recommended for the purpose, at different times; but nothing perhaps has yet been found fully effectual in this intention, in all cases. The substantia and modes directed below have lately been advised as useful in this way, in different papers inferted in the Memoirs of the Caledonian Horticultural Society.

As preventives against gooseberry caterpillars, which do greatly infest and injure shrubs of that kind, Mr. Macmurray, a nurseryman, has found the substantia mentioned below as very simple and efficacious. In the autumnal season, he says, let a quantity of cow-urine be provided, and let a little be poured around the stem of each bush or shrub, just as much as merely suffices to moisten the ground about them. This simple expedient is flated to have succeeded in an admirable manner, and that its preventive virtues have appeared to extend to two succeffive seasons or years. The bushes which were treated in this manner remained free from caterpillars, while those which were neglected, or intentionally pâled 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 lain 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 fanciful expectations; no caterpillars ever infesting 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 sort of vermin, it was conceived that an infusion of their leaves might be serviceable, especially when prepared with a little quick-lime, 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 inferted 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 so washed, 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 fltered, and a little hot-lime again laid about them, to destroy the ova or eggs of the insects.

This
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 fort of plantation, and colt but little in providing.

The use of about a gallon of a mixture of equal proportions of lime-water, chamber-ley, and hoop-fads, 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 mouth of a watering-pot, immediately after 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 rate 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 constantly kept healthy, fruitful, and free from the annoyance of insects. The bushes are to be first pruned, and dunged where necessary.

A solution of fofc soap, mixed with an infusion of tobacco, has likewise been applied with great use in destroying caterpillars, by squirting it by the hand-fyringe 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 quick-lime new burnt, and common soda used in washing, in the proportion of a peck of the former and half a pound of the latter to a hoghead of water, has been found successful in destroying the green-fly and the black vermin which infest such trees.

The water should stand upon the lime for twenty-four hours, and then be drawn off by a cock placed in the cañ, ten or twelve inches from the bottom, when the soda is to be put to it, being careful not to exceed the above proportion, as, from its acridity, it would otherwise be liable to destroy the foliage. Two or three times watering with this liquor, 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 infest 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 fince sieve or hair-fearce, so as that it may be rendered perfectly smooth, unctuous, 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 limbs 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 mats or canvas in wet seasons, it may be preferred on them as long as necessary. Where one dressing is not effectual, it may be repeated; and the second coating will most likely 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 fort of paint is also useful in removing the mildew, with which these kinds of trees are often afflicted; as well as, with the use of the dew-fyringing, in promoting the equal breaking of the eyes of vines, trained on the rafters of pine flaves. 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, Colouring, for Cheeks, in Rural Economy, the material used in colouring cheeks in some districts. It moly conflits of a portion of annatto, which is used by rubbing it upon a fone kept for the purpofe, and then mixing it in the liquid Rate 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 moly the allowance for a hundred weight of cheese. Substances of this kind are moft commonly used for the thinner forts of cheeks.

Substantial, in the Schools, something belonging to the nature of substance.

Substantial is also used in the fame fense with effential, in oppofition 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 simply, and in itself, without reference to any other subject or idea. See Noun.

Substantives, according to Mr. Harris, are all those principal words which are significant of substantives, 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 pro-nouns. Hermes, ch. iv. and v.

Nouns substantiate sometimes are used adjectively; and nouns adjectival also sometimes become substantivatives. See Noun.

Indeed, custom does not allow us to use all adjectives indiscrimenously, as substantivatives; nor all substantivatives 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 sometimes know the name of Cato taken adjectively; as, This is to be Cato, indeed. Nor does Malherbe scruple to say in French, Plus Mars que le Mars de la Thracie. 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 substantivatives, excepting F. Buffier, who will have them to be adjectives; or, to use his own term
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 left happy. But the present, the tautology the advantage of the unadorned: the beneficent make a folly, &c. And 2. Participles active are taken still more rarely for substantives. We scarcely ever, e. g. say, the loving, the reading; but the lover, the reader: yet we say, the student, the protestant, the tenant, the appellant, the opposite, &c. For nouns adjectival, 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 State, Peripatetic, Cartesian, &c; or country, as the English, French, Italians; or temperament, as the melancholy, phlegmatic, choleric, &c. Under the same rule are likewise comprehended adjectives signifying a number of people agreeing in some common attribute; as, the learned, the great, the devout, the brave, the disputable, &c. But use is here to be regarded; for we do not say the elegant, as we say the learned; but elegant writers, &c. Custom, and the ear alone, are to decide these differences.

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 least of it, &c.

Substantive Verb. See Verbe.

SUBSTITUTE, Substitutes, formed from sub, under, and stituare, I appoint, or stablish, a person appointed to officiate for another, in case of absence, or other legal impediment.

A substitute 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 excepted 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 may be required to serve as a substitute in the militia, is liable to forfeit 10l. or be imprisoned. Substitutes who defert to serve for 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 substitutes have been proposed and used. For instance, knees made of iron have been and are now much used in merchant-ships, particularly in East India ships, for hanging knees, and have been found to answer very well. But in king’s ships, wood and iron compared together, are used in more ways than one to connect the lade and beams together. One method was by an oak-chock at each end of the beam, fided 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 fix inches up the spirketing. These chocks are fayed to the side, and close up to the under side of the beam, in such manner as to have a mortise, 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 fix 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 mortise at the head of the chock, which are sheathed with copper for that purpose. The iron-plate knees are then let in flush their thickines into the side of the beam and chock, one on the fore-side and one on the aft-side, and are well bolted and clenched 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 knee’d at each end with one wood lodging and one wood or iron hanging knee, to call clear of the side of the port.

At present, the sides 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 fluff of ten inches deep and about fourteen inches broad, fayed along the side and under-side of the beams all fore and aft, and Sears one into the other, with a scarf fix feet long, or in the round of the bow to have anchor-lock pieces fayed into the scars. The fore end of the shelf laps about four feet under the deck-hook, and douels thereto with two or more douels, and bolts upward through the heads of the beam.

Along the sides, the shelf is douelled into the clamps, with four-inch douels, about every four feet asunder, and four douels in each scarf, and two douels upward into each beam and into the deck-transom; it is then set close, and bolted through the side with one inch and quarter bolts, about twenty inches asunder. The ends 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 fided, 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 spirketing. In the front of each chock is fayed an iron knee, five inches broad and five inches thick on the shoulder, and one inch thick at the extremities, that is, the beam-arm to be three feet fix inches long, and the arm on the chock to reach about fix inches, or to take a bolt through the spirketing: 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 flap on each side, which clasps the beam and bolts, with
with two bolts through the beam fore and aft, and one up-
wards at the shoulder or return.

Observe, that the foregoing given dimensions are for secur-
ing the gun-deck beams of a seventy-four gun ship, conse-
quently the decks above are less in proportion, as likewise
hips of a less rate.

SUBSTITUTION, in Grammar, the using of one word
for another; or one mode, state, person, or number, of a
word for another. This the grammarians otherwise call a
iselle.

Substitution, in the Civil Law, a disposition of a te-
tator, 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
fidei commissio, 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 those fiduci-
ary 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 stand 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 after another manner.
See Reduction of Equations.

SUBTRACTION, or Substraction, in Arithmetic,
the second rule, or rather operation, in arithmetic, by which
we deduct a less number from a greater, to learn the precise
difference.

Or, more fully, subtrahfx is the finding of a certain
certain number from two homogeneous 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
homogeneous figures answer to homogeneous, i.e. units to
units, tens to tens, &c. as directed under Addition.
2. Under the two numbers draw a line. 3. Subtract, feve-
rally, 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 corre-

cpondent places, under the line. 4. If a greater figure
come to be substracted 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 substracted out of
another greater. For example;

If it be required, from
9800403459
To subtract
9800403459

The remainder will be found
5056538196

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 hun-
dreds, 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, substracting 6, I find 9 tens remaining, to be put
down under the line. Proceeding to the place of hun-
dreds, 2, and the 1 borrowed at the last, make 3, which
substracted from 4, leave 1.

Again 5, in the place of thousands, cannot be substracted
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 thou-
sands; whence one 10 being borrowed, and added to the
3, and from the sum 1 9 thousand, 5 thousand being sub-
tracted, we shall have 8 thousand to enter under the line;
then substracting 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 substruction easily performed.

If heterogeneous numbers be to be substracted 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 con-
itute an unit of the greater: for example:

\[ \begin{array}{l}
\text{£ } 1 & \text{ 2} \\
\text{ 45} & \text{ 16} \\
\text{ 27} & \text{ 19} \\
\text{ 17} & \text{ 69}
\end{array} \]

For since 9 pence cannot be substracted 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
subtracted, there remain 9. In like manner, as 19 shillings
cannot be substracted from the remaining 16; one of the 45
pounds is converted into 20 shillings, from which, added
to the 16, 19 being subtrahed, the remainder is 16 shill-
ings. Lastly, 27 pounds substracted from 44 pounds,
there remains 17.

If a greater number be required to be subtracted from
a less, it is evident the thing is imposisible. The less num-
ber, therefore, in that case, is to be substracted from the
greater; and the defect to be noted by the negative char-
acter. E. gr. If I am required to pay 8 pounds, and am
only master of 3, when the 3 are paid, there will still remain
5 behind, which are to be noted. — 5.

Substraction is to be proved by adding the remainder to
the subtrahend, or number to be substracted: for if the
sum be equal to the number whence the other is to be
subtracted, the substraction is justly performed. For example:

\[ \begin{array}{l}
\text{£ } 9 & \text{ 8} \\
\text{ 9800403459} & \text{ 156} \\
\text{ 4743865263} & \text{ 11} \\
\hline
\text{5056538196 remainder.} & \text{ 3} \\
\text{134} & \text{ 14} \\
\text{9800403459} & \text{ 192} \\
\text{156} & \text{ 11} \\
\hline
\end{array} \]

Substraction, in Algebra, is performed by connecting
the quantities with all the signs of the subtrahend changed;
and at the same time uniting fuch as may be united; as is
done in addition; which fee.

Thus \[ + 7 a \text{ substracted from } + 9 a \], makes \[ + 9 a - 7 a \],
or \[ 2 a \].

In the substraction of compound algebraic quantities,
the characters of the subtrahend are to be changed into the
counterary ones, viz. \(+\) 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 less co-efficient from the greater, to prefix the sign of the greater to the remainder, and to subjoin the common letter or letters; and 3. The addition of quantities that are unlike, for which set them all down after one another, with their signs and co-efficients prefixed: the general rule for subtration, 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
Subtract + 3 a

Rem. 5 a - 3 a or 2 a.

From + 5 a
Subtract - 3 a

Rem. + 5 a + 3 a = 8 a.

From - 5 a
Subtract + 3 a

Rem. - 5 a - 3 a = - 8 a.

From - 5 a
Subtract - 3 a

Rem. - 5 a + 3 a = - 2 a.

From 2 a - 5 x + 5 y - 6
Subtract 6 a + 4 x + 5 y + 4

Rem. - 4 a - 7 x ... 0 = 10.

Subtraction of Logarithms. See Logarithms.
Subtraction of Vulgar Fractions. See Fractions.
Subtraction of Decimals. See Decimals.
Subtraction of Surds. See Surd.

SUBSTRAJUM, 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 substratum upon which the whole is disposed or laid. See Soil and Strata.

SUBSTRAJCTION, in Building, denotes underpinning, ground-felling, &c. See Foundation.

SUBSTYLE, or Substylyar 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 stile, is called the elevation or height of the stile. See Style.

In polar, horizontal, meridional, and northern dials, the substylyar 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 substylyar 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.

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 semidiameter PM, and the tangent TM, is the subtangent. And PR is to PM as PM to PT; and PM to PT, as MK 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 \( p \cdot x = y \), the subtangent is in length equal to \( x \), the absciss, multiplied by \( x \), the exponent of the power of \( y \), 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 \( p \cdot x \cdot x = y \cdot y \), the length of the subtangent will be \( 4 \) of the absciss; and in a parabola of any kind, the general equation being \( a \cdot x = y + y + \ldots \), the subtangent is \( m + n \times x \), or its ratio to the absciss is constantly that of \( \frac{m + n}{n} \).

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, I stretch, in Geometry, a right line opposite to an angle, and prefixed to be drawn between the two extremities of the arc 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 pro. of Euclid. See Hypotheneuse and Triangle.

SUBTERGENCE, in Geography, a town of Hindooftan, in Oude; 22 miles E. of Luckow.

SUBTERMOOKY, a river of Bengal, which runs into the bay of Bengal, N. lat. 21° 35’. E. long. 88° 32’.

SUBTERRAUNEUS, or Subterraneous, something under ground.

Naturalists talk much of subterraneus fires, as the cause of volcanoes; and subterraneus winds, as the cause of earthquakes.

Among the many places where subterraneus 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 antique statues, paintings, and other curiosities have been found.

This subterranean town is probably the ancient city of Herculaneum, which was swallowed up by an earthquake. See Phil. Trans. No. 458, sect. 4, 5, and 6.

It is remarkable, that some of the antique paintings found there are as fresh and perfect, as if lately painted. Ibid. sect. 6. See Herculaneum.

SUBTIL, 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 subtil than another, in that, being divided into smaller parts, and those too more agitated; on the one hand, it makes less resillience to other bodies; and, on the other, inures itself more easily into their pores.

The Cartesians suppose a subtile matter for their first element. See Cartesian, and Materia Subtilis.

SUBTILIZATION, Subtilization, the art of subtilizing, or rendering any thing smaller and subtiler; particularly, the diffusing or changing of a mixt body into a pure liquid, or a fine powder, by separating the grosser 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 define it, contrary to the inclination of the other.

Subtraction of Legacies, denotes the withholding or detaining of legacies, for which the spiritual court admonishes refiers, 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 of some other species of relief prayed by the complainant; as to compel the executor to account for the telfastor's effects, or affent 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, withdraws or neglects to perform it. It differs from a diftiffen, (which see,) in that this is committed without any denial of the right, confiding merely in non-performance; that strikes at the very title of the party injured, and amounts to an easier or actual dispossession. (See Ouster.) Subtraction, however, being 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 tenure, or by custom only. Blackst. Comm. vol. iii.

Subtraction of Tithes, is the withholding of tithes from the parson or vicar, whether the former be a clergyman or a lay appropriator. (See Tithes.) In this case, summary and expeditious assilance 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 tithes, any privy-counsellor, 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. Blackst. Comm. vol. iii.

Subtray, or Measures en Brene, in Geography, a town of France, in the department of the Indre; 9 miles S. of Châtillon.

Subtriple Ratio. See Ratio.

Subu, in Geography. See Seeboh.

Subversio Stomachii, a term used by some authors to express a violent vomiting, when what should pass through the intestines is voided confluently by the mouth.

Subulare Folium, among Botanists. See Leaf.


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 Willdenow in making this a species of Subularia, from Scopoli's description.

Subulatus Leaf. See Leaf.

Subulcula, 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 flag, 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 subulo. 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 is thus described: the only 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 stone-quarries to break a way through large malleis.

SUBURBICARY, SUBURBICARIUS, formed from sub, under, and urbs, city, an epitet given to those provinces of Italy, &c. which composed the ancient diocese, or patriarchate of Rome. They were also sometimes called urbariae provinces.

Authors usually reckon ten of these suburbanicary provinces; of which Italy, from the Po to the heel, made seven; and the isles of Sicily, Sardinia, and Corsica, the other three.

Yet Salmasius will have the suburbanicary 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 dioce of ancient Rome.

F. Sirmond takes the other extreme, and comprehends all the West under the name of suburbanicary provinces.

Kuhnus, who lived in the age of the council of Nice, explains the power ascribed to the pope, in the sixth canon of that council, by saying, that he had the care and supervision of the suburbanicary provinces. Hence the different sentiments of authors, with regard to the suburbanicary provinces; some only considering 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 SAMIBIL, in Geography, a town of Peria, in Chusititan; 70 miles S.E. of Tolcar.

SAUCIFE, a town of Arabia, in Hedesjas; 25 miles S.E. of Jambo.

SUCCA, a town of Tripoli, in the gulf of Sidra; 45 miles S.E. of Mefurada.

SUCADANA, 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° 6' E. long. 109° 56'.

SUCCEDANEUM, formed from succedit to succedet, in Pharmac. a remedy substituted in the place of another first preferred, when the ingredients are wanting necessary for the composition of that other.

Substitute and succedaneum are of equal import; unless with some authors we choose to use a substitut, where a simple of like virtue is put for another; and succedaneum where a compound is used with the fame intention for another compound.

SUCCELENTIATI RENES, in Anatomy, the renal capsules, as if they were subfidiary kidneys. (See Kidney.) The same epithet is also given to the small additional spleens, when they occur.

SUCCELENTIATION, 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 Itraits of Le Maire. On the mountain island 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 irresistible; he therefore conjured the company to keep moving, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest: whatsoever sits down, says he, will sleep; and whosoever sleeps, will wake no more. Dr. Solander himself was the first who found the inclination, against which he had warned others, irresistible; and inflicted upon him so much upon the body and spirit as to cause him to lie down. Mr. Banks intreated and recommended him to confess and intreat, 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 produced no effect: when Richmond was told, that if he did not go now he would be in a short time be frozen to death; he answered, that he desired nothing but to lie down and die. The doctor did not so explicitly remonstrate 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 sit down, being partly supported by the bullocks, 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, and the mulefes were so unruly, that his shoes fell from his feet; he contented to go forward, with such assistance as could be given him, but no attempts to relieve poor Richmond were successful. Richmond, and a seaman sent to his relief, died. S. lat. 54° 57'. W. long. 65° 27'.

Cape Success in this bay at the point lies in S. lat. 55° 1'. W. long. 65° 27'.

SUCCESSION, Succesor, 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 part of this succession, is what we call duration (which see). When this succession of ideas ceases, we have no perception of time, or of its duration, but the moment we fall asleep, and that in which we awake, seem connected.

They who think they 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 dilinguishable ideas.

A man that looks on a body moving, perceives no motion unless that motion produces a constant train of successive ideas. But wherever a man is, though all things be at rest about him, if he thinks, he will be conscious of succession.

SUCCUSION 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, congenerius.
This order is expressed in the two following technical verbs:

"Sunt Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Arcitenens, Caper, Amphora, Plices."

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 Fish with glittering tails."

When a planet is direct, it is said to go according to the order and succession of the signs, or in consequentia; that is, from Aries to Taurus, &c. When retrograde, it is said to go contrary to the succession of the signs, or in antecedentia; viz. from Gemini to Taurus, then to Aries, &c.

**Succession,** in the Civil Law, implies a right to the whole effects 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. See **Intestate.**

The statute of distributions bears some resemblance to the Roman laws of succession **ab intestato**; the general rule of which succession was this. 1. The children, or lineal descendants, in equal portions. 2. On 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. Blackl. Comm. vol. ii.

**Succession, Testamentary,** is that which a person comes to 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 burdensome or vexatious one, which no body will accept of.

There is no real succession in benefits; for, here nobody inherits.

In effects that are divided, as kingdoms, &c. the succession falls on a single head; which is usually the eldest son of the deceased, as being supposed the indivisible representative of his father.

In effects that are divided, all the children represent their father. It was on this principle, M. Courton observes, that each of the sons of Jacob had his share assigned to him in the Land of Promise. It is true, Mansfield and Ephraim, the two sons of Joseph, had likewise their share; 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 soils, 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 flatted, in a paper in the "**Memoirs of the Caledonian Horticultural Society,"** to be that of beginning with celery, which is planted on poor run-on parts of the ground, formed into ridges seven feet in breadth, and five between them, allowing three at each side; the space of seven feet is then cut out in making them to the depth of a fpatling and the shovellings, the earth being laid equally on each side, and filling the ridges with good dung, to 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 let out across the ridges, about fourteen inches row from row. The crop will thus, it is said, when fully earthed up, land 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 practiced, 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 be cropped with German greens. All these crops are capable of being raised with perfect success, in succession after the celery, without any further manuring.

**SUCCESSIVE ACTION, 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 coadjutor is a necessary successor to a prelature; a refugee to the refugian.

Civilians say, a titulus usufruituarius can do nothing to the prejudice of his successor.

**SUCCIFERA VASA,** 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 distillation from those which only give pottage to the air, and are called **trachea.** Leeuwenhoeck tells us that the microscopes 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, fats formed by the combination of any bale with the succinic acid.

**Succinic Acid,** is an acid that rises during the dry distillation of **Amber** (which fey), partly in the form of pithy crystals, 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 succellent rectification before it can be obtained tolerably pure. Two methods have been practiced of purifying the acid: the first is, to mix the brown concrete acid with sand, or, which is still better, with dry unburnt white clay, free from calcareous earth, and proceed to sublimation by a very gentle heat; the clay detains the most part 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 in
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 effectually, according to Lowitz, 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 70°F. 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 tablets. A gentle heat is sufficient to volatilize this salt; it rifies in white vapours like carbonated ammonia. It is neither efflorescent nor deliquescent when exposed to the air.

The base of succinic acid is a compound combustible, one like the vegetable acids; it burns when exposed to the blow-pipe, detonates 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 six 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.

Nitric acid dissolves the succinic acid, but does not convert it into oxalic acid, as was supposed by Wetttrump.

Potash combines readily with succinic acid, forming a neutral salt.

Succinat of potash, crystallizing in truncated trihedral prisms, which are somewhat deliquescent in the air, are readily soluble in water, have a bitterish saline taste, and deacrepit 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 digengage the ammonium, and unite with the acid.

Succinic acid with lime and barytes forms salts of difficult solution in water. It unites with magnesia into 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 form of salt. According to Murveau, barytes has the most powerful attraction for succinic acid, after which come lime, the fixed alkalies, ammonia, 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 acids.

The alkaline succinates are also decomposed by nitric, and muriatic, and fluoridic acids, but nitrates, muriates, and fluors of lime and barytes, are decomposed by succinic acid.

The boracic, benzoic, and acetic acids, are inferior in affinity to the succinic acid. Aikin's Dict. of Chem. and Min. vol. i.

Succinum. See Amber.

Succina, in Botany, an old name for a common European species of Scabiosa, (see that article) whose root has the appearance of having been 'lepped off' at the bottom.

Succondee, in Geography. See Sukkonda.

Succoot, a town of Nubia, on the Nile; 10 miles N. of Dongola. N. lat. 25°. E. long. 31° 40'.

Succory, in Botany and Gardening. See Cichorium.

Succory, Gum. See Chondrilla.

Succotrino Aloids. See Aloeis.

Succour, in Military Art, denotes assistance for relieving a place, that is, raising the siege and forcing the enemy from it.

Succubus, or Succuba, 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 indifferently; 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.

Succula, in Mechanics, an axis, or cylinder, with flaves in it to move it round; but without any tympanum, or peritrochium.

Succulent, in Agriculture, a term signifying rich, juicy, moi, &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 fuccharine 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 defraction. 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 jult in flower, or at the time they are beginning to form and show 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 freely beneath the soil; the soluble matters are gradually diffused; and the slight 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 disipation of elastic matter.

In the case of breaking up old graf lands, and rendering it arable, the soil is not only enriched by the death and flow decay of the plants which have left soluble matters in the soil; but the leaves and roots of the grafts which are living at the time, and occupying so large a part of the surface, and in it is said, fuccharine, 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.
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 as food for animals.

Succumi, in Geography, a town of Japan, in the island of Xino; 25 miles S.W. of Fumai.

Succunderah, a town of Hindooollan, in the fubah of Agra; 46 miles S.E. of Etnavah.

Succucus Pancreaticus. See Pancreatic juice.

Succius Nerofutus. See Nervous Fluids, &c.

Succusary, in Geography, a town of New Jersey; 24 miles N.N.W. of New Brunswick.

Sucharevo, a town of Ruffia, in the government of Upha; 32 miles N. of Menzelinick.

Suchipila, a town of Mexico, in the province of Guadalajara; 42 miles S. of Guadalajara.

Suchitepec, or St. Antonio de Suchitepec, a town of Mexico, in the province of Sconoofo, on a river which runs into the Pacific ocean; 60 miles W.N.W. of Guatimala.

Suchona, a river of Ruffia, which rives in lake Kubenfii, and runs into the Dwina, near Ufling.

Suchotzkoii, a town of Ruffia, in the government of Novgorod; 52 miles E.S.E. of Titchvin.

Suchteleen, a town of France, in the department of the Reer; 21 miles N. of Juliers. N. lat. 51° 15'. E. long. 6° 14'.

Suck, a river of Ireland, which runs into the Shannon, about five miles S.E. from Bailahloe, separating the counties of Galway and Roscommone during a course of thirty miles.

Suck Creek, a river of America, in Tenellees, which discharges itself into the Tenelles, at the Suck or Whill, a few miles N. of the Georgia north line.

Suckaltal, a town of Hindooollan, in the cecor of Scharunspour; 21 miles E.N.E. of Merat.

Suckasunny, a town of America, in New Jersey; 12 miles W. of Morritivill.

Sucker, or Suck-Fish, in Ichthyology. See Remora.

Sucker is also a name given to the lump-fish.

Sucker, Rimaculated, is a new species of sucker discovered near Weymouth, and described by Mr. Pennant. Its head is flat and tumid on each side; the body taper; the pectoral fins placed unynually 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, Storl, the English name of a genus of fish. See Patromyzon.

Sucker, Uinptus. See Liparis.

Sucker, Goat, in Ornithology. See Caprimulgus.

Suckers, in Gardening, such young offsprings 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-Sex 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 friggling fibres, and cutting off any thick-nobbled 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 dispofed to send forth fibres for rooting; preparatory to planting them out, the items of the shrub and trees-suckers should likewise be trimmed occasionally, by cutting off all lower laterals; and any having long, flender, and weak tops, or such as are intended to allume a more dwarfish or bushy 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 floriferous 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 the 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 or two or three years they will be of a proper size for planting out where they are to remain; and where 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 sorts of roffes, and numerous other flowering shrubs; also some plants of the strong shooting goosberries, currants, raphberries, 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 whatever 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 cain, 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 increase, it is proper to eradicate them completely, as they are produced in the spring and summer especially.

Also numerous herbaceous and succulent plants are productive of bottom offset suckers from the roots, by which they may be increased.

In flapping 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 onesummer'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 month 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 flapped 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
SUC should always be taken off without disturbing the plants in the pots, especially when they are few. The suckers, in all cases of this sort, should constantly be planted as soon as possible after they are flapped, in proper small upright pots, giving a slight watering at the time, with suitable temperature and 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 flowering, and become inactive, and as the winter immediately succeeds, seldom do well, especially without great care and trouble.

Timber-trees, in some cases, 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 cases, 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 Hindoostan, in Bundeund; 8 miles S. of Pannah.

SUCKING PUMP. See PUMP.

SUCKLER, in Rural Economy, a term applied to a calf which is used for the purpose of suckling, 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.

Suckling, Sir John, in Biography: an English poet, was born at Witham, Essex, in 1613, and is said to have possessed such natural talents, that he spoke Latin at the age of five years, and wrote 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 Guilielus 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 sprightly rhymes and gaiety. 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 "Aegla" 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 fables; by his brother poets, and which is supposed to have haltened his death in 1644, when he had arrived only at the 28th year of his age. Suckling has no claim to distinction among the British poets; though, if he had bestowed greater care and correctness on some of his songs 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 few 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 Suckling, prefixed to his Works.

Suckling, Cape, in Geography, a cape on the N.W. part of North America, oil 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° 49', and W. long. 143° 1'.

SUCKER, a town of Hindoostan, in the circar of Ruttanpur; 8 miles N.W. of Ruttanpur.

SUCKRY; a town of Hindoostan, 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 preflure 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; by enlarging the chelle, the atmospheric pressure 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 laciferous tubes into the mouth. If the lips are immerged in any fluid and the chelle expanded, the preflure of the external atmosphere will force it into the mouth. The act of suction, indeed, depending on this atmospheric preflure, is in all cases 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 chelle, he rarifies the air, and of course diminishes its preflure on the liquor, which is immediately under the tube; in consequence of which, the preflure 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., in lying prone to drink out of a spring, &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 dilated as before, the preflure of the air incumbent on the surface of the water, without the circumference of the mouth, prevailing over that upon the water within the fame, 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 bigness and diameter of the pipe make a farther alteration therein. The reason of this arises from that great principle in hydrostatics, that fluids prefl 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 preflure of the atmosphere.

A very curious and intelligent person distinguishes two different forts 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 dilated, 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 oriflices at the same time. This is the true proper suction: the other ought rather to be called sapping than sucking through a tube.

Note, the cavity of the mouth is enlarged by being a little
little opened, while the lips are close flutt, the tongue being
at the same time contradistinct, and drawn backwards towards
the throat.
In the operation of sucking, after the manner of children,
the rarefaction is produced in the fore part of the mouth;
that is, the tongue is applied so as to fill up the space between
the lips and the nipple, or pipe which conveys the milk or
other liquor; then the tongue is drawn backwards, while the
lips are laterally pressed against it, by which means a
small vacuum is formed before it, and the liquor is forced
into that vacuum by the pressure of the atmosphere upon
its external surface, or upon the surface of the bag which
contains it.
It is for the same reason, that flatnails remain attached to
folds, that limpets adhere very firmly to rocks, that the
po1ypus holds with great force whatever it fastens its
claws to, and that some insects suspend themselves to folds;
for though not performed with the mouth, the principle of
the operation is exactly the same, viz. a soft membrane is
applied to the fold, then the middle part of that surface is
withdrawn a little way, so as to form a vacuum, or at least
a rarefaction of the air between the centre of the soft mem-
brane and the fold, in consequence of which the parts of the
membrane which surround that spot are, by the gravity of the
atmosphere, pressed against the fold, and the latter is pressed against the former; hence the adhesion takes
place.
Leather suckers, which act precisely upon the same prin-
ciple, are not unfrequently seen in the hands of boys about
the streets of London. A circular piece of thick leather,
about two inches in diameter, has a string fastened to its
centre. The leather, being previously well soaked in water,
is applied flat and close to the smooth surface of a stone.
The interposition of a little water promotes the adhesion.
Then the boy pulls up the string, and the stone, if not too
heavv, comes up adhering to the leather.
The claws of the polyopus are furnished with a great many
suckers of the like nature. The limpet forms one sucker of
its whole body, and the same thing, with little variation,
is done by various other animals, especially of the infect
tribes.
The action of the glass cup, which is made to adhere to
the flesh, for the purpose of bleeding, depends upon the
same principle; excepting that the air, within the glass
cup, is rared by means of heat, or by means of a small
exhausting engine.
It is hardly needful to add, that the limpet could not ad-
here to the rock, nor could the leather sucker act, or, in
short, that none of those sucking operations could take
place, in vacuo.
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 sometimes 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 Mechanics. See SUCULA.
SUCY, in Geography, a town of France, in the depart-
ment of the Seine and Oise; 10 miles N. of Corbeil.
SUCZAVA, or SUCZOW, 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 Jaffy. N. lat. 45° 57'. E. long. 25° 58'.
SUCZAVA, a river of Moldavia, which runs into the
Sirett, 16 miles S.W. of Batuzsam.
time: part of which building, converted into a dwelling-house, is yet standing. Abnea, countess of Clare in the reign of king John, also founded, in this town, an hospital dedicated to Christ and the Virgin. Sudbury contains three parish churches; is governed by a mayor, five aldermen, and twenty-four common-councilmen; and is also endowed with a weekly market on Saturday, and two annual fairs. This town has retained the privilege, since 1595, of returning two members to parliament; the right of whole election is in the whole body of freemen, amounting to 755: the mayor of the town is the returning officer. Sudbury was the birth-place of Thomas Gainsborough, an eminent artist. (See Gainsboro.)—Beauties of England and Wales, vol. xiv. Suffolk, by F. Shoberl. Oldfield's Representative History, vol. ii. part 2, 8vo. 1816.

Sudbury, a county of New Buckingham, on the west side of St. John's river, near its mouth. Also, a township of Vermont, in Rutland county, having Oswald on the west, and containing 754 inhabitants.

Sudbury, Essex, a township of Mafschuchetta, in Middlesex county, on the post-road to Boston, and 19 miles from it; incorporated in 1786, and containing 824 inhabitants.

Sudbury, West, or Sudbury, a township in the same county, and west of East Sudbury; 25 miles W. of Boston; incorporated in 1639, and containing 1287 inhabitants.

Sudbury Canada, a township in the district of Maine, in York county, situated on the south side of Androscoggin river, and south of Andover; erected in 1796 into a township, called Bethel, and containing two parishes.

Sudenburg, a town of the duchy of Magdeburg, of which it is a faubourg, though governed by its own magistrates.

Suderapour, a town of Bengal; 10 miles E. of Moidrey.

Suderhasdeide, a town of the duchy of Holstein; 7 miles S.E. of Meldorf.

Sudermannland, or Sudermania, a province of Sweden, bounded on the north by the Mealer lake, which separates it from Upland and Westmannland, on the east and south-east by the Baltic, on the south-west by East Gothland, and on the west by Nericia; about 100 miles in length, and 60 in breadth. This province appears to be one of the first that was inhabited and cultivated in this kingdom. The soil is fertile, and no labour is spared for the improvement of it. It abounds in fine arable land, pastures, woods, iron-mines, and forges; and its lakes are well stocked with fish. Its advantageous situation between the main sea and the Mealer lake is also the cause of a considerable trade. There are several considerable lakes besides the Mealer, as the Hiemar and Beaver. The inhabitants of this country chiefly subsist by agriculture, hunting, fishing, and working in the mines; and carry on a considerable trade in copper, iron, and wooden ware. On account of the pleasantness and fertility of the country, the dowager queens had their dowry, and the dukes their duchies, in this province. Nykoping is the capital.

Suderoe, one of the Faroe islands, in the North Atlantic ocean. It is remarkable for a dangerous whirlpool near it, which is occasioned by a crater, 61 fathoms deep in the centre, and between 50 and 55 at the sides. The danger at most times is great, but particularly so in storms; for ships are irresistibly drawn into it, the rudder loses its power, and the waves beat as high as the masts, so that an escape from it may be deemed miraculous. Notwithstanding this hazard, the inhabitants, at the refuge, and in very ill weather, will venture in boats, for the sake of fishing.

Suderwalle, a town of Germany, in the duchy of Verden; 6 miles N.E. of Verden.

Sudetic 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 Rifen, the middle part the Bohemian, and the south-east the Moravian chain. Of this remarkable chain, not much noticed by geographers, the highest peak in the mountains of Rifen, or of the giants, is the Schneckkoppe, or how head, in the Bohemian part, the Eylke or Owl, and the Zotteberg, supported by fume to be the Althuburgus of Pliny, the height of which is estimated at about 2120 Rhenish feet, and consisting entirely of serpentine, with some hornblende. The Moravian ridge divides into inferior branches, one of which forms a northern boundary of the principality of Troppau. Fabri computes the highest part of the Rifen at 4030 Rhenish feet above the sea, and the Zotteberg at 1700.

Sudis, Esox Sphyrena of Limnias, 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 conical 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 flocks together. Its usual 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 Black sea; 60 miles E. of Drifta.

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 Budha.

Sudogda, in Geography, a town of Riffia, in the government of Vladimir; 28 miles S.E. of Vladimir. N. lat. 55° 40'. E. long. 40° 54'.

Sudor, in Medicine. See Sweat.

Sudor Anglicanus, the English Sweat. See Sweating.

Sudoricif, in Medicine. See Diaphoretic.

Sudzjava, in Geography, a town of Riffia, in the government of Kurfik; 40 miles S.W. of Kurfik. N. lat. 51° 20'. E. long. 35° 14'.

Sue, in Geography, a town of Africa, one of the branches of the Balbargue, in Benguela.

Sveaborg, a fortress of Sweden, in the gulf of Finland, situated about 34 miles from Helsingfors, composed of seven rocky islands, which lie within the circumference of four miles. The principal of these islands is Warg-on, or Wolf's island, which is 2400 feet in length, and 2000 in

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breadth, and contains the governor's house. The project of surrounding these islands with fortifications was formed by general Ehrenwald, and the work began in 1748. The works are said to be stupendous, and worthy of the ancient Romans. The walls are chiefly of hewn granite, covered with earth, from fix 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 Holmingska, render the passage 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 fold rock, 300 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 fluing-gates, so that each vessel lies separately from the others. The whole is covered with a wooden pent-house roof, in order to preserve the frigates from the rain. This basin contains eleven frigates. At one extremity of this dock is a bain, 200 feet square, closed at each end with fluing-gates, which serves for the entrance and exit of the frigates, and likewise for repairing or building ships. At the other extremity is another bain 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 repairing ships, the Swedes procure oak from Gotland, part of the flax from Finland, hemp and maats 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 Harjedalen, on the Liuna; 86 miles W. of Sundiwall.

SVEGLIATO, in the Italian Mufo, is used for a brisk, lively, gay manner of fudging or playing. Thus they say, maniera fuggiata.

SUEIRO da Coia, in Geography, a river of Africa, which runs into the Atlantic. N. lat. 5° 5'.

SUELDO, in Commerce, a money of account in some parts of Spain. At Alicat, accounts are kept in reals of 24 dineros, and also in libras of 20 feuless, subdivided into 12 dineros; the libra being valued at 3d. 5d. 6d.

In Aragon, a fueno is divided into 8 quartos, or 16 dineros, and the libra is worth 20 feuless, or 4s. 3d. fering nearly. See Money.

SVELMOE, in 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 Baylov Bucarel, about 25 miles in circumference. N. lat. 55° 16'. E. long. 22° 50'.

SVENBORG, a leaft port of Denmark, in the island of Funen, with the belt harbour in the island; in which are manufactures of wool and linen; 22 miles S.S.E. of Odense. N. lat. 55° 9'. E. long. 10° 37'.

SUDENHOA, a city of China, of the first rank, in Pe-thie-li, near the great wall; 77 miles N.W. of Peking. N. lat. 49° 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'.

SVENSTIUNGA, a town of Sweden, in West-Gotland; 40 miles E.S.E. of Gothenburg.

SUERA. See Mogador.

SUERFIO, a town of Sweden, in Dalecarlia; 20 miles N. of Falun.

SUESANY, a town of Hungary; 8 miles W.N.W. of Rosenborg.

SVEIT, a flourishing village of America, in Massachusetts, the county of Barnstable, and township of Dennis, bordering on Harwich; containing about 35 dwellings, houses, the town of Dennis including 1750 inhabitants. Belonging to this village are five fail of fullerens, and 24 fail-works, which yield annually upwards of 600 buffets of marine fat, besides 2700 lbs. of Glaber fats.

Suet, Suetum, a kind of fat, found in deer, sheep, oxen, logs, &c. which, melted down and clarified, makes what we call tallow, uled in the making of candles.

The word is formed from the Latin, suetum, from sues, which signifies the same; and theae a sues, from sues, by reason of the fattiness of that beast.

Mutton-fuit is the most confident of real animal fats; it has some degree of brilleness, and requires a temperature of 127° Fahr. to melt it. In other respects it agrees with animal fats in general. Like thee, it is emollient: it is sometimes boiled in milk in the proportion of 3:5 of the fat to 1 of milk, and a cupful of the mixture is given occasionally in chronic diarrhoea, when there is much acrimony of the contents of the bowels; but its principal use is to give confidence to ointments and plasters. The "suet preparatum," or prepared suet of the London Ph., is obtained by cutting the fat in pieces, then melting it by a gentle heat, and pressing it through linen.

Another kind of fat, which we shall mention in this connection, is the "asxugia porina" of the Edib. Ph., the "adesullum" of Dub., the "ades" of London, or the hog's lard. The lard is chiefly obtained from the flank of the animal. It is freed from the membranes and vellicks, by being cut in small pieces, then washed in water till the water comes off colourles, 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 inedorous, tasteless, and white; soft, and nearly liquid. Exposed to a heat of 67° it melts, and concretes again when cooled. It is insoluble in water, alcohol, and ether; but is dissolved by the strong 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 is flared into it; and affumes a greater degree of firmness, with a yellow colour. By de-structive distillation it affords reflux 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 fetid odour; and, owing to oxygen being attracted from the atmosphere, theabolic acid is formed. This flate 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 seetness and unctuosity, 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 "ades preparata," or prepared lard. That of the London Ph. is obtained by cutting the fat into small fragments, then melting
melting it by a gentle heat, and pressing it through linen. The "adeps fulsus 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 by pressing it through a linen cloth. Lard prepared by the dealers, and preferred with fat, is to be melted with twice its weight of boiling water, and well stirring the mixture; it is then allowed to cool, when the lard may be separated. The above-mentioned processes are intended for purifying 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 are 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 apothecary, as both kinds of fat may be procured very well purified from the dealers. To keep 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 Disp. See ADeps, FAT, and Animal OIL. See also CELLULAR Substances.

SUETONIUS TRANQUILLUS, CAIUS, in Biography, was the son of Suetonius Lenis, tribune of a legion in the time of Otho, and born about the beginning of the reign of Vespanian, and died after A.D. 117. He is designated by Pliny the younger, as one of the "Scho- laetci." 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 indebted to him for several favours. By his interest he obtained the dignity of military tribune, and also the "ius trium liberorum," granted to him by the emperor Trajan, though he was childless. He was afterwards secretary to the emperor Adrian, though he lost this office by his indiscreet 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.

Steele calls him a "grammian," and ascribes 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 narratives, acquit him of any intentional misrepresentation; though he indicates a propensity to pay undue attention to vulgar tales and fumilias. His freedom in exposing the infamy of the Caesars may be politically vindicated on this general principle, "that history affords no lemons more instructive than the crimes and vices consequent upon despotick power." Suetonius's disrepectful account of the Chri-

SUEUER, EUSTACHIUS 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 vitiates the style of art practised in France before the revolution, Le Sueur had the singular felicity of emerging with pure talent; and the firmness to pursue such studies as were most conducive to its improvement; while almost all his fellow students, seduced by the glitter and tinsel of art displayed by their master, 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 effect. Had Vouet had many scholars like Le Sueur; or had the latter been duly estimated, and been lexier preferred in excellence, France might perhaps have justly boasted of her Raphael; and true talent have sublimed 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 same kind of subjects interested him, and above all he was actuated by the same devotedness to the subject, of whatever nature it were. With him, as with Raphael, it led to the composition, and controlled his imagination in the execution of it: as 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 deligius; 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 caused their employment; and at the age of 23, (in 1640,) he was elected a member of the Royal Academy at Paris, and painted upon his admilion a picture of St. Paul calling 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 fully or malice, and by the hand of time; and still more, have so severely endured the unshallowed touch of picture-cleaners and refiners, 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 harsh 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 the series above-mentioned; but in an attempt to combine somewhat of the style 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 by far his most perfect productions. He died at the early age of 38, in 1655.

SUEZ. Geography. A town of Egypt, situated on a point of land, in the form of a peninsula, on the western coast of the Red Sea. According to M. d'Anville, Suez was the ancient Arinone; but Volney thinks that Arinone was situated further north towards the bottom of the gulf. Browne says, that the ruins of Arinone may yet be recognized in a mount of rubbish in the neighbourhood of Suez; and that the spot is now called "Kolsum," and that remains exist 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 just 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-shine 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 fishery for the: for this was the Arabian gulf of the ancients, whole Mare Erythreum, or Red sea, was the Indian ocean. This weed may, perhaps, be the Τιτος of the Hebrews, whence יִתָּא "Iam Saph," their name for this fish. 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 buildings; there are also several coffeehouses. The houses are close to one another, that there are only two paries into the city, that nearest the sea being open, and the other shut by a very insufficient gate. The only solid buildings are the khans. Scarcely any part now remains of the castle, which the Turks built upon the ruins of the ancient Kolsum or Kolzoum, the "Clystra" of the Greeks, situated about 800 paces N. of Suez, on the border of the sea, opposite to the ford which leads to the spring of El-Nab. 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, intermarried 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. They have a considerable 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 khān or shed where merchandise is lodged; some Greek Christians constantly residing 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 invitably 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 tea here produces few fish; oysters, indeed, and a few others of the shell kind, are seen; but the bell fish come no higher than Colfeir. Meat is scarce, bred of an inferior quality, and sometimes hardly edible. Butter and milk are brought in small quantities by the Arabs. Water is brought from three several places: Bir-Naba, northward, affords the bulk; the other places are Aidun Muca, and Bir-es-Suez. It is always bought in the kins at a considerable price; and in case of war with the Mameluke 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 these, are destroyed, for in this shifting soil they are presently filled up, both by the sands 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 3500 camels, and 7000 or 6000 men. The merchandise consisted in wood, falls, 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 barrels of cochineal, corn, barley, and beans, Turkif piaitres, Venetian seigneur, and Imperial dollars. All these commodities were denied for Djeelda, Mecca, and Moka, where they were to be bartered for Indian goods, and the coffee of Arabia, which forms the principal article of the returns. 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 destitute of every necessity than Suez. From the tops of the terraces the eye, forewearing 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 single 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 mixture of rum, it is insupportable 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 Mameluck, 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 brafs four-
four-pounders, and two Greek gunners, who turn their heads side when they fire. The harbour is a wretched quay, where the smallest boats are unable to reach the shore, except at the highest tides. There, however, the merchandise is embarked to convey it over the banks of sand, to the vessels which anchor in the road. This road, situated a league from the town, is seperated 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 friezes. Their number diminishes every year, since by continually coasting along a shore full of shallops, one out of nine, at least, is shipwrecked. In 1783, one of them having anchored at El-Tor, to take in water, was suprised 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 tare it upon the coast. The dock at Suez is ill adapted to repair such damages; scarcely do they build a casaya in three years. Besides that the sea, which, from its flux and reflux, accumulates the sand upon that coast, will at last choke up the entrance, and the same change will take place at Suez, which has already occurred at Kolzoum and Arifino. Suez is 60 miles E.S.E. distant from Cairo. N. lat. 30°. E. long. 32°7'. Volney, Nieh-bahr, Brown.

Suez, 〈iblum〉 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 isthmus, so that vessels might arrive at India by a shorter route than by the Cape of Good Hope. This space is not more than 18 or 19 ordinary leagues; nor is this interval intersected by mountains; nor can we discover, from the tops of the terraces at Suez, with any telescopes, a single oblique on the naked 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 32 leagues, this idea will not appear so ridiculous. The great difficulty of accomplishment this object arises from the nature of the corresponding coasts of the Mediterranean and the Red sea, which are of a low and sandy fey, where the waters form lakes, shallops, and morasses, so that vessels cannot approach within a considerable distance. It will therefore be found scarcely possible to dig a permanent canal amid these shifting sands: not to mention that the shores are ditfiliate 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 belt and only method, therefore, of effecting this junction, is that which has been already successfully practised at different times; which is by making the river itself the medium of communication, for which the ground is perfectly well calculated; for mount Makattam 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 undertook 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. xvii.) 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-ehn-el-Kattab," 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 loses itself in the country to the N.E. of Berket-el-Hadji, or the Lake of the Pilgrims. Volney.

SUFANGE 〈ul Babri〉, a narrow isthmus in the Red sea, near the coast of Egypt, about 7 miles in length. N. lat. 27°. E. long. 33°56'.

SUFEDOON, a town of Hindooistan, in the subah of Delhi; 20 miles W. of Paniput.

SUFFA, a town of Candahar; 30 miles E.N.E. of Candahar. N. lat. 33°10'. E. long. 66°8'.

SUFFERANCE, in Ancient Customs, a delay or repitse of time, which the lord granted his vassal, for the performance of fealty and homage, so as to secure him from a feudal seizure.

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 vassals, 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, Ejectee at, in Law, 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 lease from the owner of the elette. Or, if a man maketh a lease at will and dies, the elette at will is thereby determined; but if the tenant continues possession, he is tenant at sufferance. This elette, in the case of a subject, 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 supposte him to continue upon a ticle equally lawful; unlefe the owner of the land, by some public and avowed act, such as entrance, will declare his continuance to be tortious or wrongful. Thus itlands the law, with regard to tenant by sufferance; and landlords are obliged in those cases to make formal entries upon their lands, and recover possession by the legal process of ejectment; and at the utmost by the common law, the tenant was bound to account for the profits of the land so 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 premisses, by him to whom the remainder or reversion of them shall belong; such person, so holding over, shall pay, for the time he continues, at the rate of double the yearly value of the land so detained. This has also put an end to the practice of tenancy by sufferance, unless with the tacit consent of the owner of the tenement. Bl. Com. vol. ii. See EJECTION FORUM. SUFFER-
SUFFERDAM, 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.N.W. of Currupour.

SUFFIBULUM, among the Romans a name given to the pretexa of the pontiffs, and palla of the Veiled virgins.

SUFFIELD, in Geography, a pleasant poll-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 poll-road from Boston to New York; 10 miles S. of Springfield.

SUFFIMENTA, Fumigation, in Pharmacy. See Fumigation.

SUFFINAGORE, in Geography, a town of Bengal; 14 miles N. of Islamabad.

SUFFITION, Suffitio, among the Romans, a kind of infestation, practised by persons who had attended a funeral: it was performed by walking over fire, and being sprinkled with water.

SUFFITUS, Suffitum, or Suffitiation, 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.

SUFFLATIO, in Rural Economy, blown up with rich green food in different animals. See Blown and Hoved.

SUFFOCATIO Stridula. See Chrop.

SUFFOCATION, in Medicine, apoplexia, 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 same effect takes place from either of these causes, which is described at length under the article Drowning, and the same process is required for the restoration of breathing and animation in all these cases, except that, in the infusation 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 restoration 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 Cambridgehire. On Mr. Hodkin'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 Sudfolk, or southern people, in contradistinction to the Northfolk, or northern people, constituted, at the time of the invasion of the Romans, part of the district belonging to the tribe whom those conquerors denominated Iceni, or Cenomanni. In the Roman division of the island, it was comprehended in the province of Flavia Caesariensia. When the Romans, after a possession of four centuries, abandoned Britain, the Saxons, on the invitation of its pusillanimous inhabitants, made themselves complete masters of the country, Suffolk constituted, with Northfolk and Cambridgehire, 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 stipendious 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 Floracensfis says, that "on the well 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 father's

To Robert, earl of Mortant and Cornwall

To Odo of Champagne, earl of Albemarle and

To William Warren, earl of Surrey

To Eude de Rye, reward of his household

To William Malet, lord of Eye in this county

To Robert de Todmanc, a noble Norman

To Robert de Stafford

To Almeric de Vere, earl of Oxford

To Jeffery de Magnavil, or Mandevill

To Richard de Tencrudge, or de Clare

To Roger Bigod, earl of Norfolk

To Ralph de Lemei

To Hugh de Grentmainell

To Peter de Valones

To Ralph Bainard

To Swene de Effex

To Roger de Aubervil

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 confpired 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 Bury, a battle ensued, and the former were repulsed with great slaughter. In the time of king John this county was again invaded, and subdued by Louis, the dauphin of France, and his allies, the barons. During the reign of king Richard II. the population 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 state of property in this county may be considered beneficial in its division. The largest estate is supposed not to exceed 8,000l. a year: there are three or four others which rife above 5,000l., 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 said districts 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 said districts have been converted from warren and sheep-walks into productive enclosures. They have caused large tracts to be hollow-drained; and occasioned an improved cultivation in almost every respect, where it 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>
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<tr>
<td>30,000</td>
<td>538,664</td>
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<tr>
<td>15,000</td>
<td>599,000</td>
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<tr>
<td>20,000</td>
<td>622,666</td>
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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 decaying 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 1500l. a year, the repairs amounted in eleven years to above 4000l.

Though some individuals have most handsomely 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 inconsiderable; 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 was still carried on in the manufacturing port of Great Yarmouth, but has been carried off to the manufacturing districts of London, where it is more extensively employed.

extended throughout the greatest 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 Yorkshire. At Sudbury there is a manufacture of fayons, and also a small silk manufactory; 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 swing-plough; the horse-rake, for clearing of spring-corn and rubbles; the new drill-plough, invented by Mr. Henry Bading, of Mendham, who was ten years in bringing it to perfection, at a considerable expense; threshing-mills, on the improved construction of Mr. Abrey of Blythborough; and the extirpator, or scalp-plough, a machine for detroying of weeds, and clearing ploughed lands for feed, invented by Mr. Hayward, of Stoke-Ath. 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.

To agricultural societies, which in other parts of the kingdom have been productive of great and extensive benefit, Suffolk is perhaps less indebted than any other county; the only institution of the kind is the Melford Society.

Suffolk was formerly noted for its hop-gardens, but not more than 200 acres, in the neighbourhood of Stow-Market, 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 Tuffer, 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 calculated that at least 240,000 sheep were usually fed within Suffolk.

Suffolk is not less celebrated for its breed of horeses, 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 Cambridgshire. Suffolk contains many rabbit-warrens, especially in the western land 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.
that writer, "are, strictly speaking, absolutely waste, 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 cafe to the public. Many farmers think sheepwalks necessary for their flocks, which is very questionable. They are undoubtedly useful, and if they were converted into crop, the number of sheep kept upon a farm might in a few cafes decline, but good grass adapted to the soil would be abundantly more productive for the flock. Whoever has viewed the immense walls that fill almost the whole country from Newmarket to Thetford, and to Gartrop 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 grass would enable the county to carry many thousands of sheep more than it does at present."  

State of the Poor.—The amount of money levied in this county in 1803, 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 creating and supporting houses of industry. The local inconvenience and difficulties 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 pleasant situations as the vicinity affords. The offices, such as the kitchen, brewhouse, bakehouse, laundry, cellars, are all large, convenient, and kept extremely neat; the work-rooms are large and well aired, and the fixtures kept apart, both in hours of work and recreation. The dormitories are also large, airy, and conveniently disposed; separate rooms for children of each sex, adults and aged. The married have each a separate apartment for themselves; mothers with nurse children are also by themselves. The informaries are large, convenient, airy, and comfortable; none without fire-places. All the houses have a proper room for the necessary dispensary, 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 disposed. In one or two these apartments were rather more spacious and elegant than necessary. There are also convenient store-houses and warehouses 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 land, yet in many places this is combined with different loams. Near the S.W. side of the county, on a line from Wratting park, 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 fertile 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 substratum of chalk. A small part of this county is fen, and in some places the peat-bog is found from one foot to six feet beneath the surface. A tract called Burnt Fen has lately been so much improved by the reparation of banks that 14,000 acres of land have been drained and cultivated.

Divis and Population.—The two grand divisions of Suffolk are the fraschipe, or liberty of Bury St. Edmund's, and the body of the county, or guildable land, each of which furnishes a distinct grand jury for the county affizes. These are subdivided into 21 hundreds, comprehending 523 parishes.

The inhabited houses in 1801 were 30,253
By how many families occupied 43,481
Uninhabited houses 552
Perfons 210,431
Chiefly employed in agriculture 55,744
In trade, manufactues, or handicraft 34,064
In all other occupations 113,692

Rivers.—Suffolk is a well-watered county; its boundaries to the feath 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 Cambridgeshire, and forms throughout its whole course the boundary between Suffolke 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 feast and grounds of Millly 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-easterly direction, it meets at Ipswich, and affirures 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-easterly direction, and passing by Woodbridge, falls into the German ocean.

The Ald rises near Framlingham, and runs south-west to Aldborough, 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 Blyth has its source near Saxfield, in the hundred of Hoxne, whence running east-north-east to Halworth,
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, palaces 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 easterly 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 affords as a secondary river in deepening and enlarging the harbour of Yarmouth. The meadows through which it palaces with an even and gentle course, are supposed 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 Pins 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, 1792. In conjunction with Elysex, it lends one representative to the provincial parliament.

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. Bolton and Chelsea, besides several islands, in which are 34,381 inhabitants. It was constituted a county May the 16th, 1643.

SUFFOLK, a county of New York, comprising all that part of Naffau or Long island, that lies easterly of Queen's county; bounded N. by Long Island Sound, E. and S. by the Atlantic ocean, and W. by Queen's county. The whole area may be about 759 square miles, or 510,720 acres. It contains 21,113 inhabitants, of whom 413 are slaves, 2255 voters, and lends 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 any where than among the inhabitants of Long Island; which fees.

SUFFOLK, a part-town of Virginia, in Nancemond county, on the E. side of the river Nancemond, containing a courthouse, 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.—Alfo, a part-town of Virginia, in Suffolk county; 185 miles from Washington.

SUFFOLK Bay, or Trenwalske Bay, a bay on the W. coast of St. Vincent; 1 mile N. of Cumberland bay.

Suffolk Farmer's Cart, 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 Grazes, the common name given to the dwarf or annual meadow-grases, which is said to be very commonly

met with on all good loamy lands, and to be perhaps the best grasses which we have for pastures, from the rapidity with which it propagates itself, and the forage 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 countess of Suffolk, who used to give it with great success. It is still kept as a secret by some private families, but seems to be only the flour of the earth, or the common buckthorn plantain dried and powdered. Others use this 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 Farmer, gives the method by which he had cured dogs by it with great success. See Phil. Trans. No. 450. P. 455.

SUFFRAGAN, Sulfraganus, in the Ecclesiastical Policy, a term applied (but not very properly) to a bishop, with respect to his archbishop, on whom lie 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 eighteenth century. Some derive it hence, that the bishops are to help and shield the archbishop; qui archiepiscopo sufragari et offi- tere tentatur. Others say, it is because ecclesiastical matters are determined by their votes, or suffrages; & suffragani dicuntur, qui eorum suffragis caufe ecclciastica judi- cantur. Others hold they are called suffragans, because when called to a metropolis to a synod, they have a right of suffrage, or of voting; or because they could not be consecrated without his suffrage or consent.

SUFFRAGAN is also more properly used for a choripope, or an affiliate bishop, or coadjutor, who has a title in partibus infedelium, and affils another in the discharge of his function, or discharges himself 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 deacons, whose suffragans they were; and whom they assisted in duties merely episcopal, as the conferring of orders, confirmation, and consecration of divers kinds; and in this respect, it is said, they differed from the coadjutors who assisted 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 answered by two different persons: the first under the name of suffragan, and the second under that of coadjutor.

These suffragans are by some also called subsidiary bishops. By statute 26 Henry VIII. cap. 14. every archbishop or bishop, disposed 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, livery, and dignity of bishop of 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 nominated, and fixes the place of their respective residence. Their profits and jurisdiction were to be limited by the commissary 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-

3 M 9 million;
SUGHILA, in Geography, a town of Africa, in the county of Sugulmedia; 6 miles S.S.E. of Sugulmedia.

SUGAR. Saccarum, a very sweet, agreeable fatty juice, expressed from a kind of canes, or reeds, growing in great plenty in the East and West Indies. (See Sugar-Canes.) Pure sugar is perfectly transparent and colourless, when crystallized; but when granular, of a pure glos of white, soluble in water and alcohol, without fmel, and with a fimpely fweet taie, having no other flavours.

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 we can gather from the arguments advanced on either fide is, that if they knew the cane, and juice, they did not know the art of condenfing, hard邦, and whitening it; and of confecution, they knew nothing of our fugar.

Some ancient authors, indeed, feem to mention fugar under the name of Indian falt; but they add, that it oozed out of the cane itfelf, and there hardened like a gun; and was even friable between the teeth, like our common falt; whereas fugar is exprefled by a machine on purpose, and cocagulated by the fire.

Thiers, Salmunius (Pinniae Exercit. tom. i. p. 716. G.) tells us, was cooling and floofening: whereas our, the fame author afferts, is hot, and excites thirst. Hence fome have imagined, that the ancient and modern fugar plants were different: but Matthioli on Dioscorides, e. 75. makes no doubt they were the fame; and others are even of opinion, that ours has a laxative virtue, as well as that of the ancients, and that it purges phituta.

The generality of authors, however, agree, that the ancient fugar was much better than the modern; as confiding of only the fneft and mature parts, which made themselves a pallage, and were conduced in the air. The interpreters of Avicenna and Serapion call fugar, foedum; the Perrians, tohax; and the Indians, mambu.

Salmunius (Com. de Sacchar. apud Plin. Exercit. vol. ii. p. 257. A.D. 1689) affures us that the Arabs have ufed the art of making fugar, fuch as we now have it, above nine hundred years.

Others produce the following verfes of P. Terentius Varro Atacinus, to prove that it was known before Jeſus Chrift:

"Indica non magna nimis arbor creët arundo:
Illius e lentis premittit radicibus humo,
Dulcia cui nequeant fucco contendere mella."

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 fugar was not known among the ancient Greeks and Romans, who ufed only honey for sweetening. Paulus Ægineta, he fays, a noted compiler of medical history, and one of the laft Greek writers on that fubjeét, about anno 1625, is the firft who expressly mentions fugar: it was at firft called mel arundinaceum, 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 ufed only in syrups, conifcers, and fuch Arabian medicinal comofitions.

Lucan, enumerating the eastern auxiliaries of Pompey, decribes a people who ufed the cane-juice as a common drink.

"Qui bibunt tenera dulces ab arundine fuccos."

Another queftion among the naturalists is, whether the fugar-canies be originally of the Wett Indies, or whether they have been translated rather from the Eaft?

The learned of these laft ages have been much divided on the point; but F. Labat, a Dominican millifionary, in a difcufion published in 1722, afferts, that the fugar-cane is as natural to America as Ídias; and that the Spafiards and Portuguese firft learned from the Orientals the art of expressing its juice, boiling it, and reducing it into fugar.

Thofe who adopt this opinion affert, that the fugar-cane was
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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 1525, and who enumerates sugar-canes among the fruits and provisions with which the Charribes 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 1556, to 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 Hendripen, and other voyagers, bear testimony, in like manner, to the growth of the cane near the mouth of the Missisippie; 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 Portugueze; and these to the nations of the East. Thus Labat reasons, and LaFita 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, unapprized of the circumstance, might likewise have carried some of the plants to Hispaniola; and this most probably was the fact.

However this be, the industry with which the Spanish 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 50 ingenios, or sugar-mills, were established on that island to early as the year 1535.

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 island continent of Asia, very probably as far east as China, where it still greatly abounds. From that continent it was first transplanted to Cyprus, and thence (according to various authors) into Sicily, where considerable quantities of it were produced about the year 1448, and whither, as some have asserted, it was brought from India by the Saracens. LaFita conjectures, that the plant itself was unknown in Christendom, until the time of the Crusades. Its cultivation, and the method of expressing and purifying the juice, as practised by the inhabitants of Creta and Tripoli, are described by Alberius Aquines, a monkish writer, who observes, that the Christian soldiers in the Holy Land frequently derived refreshment and support, in a scarcity of provisions, by fucking the canes. It flourished also in the Morea, and in the islands of Rhodes and Malta, and from thence was transported into Sicily, but the time is not precisely ascertained. LaFita recites a donation of William, the second king of Sicily, to the monastery of St. Benet, 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 Portugueze to Madeira about the year 1420, and from Sicily, or the southern coasts of Africa, or, as Herrera, the American historian, observes, from Granada, which derived it from Valencia, whither it might have been transplanted by the Arabian Moors, it was brought to the Canaries; from the Canary isles to Brazil; where, indeed, some suppose sugar was originally and spontaneously produced. Others are of opinion, that the Portugueze, before they discovered, or at least transplanted in Brazil, being in possession of the coast of Angola in Africa, first transplanted the sugar-cane from Angola to Brazil. About the year 1520, 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 1541, 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 Colography, 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. 72—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 arils four, five, or more shoots, according to the age or strength of the root: these grow from eight or ten to 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; at each joint are placed leaves, the lower part of which embraces the stalk or 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 like wise 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 theil their leaves; the next five or six still have them, 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, whose length is from seven to nine feet, 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 soil are found rotten, or almost dried up, at the end of thirteen months: in a good soil, favourably 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 leaon, 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
drier, 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 exist till the fiftenth 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 sugar-cane;
and the rainy leaon is the proper time for planting it: the
fooner they are planted after the rains begin to fall, the
more time they have to get strength before the dry weather
sets in.

The land is proper for the sugar-canee, 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 same
plantation, says Mr. Miller, may be continued above twenty
years without replanting, and produce good crops the whole
time: whereas in the common method, they are generally
replanted in fix 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 length, 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
succulent and better ripened, they would not produce canes
so luxuriant, but their juice would be less crude, and con-
tain a greater quantity of salts, which would be obtained
by lees boiling than that of those commonly planted. How-
ever, Mr. Cazaud, a late writer, and a planter of sugar-
canes, oberves, 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 asunder 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 weaklet 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 leaon 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 le-
teenty feet broad, leaving intervals between each of about
twenty feet, for the convenience of passage, and for the ad-
mission of the sun and air between the canes.

The common method of planting the canes now practised,
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 stirred, will be more favourable to the growth of
the canes.

If the ground is afterward to be kept clear by the horfe-
hoes, the rows of canes should be five feet asunder, and the
hills be two feet and a half distant; but one cane left in
each hill. After they have made some fhoots, the fooner
the horse-hoe is naed, the sooner they will thrive, by keep-
ing the weeds under, and well ftriring the land.

When the canes are from feven to ten feet high, and of
proportionable fize, 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-
feflion.

Mr. Cazaud oberves, 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 falk joints
of two canes, which are cut the fame day, have exactly
the fame age and the fame degree of ripeneft, 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 fuppofed growth of ten months, contained the
fame quantity of sugar as that of a cane of the fuppofed
growth of fifteen.

The time for cutting them is usually after twelve or fif-
teen months growth, but this varies according to the foil
and the leaon. Thofe which are cut toward the end of the
dry leaon, before the rains begin to fall, produce better
sugar than thofe cut in the rainy leaons, when they are
more replete with watery juice, and require a greater ex-
pence of fuel to boil it.

In thofe plantations where the number of negroes is
small, sugar is made in almost all leaons indifferently, and
confequently the canes are planted when the planter is bett
prepared for his work, rather than at the moft advantageous
time. The fyrift of cultivation among planters, who are
better fuppiled in refpect of labourers, confines 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 diftances, for
the benefit of a freer circulation of the air; and in cutting
the canes in the four fefth months, viz. February, March,
April, and May, becaufe the sugar is then the fweet, the
canes are cut with the leaft trouble, and fupply (as is fupp-
fed) greater quantities of it. Thofe who adopt this me-
thod, 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 obervations
and experiments on the cultivation of the sugar-cane, has
adopted a new method. He employs the whole of the fird
fix months of the year in the bufinefs of the crop, and in
May and June plants the canes which have been cut in
January. This of courfe induces a neceflity of cutting the
rattoons (or the canes proceeding from the old fumps) 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; fo that the whole planta-
tion is cut every year; and he only plants a fixth part of
his land every year. He has largely illuftrated the leaons
and advantages of this method; the fundamental principle
of which is the neceflity of planting the canes in the only
leaon.
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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 conjoin the two or three following months, and afterwards decrease till February: and, therefore, the progress 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 fugar, this, he says, does not depend on the age, but on the seafon. In February, March, and April, all the canes, whatever be their age, are as ripe as the nature of the soil ever allows them to be; and accordingly he never fails to make the greatest part of his fugar at this seafon. 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 fugar and melaffes one with another; in February, from fifty-six to sixty-four; in March, from sixty-four to seventy-two; in April, sometimes eighty; after which period the fugar ferments, and even burns when the refiner is not very expert 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 fugar and melaffes; and to canes perfectly ripe, the quantity of fugar, he fays, is equal to that of the melaffes. After a trial of this plan for five years, he is convinced that there is a difference of above one-fifth in its favour. Miller's Gard. Dict. Phil. Trans. vol. lxix. part 1, art. xix. p. 207, &c.

The best foil, according to Mr. Edwards, which he has seen or heard of, for the production of fugar of the finest quality, and in the largest proportion, is the alluvial loam of St. Christopher's. Next to that is the foil, which in Jamaica is called the brick-mould, containing a due mixture of clay and fand. Plant-canes in this foil (which are those of the first growth) have been known, in very fine feafons, to yield two tons and a half of fugar per acre. After this may be reckoned the black mould of several varieties. The foil 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-stone and flint, on a subjacent stratum of foapy marle. We shall not enumerate the varieties of soil proper for this kind of culture; but content ourselves with mentioning a peculiar fort of land on the north side of Jamaica, chiefly in the parish of Trelawney, as few foils produce finer fugars, or such as answer so well in the pan, or which yield a greater return of refined fugar. This land is of a red colour, varying by different fluids; but every where remarkable, when first turned up, for a glossy or shining surface, and, if wetted, for draining the fugarers like paint. This foil seems to confift of a native earth, or pure loam, with a mixture of clay and fand. It is easily wrought, and at the fame time so tenacious, that a pond dog in this foil in a proper situation, with no other bottom than its own natural texture, holds water like the stiffest clay. The fystem of husbandry in fugar plantations, which abound with this, chiefly depends on what are called rattoon-canes.

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 succelfion. The common yielding of this land, on an average, is seven bagheads of 16 cwt. 10 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 cafes to great advantage: but the ufe of the plough is not adapted to every foil or situation. The only advantageous fystem of ploughing in the West Indies is to confine it to the fimple operation of holing, which is much more easily and expeditiously performed by the plough than by the hoe, and which affords, in the cafe of flif and dry foils, great relief to the negroes. The method of holing has been already defcribed. The proper seafon, generally speaking, for planting, is in the interval between August and the beginning of November. By having the advantage of the autumnal seafon, the young canes become sufficiently luxuriant to shade the ground before the 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, fo as to enable the overfeer or manager to finish his crop by the latter end of May. It has been juftly remarked, that there is not a greater error in the fystem of planting, than to make fugar, or plant canes, in improper seafons of the year; for by mismanagement of this kind, every succeeding crop is put out of regular order. However, neither prudence in the management, nor favourable foils, nor feafonable weather, will exempt the planter at all times from misfortune in the culture of his fugar-canes. They are Subject to a defaefe called the "blift," which confists of many myriads of little insects of the aphid genus, faid to be invisible to the unaided eye, whose proper food is the juice of the cane; in purs uit of which they wound the tender blades, and destroy the veffels. 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 grufh, called the "borer." In Tobago they have another deftructive insect, called the "jumper-fly." It is faid that the "blift" never attacks thofe plantations, where colonies have been introduced of the little animal, called the carnivorous ant; the "formica omnivora" of Linneus, and the "Raffles" ant of Jamaica.

The manner generally ufed in fugar-planting is a compofed of the coal and vegetable ashes, drawn from the fires of the boiling and till-houles; frecuencies discharged from the illi-houle, mixed with rubish of buildings, white lime, &c.; refuge, or field-trafh, i.e. the decayed leaves and ftems of the canes, fo called in contradifinction to cane-trafh ufed for fuel; dung, obtained from the horfe and mule ifables, and from cattle-pens; and good mould, collected from gullies, or other wafe places, and thrown into the cattle-pens.

When the rattoons or canes are ripe, as they ordinarily are in twelve or fifteen months, or, as Mr. Cazaund apprehends, in eleven or twelve months, they are cut, and carried in bundles to the mills. The mills confift of three wooden rollers, covered with fteel 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 25 inches in diameter; and the middle one, to which the moving power is applied, turns the other two by means of cogs. Between thefe rollers the canes, being previously cut, are twice compressed; for having paffed the firt and fecoand rollers, they are turned round the middle one by a circular piece of frame-work, or ferew, called in Jamaica the "dump-returner," and forced back through the fecoid and third; an operation which squeezes them completely dry, and sometimes even reduces them to powder. (For a farther account of fugar-mills, see the sequel of this article.) The juice from the mill ordinarily contains eight parts of pure water, one part of fugar, and one part made of grof oil and mucilaginous gum, with a portion of effetual oil. Some juice, however, has been so rich
as to make a hog's head (16 cwt.) of sugar from 1,500 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, cane sufficient for thirty hogheads of sugar in a week. On plantations thus happily provided, the means of quick boiling are indispensably requisite, or the cane-liquor will unavoidably become tainted before it can be exposed to the fire. The perfect 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 cane 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 cisterns that make on a medium, during crop-time, from fifteen to twenty hogheads of sugar a week, three 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 fihon or cock for drawing off the liquor. There is a flat bottom, and hung to a separate fire, each chimney having an iron slider, which being flut in the fire goes out for want of air. These circumstances are indispensable, and the advantages of them will presently be shown. The clarifiers are commonly placed in the middle or at one end of the boiling-house. If at one end, the boiler called the "teache" is placed at the other, and several boilers (generally three) are ranged between them. The teache is ordinarily from 70 to 100 gallons, and the boilers between the clarifiers and teache diminish in size from the frill to the laft. Where the clarifiers are in the middle, there is usually a set of three boilers on each side, which constitute in effect a double boiling-house. On very large cisterns, this arrangement is found useful and necessary. The objection to fo great a number is the expense of fuel; to obviate which, in some degree, the three boilers on each side of the clarifiers are commonly hung to one fire.

The steam then from the receiver having filled the clarifier with fresh liquor, and the fire being lighted, the "temper," which is commonly Britol white-lime in powder, is stirred into it. One great intention of this is to neutralize the superabundant acid, to get properly rid of which, is the great difficulty in sugar-making. This is generally effected by the alkali or lime; part of which, at the same time, becomes the basis of the sugar. The quantity necessary for this purpose must, of course, vary with the quality both of the lime and of the cane-liquor. Some planters allow a pint of Brittish lime to every hundred gallons of liquor; but this proportion is, Mr. Edwards believes, generally found too large. The lime is perceptible in the sugar, both to the smell and taste, and precipitates in the copper pans a black insoluble calx, which seethes 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 lea of it may be precipitated to the bottom, an inconveniency 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 sugar without a particle of temper. Too much temper is perceptible in the sugar, both to the smell and taste: it might be added, and also to the sight. It tinges the liquor slight yellow, and, if in excess, turns it to a dark red. Too much temper likewise prevents the metals from separating from the sugar, when it is potted or put into the hog's head.

As the fire increases in force, and the liquor grows hot, a scum 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 containing. 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 scum 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 permitted to remain a full hour, if circumstances will permit, undisturbed. During this interval, great part of the secunencies and impurities will attract each other, and rise in the scum. The liquor is now carefully drawn off, either by a fihon, which draws up a pure defecated stream through the scum, or by means of a cock at the bottom. In either case, the scum sinks down unbroken 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 fihons 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 fractioning is wonderful. Neither can fractioning properly cleanse the subjunct; 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 floated 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 scum rises, it is continually taken off by large fihons, until the liquor grows finer and somewhat thicker. This labour is continued until, from the fractioning and evaporation, the subjunct 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 copper the boiling and fractioning are contained; and if the subjunct 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 thickens too fast to permit the fractionings to run together, and rise in the scum. 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 fuch fractioning and evaporation, the liquor is again sufficiently reduced to be contained in the third copper, it
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is laded into it, and to on to the left copper, which is called the "teache," probably from the practice of trying by the touch. This arrangement supposes four boilers or copper, exclusive of the three clarifiers.

In the teache the subjëct in fall farther evaporated, till it is judged sufficiently boiled to be removed from the fire. This operation is usually called "flying," i.e. lading the liquor, now exceedingly thick, into the cooler.

The cooler, of which there are commonly fix, 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 hogshead of sugar. Here the sugar grains; i.e. as it cools, it runs into a coar e irregular matrix of imperfect semi-formed crys tall, separating itself from the melasses. From the cooler it is carried to the curing-house, where the melasses drain from it. It may be proper in this place to observe, that in order to obtain a large-grained sugar, it must be suffered to cool slowly and gradually. If the coolers are too shallow, the grain is injured in a surprising manner. Any person may be convinced of this, by pouring some of the hot syrup, when fit for flying, into a pewter vessel: 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 subjëct is sufficiently evaporated for "flying," or become fit for being laded from the teache to the cooler. Many of the negro boil ers 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, as 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 sugar 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 precept will furnish any degree of skill in a matter depending wholly on constant practice.

A method more certain and scientific was recommended some years ago, by John Proculus 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 subjëct, one on the other, and carry your tryer out of the boiling-house into the air. Observe your subjëct, 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 strip 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 system of clarifying the cane-liquor, by means of vessels 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 treatise in question.

A large curing-house is a large airy building, provided with a capacious melasses citer, the sides of which are sloped and lined with terras, or boards. Over this citer there is a frame of maffy joint-work, without boarding. On the joints of this frame, empty hogsheds, without headings, are ranged. In the bottoms of these hogsheds eight or ten holes are bored, through each of which the stalk of a planter's cane is thrust, fix or eighteen inches below the joint, and long enough to fit upward above the top of the hogs head. Into these hogsheds the mass from the cooler is put, which is called "potting," and the melasses drain through the spongy stalk, and drop into the citer, from whence it is occasionally taken for distillation. The hugar, in about three weeks, grows tolerably dry and fair. It is then said to be cured, and the process is finished. The curing-house should be close and warm, as warmth con tributes to free the hugar from the melasses.

Sugar, thus obtained, is called "mucovado," and is the raw material from which the British sugar-bakers chiefly make their loaf, or refined lump. There is another sort, which was formerly much approved in Great Britain for domestic purposes, and was generally known by the name of Lisbon sugar. It is fair, hot of a soft texture, and in the Weit Indies is called "clayed sugar." The process is conducted as follows: A quantity of sugar from the cooler 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 sugar 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 sugar,) the plug is taken out, and the pot placed over a large jar, intended to receive the syrup or melasses 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 filtratum of clay is spread on the sugar, and moistened with water, which oozing imperceptibly through the pores of the clay, unites intimately with, and dilutes the melasses; consequently more of it comes away than from sugar cured in the hogshead, and the sugar, of course, becomes so much the whiter and purer. The pots remain for twenty days in this situation, after which the sugar is taken out, dried in the sun for some hours, and then taken to a large flore-room where it is kept in a pretty strong heat 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 sugar, it was found under her tread to be whiter than elsewhere."

The reason assigned why this process is not universally adopted in the British hugar islands is this, that the water, which dilutes and carries away the melasses, dissolves and carries with it so much of the sugar, 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 lofs in weight by claying is about one-third; thus, a pot of 60 pounds is reduced to 40 pounds; but if the melasses which are drawn off in this practice be reboiled, they will give nearly 40 per cent. of sugar; so that the real loss 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 planters in shipping mucovado sugar, and distilling the melasses, is more generally profitable than the system of claying.

The Cuchinchinete prepare a very excellent moist sugar, remarkably cheap, by a very simple process, similar to that of claying. The grained sugar, after the grape syrup has drained from it, and it has become considerably solid, is placed Voi. XXXIV.
placed in layers about an inch thick, under layers of the same dimensions of the herbaceous trunk of the plantain tree; the watery juices, exuding from which, act like claying, and leave the sugar very white and porous, like a honeycomb. This is pure enough to dissolve in water, without any sediment.

F. Labat mentions several different kinds of sugars, prepared in the Caribbees, viz. Crude sugar, or mucovado; strained, or brown sugar; earthed, or white sugar in powder; refined sugar, either in powder or loaves; royal sugar; candied sugar; sugar of fayr syrup; sugar of coarse syrup; sugar of the scum.

Sugar, Crude, or Mucovado, is that first drawn from the juice of the cane; of which all the rest are compounded. 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 earthed sugar; which is the white powdered sugar.

The preparation of this is the same as that of the mucovado, with this difference, that, to whiten it, they drain 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 preparation of it; for they not only drain it, but, when boiled, put it into square wooden forms, or moulds, of a pyramidal figure; and when it has purified itself, they cut it in pieces, dry it in loaves, and barrel it up. See Refining of Sugar, infra.

Sugar, Earthed, is that which is whitened by means of earth laid on the top of the forms it is put in to purge itself. See Refining of Sugar.

Sugar of the Scum. This is all made of the fem of the two last copper ; those of the former being reserved for the making of rum.

The feum 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 feum, is put into the copper a fourth part of water, to retard the boiling, and give time for its purging; when it begins to boil, the usual ley is put in, and it is carefully scummed; when almost enough boiled, lime and alun-water are thrown in; and when it is ready to be taken out, they sprinkle it with a little powdered alun.

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 call the remainder of their syrup, and fit them to be returned into a crude sugar. The Dutch and German refiners first taught the Isla Xaders how to turn their treacle into sugar.

The second syrup is wrought somewhat differently: after the copper it is to be boiled in is half full, eight or ten quarts of lime-water are call in; it is then boiled with a brisk fire, and carefully scummed; some add a ley, and others

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 last 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 instantly into cookers, 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 incorporate the two together. This done, they drew the surface over with the same pounded sugar, to the thickness of one-fifth of an inch, this allifying the sugar in forming its grain. When fettled, and the crust gathered at the top, a hole is made in the crust 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 crust. When all the syrups are boiled, and the cooler is full, they break all the crusts; and, after mixing them well, put them up in forms or moulds.

The reft is performed in the same manner as for the earthed sugar, from which it only differs in that it falls short of its glos and brightnèfs; being, in reality, sometimes whiter and finer, though of a flatter and diller 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 leaves that have not whitened well, are the bails, or ground, of this sugar. See Refining of Sugar.

Sugar, Royal. The bails of this fort ought to be the pureft refined sugar to be found. They mix with a weak lime-water; and, sometimes, to make it the whiter, and prevent the lime from reddening it, they use alun-water. This they clarify three times, and pafs as often through a close cloth, using the very best earth. When prepared with thefe precautions it is whiter than know, and fo transparent, that we fee a finger touching it, even through the thickest part of the leaf.

The curious in the whole art of sugar-making, or the reducing vegetable juices to what we call sugar, by exprefion, decoction, clarification, draining, claying, and crystallization, will find farther accounts and directions, in the several procéfles of this art, in Pifo's Hill. Ind.; in Angelus Sala's Saccharologia; in Dr. Slave's Treatife on Sugars; in Sir Hans Sloane's History of Jamaica; Baker's Ellay, above cited; and Edwards's History of the West Indies, vol. ii. There are also several valuable papers on these subjects in the Philosophical Transactions.

Sugar, Refining of, is the art of purifying sugar, and of giving it a superior degree of whiteness and lollitude. The excellence of mucovado sugars, or such as have not been refined by the planter, but are left home in the most crude flate, confists in their whitesnes, dryness or freecness, cleannes and harffpnes, or strength. The judicious refiner decides upon thefe several qualities by the eye, the touch, and the tale.

The firft operation in the process of refining is that of clearing the pans; previously to which they are charged, by throwing about five quarts of fresh bullock's blood (called spice) into each pan, and tilling it with lime-water to about half the height from the bottom to the part in which the brace is fixed; and when thefe 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 the spig, and thrown up to the surface. About two quarts of spig are added to each pan, within the first hour after the fires are lighted. The spig 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 greasy; and it is gently removed with a broad skimmer into a portable tub, and conveyed into the cistern. Having done this, the panman stirs together a ladleful of spig (e. gr. about a quart), and a quantity of lime-water (e. gr. one or two gallons, as the cafe may require); and pours this mixture into each pan. When the spig is again brought to a boiling heat, it throws up a second spig, not so foul as the first, which is removed as before. He then adds a fresh quantity of spig, but less than the former, and repeats this operation, till the spig calls up a clean milky froth, which indicates that the impurity is wholly extracted. The spig is also sometimes examined with a bright silver or metal spoon, that any remaining foulefs may be discovered. In the making of double loaves, powdered loaves, or very fine single loaves, it is usual to heighten the natural colour of the spig by the addition of a little blue. For this purpose, when the pans are almost clear, the quantity of about six pennyweights of the finest indigo, finely powdered and filtered through a piece of woollen or blankets in a bason of fresh water, and well stirred together in a bason, is thrown into each pan. The spig being once raised in the pan after this infusion, the groffer particles of the colour are taken off in the last feem, and the remainder is incorporated with the spig in the pan.

The panman having brought the spig to the cleanest flat, prepares to "flip it off," or to shift it from one vessel to another: this is done by means of a wooden gutter laid along the parts, and opening into the clarifying cistern. Over this cistern, upon large iron bars, is fixed an oblong baleft, about sixteen inches deep, in which a large thick blanket is fastened: and through this blanket and baleft the spig liquid paffes out of the gutter; and to the mafs a quantity of syrup is usually added. Having measured the quantity of liquid in the cistern with a rod graduated by inches, the panman pours back into the pans either the fifth or ninth part of the whole, as he is directed by the supervisor or boiler; and the pans are all supplied together by means of a trough. When this is done, the fire is stirred up to a considerable degree of fierceness; and then commences a new operation, viz. evaporation. In this part of the process (the day's work being divided into three fillings), the panman pumps into the pan one-ninth part of the quantity in the cistern, which in a few seconds begins to boil, and must be continued in a boilling flat, but not with too intense a fire; and to prevent the spig from boiling up to the surface of the pan, or from boiling over, he calls a small quantity (viz. a piece as large as a nutmeg or walnut, as the cafe may require) of butter or grease into the boiling liquor. Here it is to be observed, that sugar should boil low in the pan, but not too flat, like water; for by rising hollow from the bottom, the necessary evaporation is retarded, and the spig is exposèd to the action of the fire for a longer time than it ought to be. In a space of time from twelve to thirty minutes, the evaporation will have produced its effect, and the spig acquire the requisite degree of vifcousness. The flat will be indicated by various circumstances; as by the bubbles dragging heavily over the surface of the boiling mafs, and by the clammy liquid falling in ropes from the proof-flick; but principally by that which is called the "proof." For this purpose, the boiler draws the flick out of the boiling liquid with his right hand, and placing his left thumb upon the spig, draws it across the flick, carrying away upon the end of his thumb as much of the spig as will hang upon it; he then, by means of a candle placed in a black box, called the "proof-box," and by repeated trials (drawing the spig to a thread between his thumb and fore-finger) determines when the evaporation is complete; and when this is decided, the fire is mothered, and nearly quenched. The hot spig-liquor is then removed by means of basons out of the pans into coolers, two or three gallons being left in each pan to prevent the bottom from being scorched; and the pans are again supplied with a quantity of liquor for the next evaporation. The liquor in the coolers is gently stirred to prevent a crust from forming on its surface. When the second quantity is brought to proof, and flipped off into the coolers, the pans are supplied with a similar quantity; and while this is boiling, that part of the process of refining, called granulation, is pursued. For this purpose the spig is disturbed in the coolers by an instrument called an "ear," and refembling the oar of a boat; the violent motion thus continued for several minutes, serves to destroy the vifcousnefs of the spig, and to complete the granulation. Upon this operation much of the beauty and success of the manufacture depend; for if the spigs are not stirred enough, the grain of the refined spig will be large and loose, and its colour not sufficiently white; but if it is stirred too much, the grains will be broken, the spig will be disunited in its parts, and though close and smooth, without luster; and it will lose considerably of its due weight. When the third filling is boiled, and the coolers sufficiently stirred, the contents of the pans are conveyed to the coolers, as before; and thus the first flage of boiling for the day is completed. The course of the other two fillings is precisely the same.

The next operation in refining is conducted in that part of the ground-floor of a spig-house, which is denominated the fill-houfe, 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 prepared by foaking and washing them, and filling their apertures with wet linen rags, are placed side by side, and in rows two or three deep: their number is to suffice for the quantity of liquor in the coolers, which is estimated by the number of basons which were skipped off 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 abutment; these are called "flayers." The spig, being previously skirts in the coolers, in order thoroughly to mix each skipping, is ladied out of the coolers in succession, and not all at once, (unless the skippings are small, in foaves, and always in lumps,) into basons conveniently situated; and these are carried into the fill-house, where as much of the spig 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 skimming the spig in them, is called "hauling," and is designed 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 wainscoat, and called a knife, and in fize proportioned to that of the mould to be filled; with this tool, keeping his hand over the centre of the mould, he fcrapes the spig from its sides by successive strokes downwards, carried all round; and when two revolutions are performed, the spig is allowed to remain minutes, until it has acquired some firmness. The moulds, being
being flared round three or four times, according to the direction of the boiler, are no more disturbed till they are pulled up.

The process already described relates to sugar once refined, called single loaves; double loaves are usually cleared with the whites of eggs instead of spice, (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 fumes. 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, Proflun lumps; eighth, Canary, or patton 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 bastard-boiling; and these sixteen or seventeen days constitute a complete series, denominated a complement, or refining.

From this digestion let us now return to the fill-house; 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 fum 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 finisht, 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-forted pots are placed in ranks for this purpose. The up-flairs man plucks out from the point of every one the flapper or rag; and pricks them in the point with an awl, the fize 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, contain of the vegetable falt, and an oily matter, now called syrup, but which, after the final extraction of the fats, will be called malmous. 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 falling 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 acompact and smooth appearance, they are fit to receive clay. When the syrup bals fearfully defended 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 loose, 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 prefling 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 lodgement 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 bottanning-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 liquid sugar which the trowel had cut; and they are prefled 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 overfieing. Double loaves, fine powder loaves, and fine single loaves, will sometimes, under this clay, be found neat, i.e. the rednufs or brownnufs will have quitted the loaf, and the head, though till moist, will appear perfectly free from discoloration. The workman, however, in order to be farther fatiied, 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 brufling-off, i.e. of scraping off the irregularities and impurities occasioned by the contact with the clay with an iron tool, called a brufling-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 third clay; which is usually laid on in a thinner mass than the former. If his loaves are not yet quite finisht, he puts a little fresh moisture on the back of the overfien clay, and thus effects his purpose.

The loaves being now rendered neat, and brufled off, must stand some days in the moulds to acquire face, or that flaky hardnufs of surface, which will enable them to fland 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 float, or against a popl; and thus the coats are improved by preventing adhesion to the moulds, and facilitating the precipitation of the remaining moisture. The
windows are opened to let in air, if the weather be dry; and the points or notes are also examined, which will sometimes melt away, whilst the above operation is effecting. When these symptoms appear, the workman proceeds to turn down half loaves, by taking the muds from the pots containing the floor with clear brown paper, and turning each loaf down with its mould over it. They are usually turned down either upon the flove-head, or in some warm place, because by being left uncovered, and exposed to the action of cold air, the moiture 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 fyrup's 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 congeals throughout an uniform appearance. The loaves are then taken off the floor, separately examined, and cleared of any discoloured specks with a small knife; and are either papered and set in the flove, or else are placed in the flove without paper, as the case may require. If any of them have full a remaining yellowness in the head, the point is cut off, and they are then called fpot-loaves. They remain in the flove five, six, or seven days, till they are entirely dry, and are then fit for sale and use. The management above flaws in the course of this one day's work is nearly the same, whether the fugar be fine or coarse.

Brown fugars, wrought in large moulds, require more clay than fine fugars in small moulds: nor is it necessary that lumps should be made neat; but it is the constant practice to cut off the wet head from every lump, so as to leave no remaining redness; 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 bruddings 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 fugars 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 fugar, 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 melers: they are low boiled, and tinted but little (though some boilers flir 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 parlor; a little warmth is sufficient for powder loaves, and fine finge loaves; inferior loaves, and lumps of a middling quality, require warmth; but the brownell lumps and babbage thrive in a glowing heat. Every lof of refined fugar 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 effected 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 less bound up by fire.

The fyruhs, which are discharged from refined fugar 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 manufactory; and upon the proper management of them much of its success depends. It will be proper, therefore, to offer the following remarks relating to the use of fyruhs, produced from a day's work of fugar once refined in loaves. When the loaves are prepared to receive the first clay, the fyruh is collected into gathering-pots, each of which contains from 50 to 60 pounds of fyruh; this is called green fyruh, on account of the new or green state of the loaves from which it runs; and the quantity of it is usually about 5 gathering-pots from each pan of goods. The next fyruh, called second runnings, is commonly collected when the second clay is finished, and amounts in quantity to about eight gathering-pots per pan. The third and last collection is made after 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 fyruhs oftener than three. The fyruhs of every kind of refined fugar increase in fineness and value, the latter they exude from the moulds. As for the appropriation of them, the green or low fyruhs 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 babbage fugar, form a principal article in the fugar-trade. The finer fyruhs are all incorporated with fugar, and a proportion of them is daily brought down through the fyruh-pipes into the cilters, at the same time in which the fugar is first skimmed from the pans; the fyruh-pipe discharging its contents into the clarifying baffle, so that the fyruh, as well as the fugar, passes through the blanket; and it is pumped back from the cilters into the pans.

The following estimates exhibit the quantity of fyruh 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 finge loaves, 15 ditto; for middling-loaves, 20 ditto; for brown finge loaves, and Canary lumps, 25 ditto; for lumps, 30 or 40 ditto.

With the necessaries allowances for particular circumstances, the several forts of fyruhs may be duly appropriated in the following manner. Green fyruhs 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 fyruhs 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 fyruh of double loaves would be used in making finge loaves; the second runnings would go into the composition of powder loaves; and the drippings would enter into the substance of other double loaves. Again, the green fyruh of large lumps would be boiled off in babbage; 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 ballards, which are either boiled from fyruhs that are too good to make ballards, or are made of such fyruhs, 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 fyruh that comes from them is boiled again, either to make ballards or other pieces, according to its goodness; whereas the fyruh that runs from ballards is always considered as a caput mortuum, and no efforts are made to obtain any fyruh from it, but it is put into calks, and sold under the denomination of melases. It is, therefore, worth the boiler's attention to keep all the weight of fugar pof in the quantity of ballards; and for this purpose, he must fly the work as high as he may venture, without incurring the danger of making hopped ballards, i.e. ballards from which the melases
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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 ballotards and pieces are composed, not abounding with3s like those already treated of, have not an equal disposition to con-crete; 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. The inferior productions are thinned, neither in the coolers nor in the moulds, any more than by a small movement round the coolers, with an iron crane, 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 aqueous. When the hot fluid is poured into a ballotard 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 live, fix, seven, or eight days after they have been pulled up; for they want time to harden, and cannot safely be left unlopped. Having reached the lower part of the mould, they are formed into small flinty sub-\[\ldots]\n
The liquor drawn from these scums is commonly used in ballotard boiling, or in the browned lumps. There is a large proportion of the fat scum usually left of every refining, to be made over during the ballotard boiling; it is common to let by the first or grostest scum 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 ballotards, 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 con-\[\ldots]\n
The ballotards and pieces are usually chayed but twice, and when dry enough, are knocked out of the moulds, their wet heads being cut off into a large mould placed to re-ceive them, and they are called ballotard-heads, or fine; in another mould is preferred the grain, which usually forms a fratum about two inches broad, beginning about four inches from the point of the mould. The ballotards and pieces are then put into the stove, and in five, six, or seven days, will be found dry enough; for they must not, like lumps and leaves, be rendered perfectly dry. They are then taken out and piled in a room, as near the mill as 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 ballotard or piece is di-\[\ldots]\n
We shall now close this article with a short account of the method of making over feums, and the application of their produce. The refiner extracts from the feum of his sugars, every particle of sugar which it is in his power to obtain; and after he has reduced the seum to such a flake that it appears to be a mere earth, resembling garden mould, he sells it to a seum-boiler, who again tries it over the fire, and extracts a small quantity of sweet liquor out of it. The seum of fine treble or double leaves is often put into the pans again without any procels, and mixed with raw sugar, for the production of inferior goods: but, in general, the seum of each day's work is made over in the same day after the boiling of the seum is finitched. 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 seum, each tub containing about three-fourths of a hundred-weight. Having thirred the liquor well, he makes a moderate fire, and the seum will separate from the fluid and float upon the top of it: with a small iron scraper, he prevents any souflees from adhering to the bottom of the pans; and then suffers the fire to increase, and the liquor, upon the verge of boiling, is seen through the open-\[\ldots]\n
Ungs 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 balscket, to which a coarse bag, called the feum-bag, is fitted, he pours the contents of his pan into this balscket and bag; and then the mouth of the bag is drawn up, and well twisted together, and a strong board, called a seum-board, is laid upon the bags, with several weights upon the board, to press down the seum. In the space of an hour, or an hour and a half, the bag should be twitted and pressed; 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 gross matter hath passed through the bags, it is drawn off with the reft of the seum of the sugar when cleared. The seum, as it is taken from the pan, is called fat seum, and the liquid matter drawn from it bears the fame appellation; in contra-\[\ldots]\n
The liquor drawn from these scums is commonly used in ballotard boiling, or in the browned lumps. There is a large proportion of the fat seum usually left of every refining, to be made over during the ballotard boiling; it is common to let by the first or grostest seum 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 ballotards, 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 con-\[\ldots]\n
Of the improvements that have been made in the pro-\[\ldots]\n
In October 1812, Edward Charles Howard, eq. of Welbourn Green, in the county of Middlesex, obtained a patent, the specification of which informs us, that he has etablilshed and adopted the following operations. In the first in\[\ldots]\n
which is most conveniently effected in a vessel surrounded by boiling-water or seum, under the common prelure of the atmosphere; he then adds more sugar, or a thinner magma, so as to render the mafs imperfectly fluid, and fills the moulds with it from the water-bath; and when it is become cold in the moulds, he takes the flopper out of the mould, and suffers the melaffes to drain from it. When the drain-\[\ldots]\n
He next mixes the sugar foil pared off with cold
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cold water, till the magnum acquires a consistency, which will not allow it to readily close behind the filter; and then replaces it, in that condition, upon the uniform and firm surface before prepared; and as soon as the magnum 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 magnum 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 that mentioned, and again replaces it as aforesaid; and he repeats the said operations by this magnum, or with a cold saturated solution of finer sugar than that which he intends to refine, according to its nature or quality. He farther declares, that when the fugar proves extremely close-grained, and the surface extremely hard, an unfaturated solution of fugar, or even water itself, may be poured on it, without running in; but this process requires too much nicety for general practice.

When the fugar opens properly, the finer the fugar, made into magnum, is ground, the better, because the moisture is thereby prevented from descending too fast or unequally into the fugar. It is not necessity, that the fugar 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 fo prepared, or by observing the greater or lesser freedom with which new moiture is admitted, and the colour of the malafles dripping out. It is farther declared, that it is most beneficial in conducting this proceed, to leave the temperature of the place or apartment in which the moulds are placed, previously to their being treated with the magma, to about 60°, and again to raise the fame to about 80° or 90°, after the surface of the fugar becomes dry for the last time. It will be necessary, in every case of the percolation of malafles or syrup, to pierce, perforate, or break the dry surface of the mafs of fugar in the moulds, when it is become fo solid or iceed over as to prevent the access or escape of the air into or out of the fugar, and thus to impede or prevent the flow of the malafles or syrup.

The 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 fugar from that which retains malfles, reserving this latter to be mixed up with raw fugar, for a subsequent preparatory operation, such as has been already described. The former is then refined by pouring upon it, in any convenient vessel, 6lbs. of water (boiling-hot) to every 5 lbs. of fugar, deducting about 6 per cent. for the moiture previously contained in it; and having infused a perfect diffusion of the fugar, by stirring, the impurities are allowed to subside, and then the solution is drawn off from the faid impurities into another clean fuitable vessel; and in order farther to clarify and separate impurities and colouring matter, the ordinary finings are added. These finings are prepared by flaking 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 chemifls term it, by the proeef of elutriation; and that this may be done effectually, the lime and liquor so washed over, are made to pass through as fine a sieve as is practicable; and about the pallage of the finell curd. The next part of the proceefs is to diffuse about 1½ lbs. of alum for every cwt. of folid fugar that is to be refined in about 16 times its weight of water, and to add to such solution about 70 or 80 grains of whiting for each pound of alum; and after stirring up the mixture till the effervescence ceases, the suspended fubfiances are allowed to subside, and the solution is drawn off from the precipitated matters, and then poured 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 fanned 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 subfdence, be scarcely changed at all. The finings, thus duly prepared, are furred to settle to the bottom of the containing vessel; and after draining off the supernatant liquor, the faid finings are placed upon blankets, supported in the manner of a filter, and the moiture is drained off till the mafs begins to contract, and separate by cracks in it; and in this latte the faid finings are fit for the clarification of the fugar laid down off, as above defcribed. Such a quantity of that solution, or of any other fimilar solution of fugar, is added by degrees, and with stirring, as will bring them to an uniform creamy flate. This mixture is then poured into the whole quantity of the faid solution of fugar prepared or intended for clarification as aforesaid, with sufficient agitation for diffusing the finings equally.

The refined or clarified fugar is then furred to remain, either during the night, or for about fix 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 belt effected by the heat of steam, or water under the common prevalence of the atmosphere, until the hot liquor shall have acquired a specific gravity of about 1.37 (that of water being 100), and in this flate the fame is transferred to any convenient vessel, and exhilarated, or stritten in the proper graminulous confluence to fill the moulds, and accordingly the moulds are filled with it. The flippers 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 faid operation, and when the fyrup has left the upper surface of the lump, loaf, or mafs, the fame is pared down, as before defcribed; and if the fugar appear sufficiently fine for the intended 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 fugar 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 close in its grain to satisfy the confeumer, 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 redeliver the fame. If it be required to retain the point of the lump, loaf, or mafs, without returning the fyrup contained in that point upon its body, this defideratum is effected by the appendage of a pipe, applied and fixed to moulds of the usual confluence, having the aperture enlarged to one inch at the leaflet, or to form part of a new mould, which is to be fabricated on purpose; then the lower portion of the fugar is taken off, which will be contained in the said pipe, along with the redundant fyrup, instead of taking off the point as usual.

One fourth of the liquor left in the two flims 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 filtration, all the sweat they contain; which sweet liquor is used for magmas. The syrups, which drain from fuggars 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 steam or water-bath above-mentioned; and such syrups will, by such treatment, afford strong crystalline a second, third, or even fourth time. Or, otherwise, fugar remaining from top-parings, cut-off points, or any other remnants, may be melted in them, upon the water-bath, to bring the same up to their crystallizing density or granular consitency; and the inferior syrups may be advantageously mixed with mucovado sugar instead of water, in the manner slated in the account of the primary operation.

The lumps, loaves, or masses of fugar which have been refined by the use of the ordinary or common finings, or any other fuggars in a forward state of refinement, may be further refined by the application of other finings, prepared in the following manner; viz. by dissolving about three pounds and a half of alun for every hundred weight of solid fugar, in about sixteen times its weight of boiling-hot water, and adding to such solution about twenty or eighty grains of whiting for each pound of alun; and after furring up such mixture till the effervescence ceases, allowing the suspended substances to subsidence, and drawing off the solution, pouring it (instead of the lime-curls in the ordinary finings) a concentrated solution or lea of caffic foda, until the agitated mixture shall produce a very light ftrain upon turmeric paper; and then adding to it the fairer water, washing the precipitate by alternate diffusion and subsidence, until the water comes off taieled, and then drawing off or draining the remaining water from the finings, as before described. The water is often purified by the well-known process of boiling it with a small quantity of alun, and a little lime or chalk, taking care to leave no excess of caffic lime in solution. It is observed, that a compound of lime and alumine would answer the purpose of the first finings, and that pure alumine, however obtained, will answer the purpose of the second finings: and that caffic lime is preferred to potash, because the salt resulting is most easily washed away, and to ammonia, because this salt is an article of great price. In the specification it is added, that the superior degree of refinement in solid fugar (already refined to a forward state) is produced by diffusing the fugar intended to be refined, in the fairer water (boiling hot), in the manner and proportion already described. Subsequently to his preparatory operation, and immediately upon the solution being effected, the patentee mixes and diffuses his second finings as the first finings were directed to be mixed and diffused, and after due clarification by repose, he proceeds to the evaporation and subsequent completion of the fugar in aoves, as before directed and prescribed in like cafes. He farther declares, that in the application of heat to the refining of fuggars, he makes use, in certain circumstances, of higher temperatures than above stated (although less beneficial), taking care to preserve an uniformity in the application of the heat to the surface of the boiler. For temperatures above the boiling point of water, he makes his steam-bath strong, and capable of being properly clozed, and provides the same with a feeder under due preface, or a forcing-pump for feeding, and a safety-valve and pipes of communication, cock, and gauges, and all or any of the needful fittings-up, which are commonly used with steam-boilers. It is farther remarked, that if it be required to use the ordinary or common finings to very coarse moist or deliquecent fuggars, it will be necessary to add a greater proportion of the lime-curls than that which has been prescribed with regard to fuggars partly refined by percolation or otherwise; and making the said addition, the judgment of the operator must be directed by the quality of the said coarse moist or deliquecent fuggars. The patentee further declares, that his invention, and the several manipulations of it, may be practiced, wholly or separately, without or in conjunction with the methods of refining fuggars already in common use. Mr. E. C. Howard obtained another patent, dated Nov. 20th, 1813, for certain improvements in the procedures described in the patent granted to him October 31st, 1812, and certain apparatus for carrying the same into effect.

A patent, dated May 8th, 1815, was granted to Peter Martinieu the younger, of Canonbury-House, Ilfington, and John Martinieu the younger, of Stanford-Hill, gentleman, for a new method or methods of refining or clarifying certain vegetable substanases. In their specification they declare, that if their invention, so far as relates to animal charcoa, is applied to vegetable acids, such as are usually prepared or manufactured in a crystallized state, or other vegetable substanaces, the process should be the same is hereafter described, excepting only that as blood may be advantageously used in refining fuggars, it is not necessary for refining other substanaces, from which the articles which they employ may be separated by filtering in common and well-known methods.

The articles employed by the patentees for purifying and clarifying fugar, are, 1st, animal charcoa; that is, animal substanaces, properly burnt, or charred, or calcined, such as ivory-black, bone-ash, &c. and afterwards reduced into smaller pieces or powder, 2dly. Bituminous earths, commonly called coals, either in the state in which they are mineral, or articles of their products after fusion, and reduced, as before-mentioned. 3dly. Certain argillaceous earths, known by the name of ochre. 4thly. The vegetable charcoa, usually called lamp-black. The first-mentioned articles, however, are preferred in the process of refining and clarifying fuggars, which renders the fugar to a clarified much whiter than by the heretofore common method of clarifying. The following method of applying the above-menionted substanaces is preferred. We charge, say the patentees, fill our boilers or pans with fugar and water, or lime-water, as in the common and well-known methods of refining fuggar, 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 charcoa, or other substanaces, from the liquid fugar. And we also add to the above fugar and water in the boiler the substanaces before-mentioned, in any quantity, according to the quality of the fugar to be refined or clarified; though we generally prefer from two to four pounds of charcoal or earths before mentioned, and for every hundred weight of fugar 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 charcoa, or other substanaces, with the dirt contained in the fugar. And we now fill up, and agitate the liquor in the boiler, in order that the animal charcoa, and other substanaces, may have the greater effect in blanching the liquor. And after the coagulated albumen has completely riven in the form of scum by the application of heat, in the usual way, we either skim it off, as in the common proceses, or we pour the whole of the liquid fugar and scum into and upon the
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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 running of the clarified liquor, if not quite separated from the albuminous substance used. And, further, we proceed in the usual manner to evaporate, granulate, and refine, the said liquid sugar so clarified. And, further, we boil over and filter our scum 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 from these process have not that tendency to ferment which the syrups have which are produced in the heretofore usual method.

A patent, dated June 22d, 1815, was granted to John Taylor of Stratford, in the county of Essex, manufacturing chemists, 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, as 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, 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 malasse and other soluble impurities contained in raw sugar may be separated therefrom by mechanical means, without the use of heat; and that by abstracting these from the raw sugars, the injury caused by their mixture with the refined sugar in crystallizing is avoided. For purifying raw sugar according to my invention, I must first be brought to a moist flate; 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 pressure, carried to such a degree as to express all the fluid part therefrom, which will be found to contain the malasse and soluble impurities, and a certain quantity of sugar in solution; and the sugar, if the pressure be sufficient, will be rendered dry, and much improved in color and appearance."

I further declare, that though my invention may be carried into effect in a variety of ways, by using pressers of various construction, and by exposing the sugar to pressure 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 of a platform, capable of containing at least four pieces of these cakes, which may be arranged so as to stand at a certain height, and may then receive a degree of pressure, which will cause the fluid part to flow out, and which is to be received in a copper pan, fixed upon the platform, and furnished with a spout, to convey the expressed syrup into a receiving vessel. While these cakes are pressing, another set is to be got ready, and the first having been hardened with pressure, may be adjusted so as to keep the piles upright, and the fresh cakes set upon them, and so exposed to pressure. 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 pressure, which will render the whole dry, and of uniform good color and appearance.

I further declare, that any machine or apparatus is capable of applying pressure to sugar, either vertically or horizontally; and whether the sugar be included in cloths, as I have described, or in bags, or in cans, 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 press, and commonly known by the name of Bramah's prellés, 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."

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SUGAR-CANDY. Saccharum Candum, or Cryallathum, 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 dissolved in a weak lime-water, then clarified, scummed, strained through a cloth, and boiled, and put in forms or moulds, that are swoviwered with little rods, to retain the sugar as it crystallizes. These forms are suspended in a hot fowe, with a pot underneath, to receive the syrup that drops out at the hole in the bottom, which is half-ropped, that the filtration may be the gentler. When the forms are full, the fowe is shut up, and the fire made very vehement.

Upon this, the sugar softens to the sticks that cross the forms, and there hangs in little spaluters 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 fowe, 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, 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 float is let 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 very large weight; upon which strong planks are laid when they are wanted, and upon the planks the candy-pots are let; when the float 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 most perfect flatness, 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 float 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 the upper rows, and widening downwards to two inches; and the candy is formed in distinct bars, more convenient for package and sale, and much more beautiful than the former.

When a float 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 strung, 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 inside 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 strung in the same manner, &c. till every row is finished. The pots, being all strung (viz. about forty to each float of sugar), must be pailed, i.e. the holes must be filled either by paling papers over them on the outside, or by brushing any glutinous matter over the outside. When the floats and pots are ready, the workman places five pots upon the pavement, beginning either at the right or the left-hand corner of the float opposite to the cockell.

The management of the pans is nearly the same as has been described under Refining of Sugar, with some small difference. The sugar intended for candy should be cleared with lfs water than other goods: 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 disolved. No scum is ever incorporated with the sugar 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 sugar melted for candy should be the strongest that can be obtained.

When these precautions have been observed, let us imagine the sugar cleared off and skirped into the ciltern. The panman pumps back about the usual quantity: the boiler carries the evaporation to the point he judges proper; and it is immediately skirped off into barons, which are carried directly to the float; and the pots are then filled in the following manner. The fill-house man receives the first baron, 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 float is filled, the fill-house man goes on till he has covered the whole pavement: he then lays two planks upon the lowell 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 finished. In the whole process of this business he moves slowly and cautiously, and covers all the doors to be shut, so that no currents of air may approach him; as filling is of the greatest consequence, and the leat uncumbersome of the air is sufficient to disturb and break the crystallization. When the pots are filled, the float-door is skirped up, and covered with a blanket, or flipped with wet clay. The cockell is skirped to such a degree, that the candy may stand in a blood-heat; at the end of six 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 firring, or breaking-up a float of candy. Each pot is brought to the side of a cooler, upon which, over a frame, a clean balloween is laid, into which all the sugar that has not crystallized is poured off, and along with it the crust, which is a coat of candy, that had formed itself upon the surface: the syrup or uncrystallized sugar runs through the balloween into the cooler, but the crust remains in the balloween, in which it is washed and dried, and afterwards packed for sale with the candy. As soon as the syrup is poured off, the pot is brought to the side of the pan, and ladles of clean water, blood-warm, are poured in till it be nearly filled; the pot is then finnarily 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; its sides of the pot are every where covered with a coat about half an inch thick, the front of which is cut in slurry forms, reflecting the light in various directions; and upon every line the cryftals fall in the most various and capricious forms. If the pots were pierced, as they formerly were, so that the sirings might lie but an inch or two under the candy, 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 cryftals are suspended upon every thread in distinct bars, without either lateral or perpendicular cohesion.

The washing above described is necessary to cleanse from the face of the cryftals every particle of sirupy matter, which would otherwise occasion a clarnmifhes in the candy, and obscure its luster. After washing, each pot is turned down into a cooler or other receiver, to drain, and when they are washed and drained, they are again put into the float to be dried; for this purpose they are placed in the float again, reeling against the wall, or against each other, with the mouth downwards; and under each pot is placed a small earthen pan, called a candy-pan, to receive the remaining moisture which will drip from them: the float is again fastened up, and the cockell skirped, 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 float, 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 float 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-six pounds each: at the bottom of the box is a layer of the bottoms of the pots, which have the leat beauty or fineft; then a course of bars of candy, upon that a bratum of crust, and fo on to the top of the box, finishing with bars of the handfomest candy,
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candy, neatly laid with the face upwards. At the bottom of the candy there are often found mafies 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 foot, and is either sold at a lower rate, under the name of candy-foot, or melted with other sugar, for the making of lumps and loaves. The syrup of candy is fit to be taken copiously with raw sugar in lump-boiling. The washings and the draps from the bacon are applicable to the fame ufe.

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; flands in a milder warmth; forms in three days instead of seven; and the value depending upon the whitefens, it muft be managed with the utmost delicacy in every stage of the procfs.

The brown fort crystallizes as regularly as the white, but becomes clammy and deliquefcent in a damp air, whereas the white candy remains always dry. On account of its fu- perior hardness, it is less easily soluble than the loaf sugar, and would be excellently calculated for preferving all vege- table food, if the price was lower. The fole difference between the white candy and the fmall loaf appears to be in the form, which in the candy is the natural falic form of sugar, but in the loaf is granular, owing to the agitation given to it for this express purpofe whilst cooling. The moft common form of the regular crystals of fugar-candy is an oblique four-fided prism, terminated by dihedral funfts.

White fugar-candy, and alo 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-Houfe, is a brick or stone building, conftrufted for a fugar-refining manufactory. A houfe intended to contain one or two pans fhouid be fquare, or nearly fquare: but a houfe of larger dimenfions ought to be of an oblong form; as it may be conveniently heated, by placing the chimney of the houfe and of the pans at opposite angles. A houfe to contain one pan fhouid confift of fix floors befiles the ground-floor; the diimencion about twenty-feven feet fquare: a two-pan houfe about thirty-fix feet fquare; a houfe of four pans, about forty feet by fixty or fifty-five feet. The houfe is a brick building from eight to fourteen feet fquare, ufually placed in one corner of the building. The height of the severall floors fhould be as follows; the fmall- houfe, or ground-floor, nine feet below the girder; the next floor above it, called the warehouse, of the fame height; and every other floor upwards, fix feet at molt between the girder and the floor. In every floor muft be left an apertu- re, through which a rope is fupplied upon a brafs pulley upon the uppermost floor for drawing up the fugar: and provided due attention be given to the fillthg of the building, and to the exclusion of damps and a cold air, a fugar- houfe cannot be rendered too light. The utenfils neceffary to a fugar-houfe are of copper, lead, iron, carpentery, back-maker's work, wicker-work, pottery, &c. The copper utenfils are the pans, coolers, ciferens, fyrup-pipes, bacons, ladles, faimers, and, in fome cafes, candy-pots, &c.

The pans are ufmally made of a conical form, from five to fix feet diameter at the top, decreafing to a diameter of about two feet fix inches, or three feet. The coolers are veflets of thin copper, of fix feet in diameter, and about twenty inches high: the number of pans and coolers is ufual by the fame. The clarifying cifer is a large receiver, either of copper or lead, placed as near as poifible to the fides of the pans, and capable of containing at leat one-third more than the contents of all the pans collectively. The fyrup- pipes are tubes of four inches diameter, made of thin copper, or tin-plates, and fpunped perpendicularly over the clarifying ciferen, from the upper floor through the whole building. The bacons are veflets containing from four to fix gallons each, in which the boiled fugar is carried from the pans to the coolers, and from the coolers to the moulds. The ladles are of fereral fizes. Skimmers are of fourteen inches diameter, pierced with holes like a cutlender; and likewise a small one of the fame kind. Cullenders are of eighteen inches diameter, and fourteen inches deep, through which the clay is to be flainede; and there is alo another, which is fmalier, for the purpofe of flaining fpice.

The leaden utenfils and plumbers' ware, are fuch as folow: the bench is a ledge about one foot broad, running before the pans, and rifing in front, by which it is capable of receiving the fugar which is fpilled before the pans. The fem-ciferen is a wooden receiver, ufually lined with lead, and nearly as large as the clarifying ciferen.

The water-pipes are a pewter or hard metal pipe from the lime-ciferen to the pans, and leads pipes for the conveyance of common water or liquor to the pans, and to the lime-ciferens. The pumps are a copper pump fixed in the clarifying ciferen, and a space pump of the fame kind.

The iron-founder supplies bars of a triangular form, to be laid under the pans, and the cockell, which is an iron trunk, ufed to dry the goods in the houfe; and alo iron doors, houfe-doors, and pan-doors, &c.

The carpenter raifes the fream-vent over the pans, which is a hooed of thin board, fo formed as to conduct the freams to the two brick funfts, which are led up on either side of the pan-chimney to the top. He also furnishes the racks of the houfe, a ftrough to convey the fugar from the pans to the ciferen, and another to return it from the ciferen to the pans, fyrup-tools, blocks, cooler oars, &c.

The back-makers supply two or more tubs or hacks for lime-water, which are round, oval, or fquare, and whose capacity varies from thirty to two hundred barrels. The liquor-back, is any veflel large enough to hold a confiderable quantity of common water. The mould-ciferen is a large oblong veflel, in which the moulds are foaked before they are brought in. The moulds are from four to fix inches deep, and should be capable of containing at once as many moulds as are ufed in one day's refining.

The clay-ciferens are supplied either by the back-maker or carpenter, and alo the clay-lar, which is made of oak or elm, its club end being ftruck full of iron points: its ufe is to macerate and fine the clay.

The wicker-work conftills of refining-bafts, feem- bafts, pulling-up-bafts, coal and clay-bafts, &c.

The fugar-mill is one of the moft fimple machines of the kind: the runner is fometimes made of cast-iron and fometimes of ftem; the former is prefereble, buca a larger diameter and a broader funfte may be had with the fame weight. The runner and the centre poft fhould have a brafs collet within them, for the iron fpindle to turn upon. The mill fhould fland on a folid foundation; either on the earth, or on the centre of a brick or stone arch. The veflets of pottery are of various fizes, and of two different forms and denominations, viz. pots and moulds.

The conftuction of the pan-chimney requires peculiar attention; it fhould be placed on iron bafts, and the horizontal bars on which it refts muft be wrought in the walls of the building, and clenched down on the outside. But the letting of the pans is the moft difficult work; for it is neceffary that they should be fo fixed, as that the flones,
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 case requires. The heat is introduced through the pan-chimney, the flove-chimney, and sometimes through iron or brick flues railed on purpose. It is communicated from the chimneys by fluctuating the register-plates, after the fires are extinguished, or when they are nearly out, and the remaining ashes are perfectly clear. After fluctuating the register-plates, the small iron doors (one of which is fixed in the chimneys both of the cockel and the pans upon every floor) are opened, to convey heat where it is wanted.

Labourers in sugar-houses are very subject to dyenteries; the vireum antimonii sermonis is an effectual remedy in these cases.

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, supra. 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 cane is introduced between these rollers, which as they turn round draw in the cane and give them a very violent pressure, which is sufficient to extract the juice and leave the cane 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, there are preferable to cattle-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 feeding of cutting the cane. 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 cases, if the machinery is not sufficiently powerful to extract the juice from the cane 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-mills leveris are provided, to which mules or oxen can be harnessed, to work the mill when the wind fails, the machinery of the fails 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 cane obtained ready for the boiling-house, in so short a time that the juice will be quite fresh. There are some water-mills in Jamaica, sufficiently powerful to grind as many cane as in a week 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 H, which is fastened upon the extremity of the horizontal axis G. The beams M, which support 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 two other rollers, A and C, are placed on each side of E, and all three are made to turn round together by a cog-wheel, S S S, at the upper end of each. The rollers are mounted in an iron frame, consisting of two horizontal frames, P P, Q Q, furnished with uprights O, O, and the openings of the frames P, Q, contain the brads bearings for the pivots of the three rollers, which brails are adjustable by means of cres 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 cane to draw them in, and also facilitate the running down of the juice from the cane into a pan or cylinder, 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 pivots. The weight of each roller, which is considerable, is supported in a brafs step or bearing beneath the frame Q Q, as is shown by the dotted lines in fig. 13, 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 cane are made to pass twice under the preflure, 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 cane in a handful, and applying their ends between the rollers B and C, the motion will draw the cane in between them and thus receive a first preflure. Another person, who stands behind the mill, and is called the returner, bends the ends of the cases 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 cases are flattened and crushed by the first preflure between the rollers B, C, and require a still larger degree of preflure the second time. The space between the rollers is very small in either case, for the cases are of a very flat sublance, and they are squeezed exceedingly 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 cases. 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 cases 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 attentive returner can do. The cases which have paffed 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.

Sugar.
SUGAR.

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 casing. The bell 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 preasure to which it is intended to subject them. When the fugar-mill is turned by cattle, the axis, D, of the middle roller has a longer lever across it, 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 fugar-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 rolls 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 a sugar-mill of this kind, with a view of making the power return, in an old fugar-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 cased with a cylinder of iron: the other two rollers at each end of the wheel are placed beneath the axis, so that it will roll upon them. The upper roller, therefore, answers to the middle roller of the common fugar-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 not to touch, which will not only protect the faces of the rollers, but prevent the juice being poured between them, in contrary 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 nearly 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 roll 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 sides 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 preasure, 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 enters between the rollers, in the same manner as a threshing-mill is supplied. The canes as they pass through are pressed 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 preasure 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-train 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 mill lose time in feeding the canes between the vertical rolls, because he can only preseat 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 pulling them forwards, preseats 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 more convenient application of the power of the cattle. 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 fugar-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 most beneficent in many sublimes which are employed as the food of domestic and other animals, and in preparing them for fattening 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 for so much overstocked with this substance in its prepared state, from our poffessions 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 regulation 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. Milk from the above description of animals are fed 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 diversifying material is constantly necessary, such as hay, cut straw, chaff, or some other similar bulky substance, in order to fill and diffuse the stomach in a proper manner. See Saccharine Matter.

It is observed on the same authority, that besides the crystallized
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 thus which constitutes
a principal part of molasses or treacle, which has also been
employed with succes in fattening animals of the cattle
kinds, in mixture with some sort of distending substan-
ces. See Stall-feeding, and Treacle.

Sugar, in Chemistry and Medicine, denotes a crys-
tallizable effluent fluid, 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 fome, con-
tains carbon, oxygen, and hydrogen, nearly in the pro-
portions 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 infusions of the gum kind; as
eleven of carbon, ten of oxygen, and twenty of hydrogen.

M. Marggraf has obtained fugar from the roots of se-
veral plants, as from carrots, parnips, white and red beets.
Among all the vegetables indigenous to the middle and
north of Europe, which are feebly faccharine, 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 Beta. Two methods
were purposed by this accurate chemist. One was to dry a
given portion of the vegetable, to boil it in rectified alco-
hol, and then keep the alcoholic solution at rett for a time,
by which the fugar will separate in crystalline grains.
This mode, however, is much too expensive to be purposed in
manufacture, but it serves as a 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
processes performed on the fugar-cane juice, which also was
attended with a certain degree of succes. The experi-
ments of this celebrated chemist are the following: three
roots were freshly, 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 shows 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 recti-
fied alcohol, and being loosely stopped, the liquor was
slowly brought to boil on a sand-bath, with frequent
shaking. The veil was then removed, the solution fil-
tered, and the powder pressed strongly, to squeeze out all
the liquor. This clear solution was then put into a bottle
which was corked, and kept by in a cool place. A crys-
tallized fat deposited gradually in the course of some weeks,
which was hard and tolerably pure fugar. This was re-
diluted 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 \( \frac{1}{2} \) of fugar; 8 oz.
of skirret-root, equally dried, gave 3 drachms, or about \( \frac{1}{2} \)
of fugar; and the same quantity of the red beet gave only \( \frac{1}{2} \)
drachms, or about \( \frac{1}{2} \) of fugar. The solution, however, full
contains a quantity of fugar mixed with the seminal part
of the root, and if it is evaporated to dryness, a twentieth
un-crytallized extract remains.

The skirret-root was then treated in the following man-
xer, without alcohol, with a view of extrasing 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 mixed with water, and boiled, to get out all
the faccharine liquor. The whole liquor was then kept at
rett for 48 hours, in a cool cellar, by which most of the
faccharine subfided, and the clear liquor was carefully
drawn off. The author has much faith on this part of the pro-
cesses, which, if it is not done properly, considerably hinders
the subfquent production of the fugar. The clear liquor
was then heated in a copper pan, clarified with white of
egg, and boiled down to the consistence 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, compo-
ited of impure crytals 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 tinned iron, with holes at the sides and bottom, and set
by in a warm place; by which, after a considerable time,
the impure uncongealed syrup slowly filtered to the bot-
tom, leaving the pure faccharine part in the form of a
brown granular mafs. The latter was then re-diluted in
water, again clarified with white of egg, strained, boiled
with a little lime, again strained, and then evaporated to
a thick consistence, and thinned till cold. A fuggy vivid
mass full purer than the laft was thus obtained, which, on
being kept for a week in a funnel-shaped pot, with a finge-
hole at bottom, plugged up, concealed into a greased fugar
equal to good molasses, 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 succes.
He further obferves, that he rapied 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 laft to go. The mucilage of sediment from the skirret,
wafted 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, defecfion, full three-quarters of its
weight, and the red beet seven-eighths.

For an account of the experiments of Aehard, and other
chemists, see Beta.

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 parnips, &c. and
from several trees, as the fycamore and birch trees. Green
maize (see Maize) contains a liquor from which the
American fuggars are foid to extract fugar. It may also be
extracted from the officinae caule etrae simplici annus, 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
Mem. des Scav. Elftrang. tom. ii. and by M. Kahn, in the
Swedish Mem. for 1757. (See Maple Sugar.) The leafon
for tapping the tree is from February to April, for about
six weeks, during which time a tree of moderate size will
yield about 50 gallons of koups, and from which may be
made about five or fix pounds of pretty good fugar.

The tree does not seem to fultan any injury from this
operation, for the juice is more faccharine from the trees that have
been
beef has already tapped, than from those that are fresh. This juice, which is clear, and of a pleasant taste, is made into sugar 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 compared juice. Sometimes the quantity of liquid is reduced by freezing at the proper season, which is preferred to evaporation. This substance, it is supposed, he made into loaf-sugar, as well as the mulcovorada; and it is commonly used 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 menstruum that would diffuse the sugar, and not the flimsy substance, the carcassiner and mucilaginous parts of plants might be separated from one another with advantage. Sugar is fearfully, 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 sugar appears either in a regularly crystallized form, or in forming white crystallized grains. Both in candy and loaf it is hard and brittle, inodorous and sweet. If hard loaf-sugar 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. Melasses, which are constituted chiefly of the uncrystallizable parts of the juice of the fugar-cane, and which Prouil has denominated liquid fugar, are more soluble in alcohol than sugar. Sugar requires only its own weight of water at 48° for its solution; and when united at a higher temperature with a smaller quantity, it remains dissolved 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 sugar, that the most efficient part of the process of vinous fermentation is the conversion of sugar into alcohol. Four parts of boiling alcohol dissolve one part of sugar; but a moiety of sugar again separates by reit in crystals. Oils readily combine with fugar, and the mixture is miscible with water. Lime and the fixed alkalies unite with sugar, and form compounds, without any sweet taste. The concentrated strong acids dissolve and decompose fugar, but the weaker simply diffuse it; and the alkaline and earthy hydro-sulphurates, sulphurates, and phosphates, decompose it, and resolve it into a substance resembling gum. Its ultimate constituent parts, according to Lavoisier, are 64 of oxygen, 28 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 viscous fluid, which, cooled, has a flavour of empyreuma, not ungrateful, mixed with the natural sweetnes. When melted, it takes fire from a lighted substance, and burns with a strong red flame, and a penetrating odour, which excites coughing, and is owing to the production of an acid.

If sugar be diffiluted per se from a glaas retort with a heat gradually increased to redness, and the products be carefully collected, they will be found to be, first, a coloured liquor, strongly acid and pungent, called the "pyromucous." A large quantity of gas comes over at the same time, which is hydrogen and carbonic acid; and a very pure charcoal is left behind, which burns away in the open air without leaving any residue. Neither azot, amon, or any other gas, is obtained in this process, whence it appears that sugar is one of the purest hydro-carbonous oxides known.

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 frequently to crystallize from water, for: 450 grains of fugar yielded by distillation 120 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 yielded 96 grains of charcoal, 210 grains of pyromucous acid, 93 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 lime and azot are substances that belong to mucilage, and not to fugar. The habits 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 difengaged, 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 fame 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 proceeds 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 suppos'd to unite the unctionous part of the food with the animal juices; hence fome have concluded, that it is nutritive to animals, and increases corpulence; others have ascrib'd to it a contrary effect, as it is laid to prevent the separation of the oily matter, which forms fat, from the blood; and others, again, have charge it with rendering the juices thicker and more sluggisht, retarding circulation, obliterating the natural secretions, and thus occasioning or aggravating febrile, catarrh, hypochondriac, and other disorders. However, experience proves it should, 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 solution upon the nerves, sugar is a useful agent in the cure of various distempers, and in the constitution of the animal body. He has prescribed it for the cure of fevers, and for the cure of the diseases of the kidneys, and for the cure of the diseases of the stomach. He has also prescribed it for the cure of the diseases of the liver, and for the cure of the diseases of the spleen.

SUGAR.

The actual chemical differences between mucilage and sugar, as stated by Mr. Cruikshank, are the following: sugar is soluble both in water and alcohol, and crystallizable from either solution; but mucilage is insoluble in alcohol, and frequently to crystallize from water. For: 450 grains of sugar yielded by distillation 120 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 yielded 96 grains of charcoal, 210 grains of pyromucous acid, 93 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 lime and azot are substances that belong to mucilage, and not to sugar. The habits 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 engaged, a quantity of white insoluble matter precipitates, which is the "mucous" acid, and the residue is "malic" acid, which a further addition of the nitric converts into oxalic. But sugar 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 sugar with nitric acid also exceeds that yielded by the same weight of mucilage with the same proportion of acid. In the spontaneous changes, also, sugar and mucilage differ essentially: sugar being the essential material of the vinous fermentation; but mucilage is incapable of this proceeds when pure, and appears to contribute little to the generation of alcohol, when in combination with fermenting materials.

From the known properties of sugar, it is supposed to unite the unctionous part of the food with the animal juices; hence some have concluded, that it is nutritive to animals, and increases corpulence; 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, obliterating the natural secretions, and thus occasioning or aggravating febrile, catarrh, hypochondriac, and other disorders. However, experience proves it should be used, 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 sugar undergoes in the stomach, and by its relaxing solution upon the nerves, sugar is a useful agent in the cure of various distempers, and in the constitution of the animal body. He has prescribed it for the cure of fevers, and for the cure of the diseases of the kidneys, and for the cure of the diseases of the stomach. He has also prescribed it for the cure of the diseases of the liver, and for the cure of the diseases of the spleen. Sugar however appears, by the experiments of several writers, to prove deleterious to various kinds of worms, either
Sugar has been used in medicine for its many properties. Among these properties, it has been used for its antiseptic effects, which can be noted by its ability to prevent bacterial growth. It is also notable for its ability to relieve the effects of dyspepsia, ulcers, and colic.

In the natural world, sugar is found in various forms, including honey, maple syrup, and cane sugar. These natural sugars have been used for centuries as sweeteners and in various medicinal preparations. For example, honey has been used for its antiseptic properties, while maple syrup has been used for its laxative effects.

Sugar is also a key ingredient in many alcoholic beverages, such as wine, beer, and spirits. These beverages are made by fermenting sugar with yeast to produce alcohol. The fermentation process converts the sugar into alcohol and carbon dioxide, which is released as bubbles.

In addition to its use in medicine and alcohol production, sugar is also used in a variety of other industries, including food, cosmetics, and pharmaceuticals. In the food industry, sugar is used as a sweetener, preservative, and flavor enhancer. It is also used in the production of yeast, which is used in the baking industry.

Sugar is produced by many different plants, including sugarcane, sugar beet, and sugar palm. These plants are grown in a variety of climates, and the type of sugar produced depends on the specific plant species and growing conditions. For example, sugarcane is typically grown in warm, tropical climates, while sugar beets are grown in cooler, temperate climates.

The production of sugar involves several steps, including the harvesting of the sugar-containing plant, the extraction of the sugar, and the refinement of the sugar. The sugar-containing plant is typically harvested and then processed to extract the sugar. The sugar is then refined to remove impurities and to make it suitable for human consumption.

Sugar is an important part of the global economy. It is produced and consumed in large quantities around the world, and it plays a significant role in many aspects of human life. From medicine to food to alcohol, sugar has been a staple of human society for centuries.
of Aysfet Point.—Also, a small island in the East Indian sea, near the N. coast of the island of Sober. N. lat. 7° 59'. E. long. 120° 59'.—Also, a cape on the W. coast of Africa. S. lat. 12° 5'.—Also, a small island in the Mergui Archipelago. N. lat. 10° 41'.

Sugar-Leaf Boy, a bay on the N.E. coast of the island of Java. Sugar-Leaf Hill, an eminence, serving as a landmark, on the N. coast of Lake Erie.

Sugar-Leaf Hills, 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 Eschewoadee, the northern island of New Zealand. S. lat. 29° 6'. W. long. 185° 8'.

SUGENHEIM, a town of Germany, belonging to the margravate of Anspach, inhabited by the bishopric of Bamberg; 20 miles N. of Anspach. N. lat. 49° 40'. E. long. 10° 21'.

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 that of his ecclesiastical appointment, so that he adopted the manners and appearance of a Rhenish, more than those of an abbot. A character, by the exhortations of St. Bernard, he determined to reform both his monasticity 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 Guienne; 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 whispering on his tomb the words, "Here lies the abbott 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 Ceres has published in the collection of French historians. Morei.

SUGGESTION, Suggestio, the act of hinting, or furnishing another with a thought or design, or of insinuating it artfully into his mind.

In the French law, a testament is said to be made by suggestion, when it is made by surplice, and contrary to the intentions of the testator. If suggestion be proved, the testament becomes null. Articles of suggestion are not admissible against a testament which 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 a passe from some magistrate to do it.

SUGGRUNDARIUM, among the Romans, a place where infants, not exceeding forty days old, were buried; it being unlawful to burn them.

VOL. XXXIV.
SUICIDE.

logy of the term, derived from *suo* and *cidere*, is self-murder. The only question in the argument concerning this subject, says archdeacon Paley, is other than this,—May every man who pleases to destroy his life, innocently do it? Shall we say, that we are then only at liberty to commit suicide, when we find our continuance in life become ulelefs to mankind? Any man may, if he pleases, render himself ulelefs; and persons of a melancholy disposition are prone to regard themselves as ulelefs, 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 ulelefs, 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 dissolve of our own lives, would be capable of the same extension. Besides, no one can be pronounced ulelefs, for the purpose of this plea, who has not lost every capacity and opportunity of being ulelefs, and also the possibility of recovering either; and this supposes a state of such complete delirium 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 so much on the state of the spirits, or the preflure of any present anxiety, as to vary very little in hypochondriacal constitutions from an unqualified licence to commit suicide, whenever the diiftreffs fancied or feared, or actually endured, rofe high enough to overcome the pain and dread of death.

Men are never tempted to destroy themselves, unless they are oppressed by some grievous uesanebns; and to these cases the restriction of the rule ought to apply. But what effect can we look for from a rule, which propels 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 ditermed 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 conferration of all; for mankind must live in continual alarm for the fate of their friends and dearest relations, when the restraints of religion and morality are withdrawn; when every diftrust, 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, too often make excellence a burthen.

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 meliorating our condition in a future state. This argument, it is true, does not in itself prove suicide to be a crime; but if it supply a motive to diffuse 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 piety and resignation under the sufferings to which we are called, testify a trust and acquiescence in the divine counsels more acceptable, perhaps, than the most profotive devotion; afford an edifying example to all who observe them, and may hope for a recompense among the most 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 deferted; the claims that are defrauded; the loss, affliction, or disgrace which our death, or the manner of it, causes to our family or friends; the occasion thus given to many for suspicious 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 of his will, who has assigned to every man his pofl in life to be maintained till the Lord of life and death dismiss him from it. It is not that it arises from 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 froller does into an army, the answer is obvious, that God, as our creator and the preferer of life, has a much greater right to our humble obedience, than a general can have to that of a froller, how willingly, however he may have enlisted himself into his service. If we confult Scripture, in reference to this subject, we there find only general principles, that may, by construction and implication, be applicable to this subject. Here we find, in a variety of paffages, 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 apostolic 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 unlawful uesanebns 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 flate 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 flate to commit its subjects to the dangers of war, and to expel their lives without scruple in the field of battle. This reasoning, we observe, is founded on an erroneous principle, viz. that the flate acquires its right over the life of the subject from his own consent; but the truth is, that the flate 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 ably than M. de Saint, in his "Reflexions sur le Suicide," printed at London in 1814. 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 suicides. 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 case in all the operations of war. Besides these suicides of duty, there are other cases of the hazard or sacriifice of life, which are considered as acts of virtue, requiring regular 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 breach, or boarding a ship. There are other suicides, which, without being either 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 case 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 professions, or by compliances which the confidence 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 misgoverned zeal, but which the people considered with reverence. Dying men deplored the natural death which robbed them of the honours of martyrdom. Another fort 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 fuprlefs. They did not, indeed, with Lucretia, claim this privilege from the shame 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 excrecence 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 indisputable 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 miserable, that their cale approaches to an exception, they are to be viewed with that merci, which is the first virtue of frail 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 self-love. This ingenious female writer discards the vulgar notion, that suicide is a proof of cowardice. To fuller 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 very essence of courage: Patience endures the gangrened limb; courage encounters the terrors of amputation; and it is alleged, that words are departing from their natural use, to call that man a coward, who has completely conquered the fear of death. But the question still recurs, whether death is not a less evil in the view and elimination 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 defect, or other evils, which they would thus endeavour to prevent or escape: accordingly, though a man, generally speaking, cannot be denounced a coward who has quashed the fear of death, yet he is more a coward, or at least pollied to a lower degree of virtuous fortitude, 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. Among the latter 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*, in which, among other things, he deems it "both the prefer and the fire," defining "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 dilapidated young man, tempted by his necessities to forget his father's prohibition. (See the biographical article DONNE.) 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 shrewdness and coarse vigour. (See DODWELL and COLLIER.) Besides 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 influences not only legal, but esteemed to be even meritorious; and this is said to be on the authority of the sacred books of the Hindoos. For it is informed by Mr. Coleridge (C. R. Ref. vol. i. 153), that legal suicide was formerly common among the Hindoos, and is not now very rare. Widows burning with the corpses 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 at late than burning. The junction of two rivers is mythically contemplated by the enthusiastic Hindoo; and all acts in themselves good, are rendered vastly better if performed at such a spot. (See JUNCTIONS and TRIVEL.) At such junctions, called Sangram, euthansia has sometimes drawn themselves, or cut their throats. Burning is, however, occasionally, though but rarely, referred to by men. We may here advert to the early influence given of this by Calanus, the Brahman, in the presence of Alexander and his army. (See CALANUS.) 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 young Anchorite, accidentally slain by
SUI

one of the monarchs of antiquity, named Dañaratha, the mortal father of the incarnated hero Rama. (See Rama; and of Dañaratha, see something under SAI.) 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 lining the body all over with cow-dung, and setting it on fire, is called karbhagni; which fee. And under the article SARKARACHARYA will be seen an instance of its application on the person of the celebrated and elegant scholar of that name. Persons afflicted with loathsome and incurable diseases, have not unfrequently caused themselves to be buried alive. Among the lowest tribes of the inhabitants of Berar and Gujdavan, suicide is occasionally vowed by such persons in return for boons solicited from idols; and is fulfilled by the succesful votary throwing himself from a precipice situated in the mountains between the Tapti and Narmada rivers. The annual fair held near that spot at the commencement of spring, usually witnesses, it is reported, eight or ten victims of this superstition.

In the Mahrañta country, in Berar, and probably in other parts of India, there is a particular tribe, which furnishes 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. Revengy, 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 relling on the head of the unyielding party. See RUNEKA 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 debtor, or offending person, threatening, in the event of refused or delayed satisfaction, to kill it; the fin relling on the unyielding party. In these usages we see how inadequate the law is found to be in securing the property of individuals, and to what extents they are reduced in seeking the justice that, under enlightened governments, is so promptly afforded.

In the Ayin Akberiy it is said, the Hindoos reckon divers modes of suicide to be legal, and five to be preferable to others. These are, 1. Starvation. 2. Being covered with cow-dung, and consumed by fire. This is the mode called karbhagni. 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 suicide, said to be in practice with the Hindoos, we should have expected to find that concerning which we have lately heard so much, viz. being cruelly stabbed under the wheels of the pondeous car of the god of Jaganath, and other idols. (See JAGANATH.) But we are inclined to think, that the victims of superstition, thus self-immolated, are not by any means so numerous as might be supposed from some recent publications. Dr. Buchanan, in his interesting tract, entitled "Christian Researches in Asia," describes his visit to Jaga-
nath, undertaken with the view of witnessing the enormities that he so feelingly describes, and so justly reprobrates. But it does not appear that he actually witnessed a single instance even of the self-immolation in question, although he was present on the grand days of the procession, at the most crowded edicm, and attended closely at the wheels of the car. Among the many thousands of pilgrims that resort to Jaganath at the annual fair,—so many thousands, that a hundred thousand, more or less, are fearemly, it is said, observable,—it might be reasonably expected that some individuals would be mad or enthusiastic enough to throw themselves before the chariot-wheels, and be crushed to death. Thus, 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 handed about from one to another, and believed by most. The language and practice of the Hindoos, however, seem to familiarize the terms of legal suicide and venial falsehood. See SARSASSAT.

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 Eulathius in his Commentary upon Homer. Grotius and some others suppose that he lived under Constantinus, 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 lays of him, that he has brought down a point of chronology to the death of the emperor Zimizes, i. e. to the year of Christ 765; so that he seems to have written his Lexicon between that time and the death of the succeeding emperor, which was in 1227. The Lexicon is a compilation from various authors, made sometimes with, and sometimes without, judgment and diligence. Notwithstanding its errors and imperfections, it is a useful book, and a storehouse of all sorts of erudition. It furnishes 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 Kultur, printed at Cambridge, with a Latin version and notes, in 1705, in 3 vols. fol. On this edition Top is 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 Tchets-

tcheou.

SUFERMA, a town of Hindoostan, in the circuit of Gobud; 25 miles W. of Gobud.

SVIAGA, a river of Russia, which runs into the Volga, near Swijaz, in the government of Simbirk.

SVIADZ, a town of Russia, in the government of Kajan, at the union of the river Swijaga 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-g; 20 miles S. of Ta-yuen.

SUILLIKEM, a town of the island of Bommelwaert; 5 miles W. of Bommel.

SUILLIAT, a river of England, in the county of Gloucester, which runs into the Avon, near Newbury.

SUILLUS, in Botany, a name given by Micheli to a kind of Fungus, called Porzo 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,
which, with the noxious ones, are now referred to the

Belum of India; Persoon, &c.

SUILLY, in Geography, a small island in the Brittel Channel, near the coast of South Wales. N. lat. 51° 25'. W. long. 3° 11'.

SUVNOE, one of the Faroe Islands, in the North Atlantic ocean. N. lat. 60° 56'. W. long. 6°.

SUIPPES, a town of France, in the department of the Marne, and chief place of a canton, in the district of Chaunons-sur-Marne, on a river of the same name; 15 miles W. of St. Meenhouil. The place contains 2165, and the canton 6049 inhabitants, on a territory of 375 square kilometres, in 16 communes.—Allo, 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 Onegskoe.

SUIRE, or Suii, a river in Ireland, which rises in the western parts of Sliebloom, but chiefly from the lofty eminence of that mountain called Ben-duffy, i.e. the black hill, on the confines of the King's county and Upper Ormond. This river first runs south-east, 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 Sillers, as having their sources in the same mountain, and, after widely separating, thus meet before they come to the sea.

The Suire 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 handsome bridges over 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 phoebus 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 SLIEBLOOM.

SUIFORD. See SCHWENFURT.

SUIMOPOUR, a town of Hindustan, in the circuit of Rantampour; 36 miles S.S.E. of Rantampour. N. lat. 26° 04'. E. long. 77° 19'.

SUIT, Sute, Seta, 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, to compel him to appear upon oath to all the matter charged in the bill. And if he be to grant the petition, to lay waste, or to stop proceedings at law, an injunction 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 six clerks, if an injunction be prayed therein, it may be had 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 200l. 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 for it to attachment, then to an attachment with proclamations, next to committal of rebellion, afterwards to the search of a forfeit at arms, and, lastly, to a sequestration. After an order for sequestration issues, the plaintiff's bill is to be taken pro confess, and a decree to be made accordingly. But if the defendant is taken upon any of these processes, he is to be committed to prison till he puts in his appearance or answer, performs what this process is designed to enforce, and clears his contempt by paying the charges.

The process against a body corporate is by dividings, to divest them of their goods and chattels, rents and profits, 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 MISTRES.

If the defendant appears regularly, and takes a copy of the bill, he is next to demur, plead, or answer. See DEO-MURER AND PLEA.

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 malers of the court; if further off, there must be a dedimus petitutum to take his answer in the country, where the commissioners administer 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, who swears he received it from one of the commissioners, and that the fame 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 supplemental bill. There may be also a bill of revisor, and likewise 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, defers 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 each 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 course 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 objected to the reversal, where he is ready to prove as the court shall award; upon which the defendant rejoins, averring the like on his side, which is rejoining issue 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 commissary. 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 pafs 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 direction of the clerk in court, regulated by the nature and importance of the suit, and the arrer 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 demitted 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 thaws good cause to the contrary on a day appointed by the court. A plaintiff's bill may also at any time be demitted for want of prosecution, which is in the nature of a non sui 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 named 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 cert or for that purpose. Another thing also retards the completion of decrees. Frequently long accounts are to be settled, innumerable debts and debts are to be inquired into, and a hundred little facts to be cleared up, before a decree can be passed, and sufficient justice. These matters are always by the decree on the first hearing referred to a matter 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 overturned, or otherwise is confirmed, and made absolute by order of the court.

When all illus 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 ordered, the decree is 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 domicelled def 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 mine to sue to his court.
SUK

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 removal 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 concerned than in pecuniary compensation. The crown has lately set a high example, by the sale of many, if not most of its claims of this nature, at a fixed and moderate rate; an example, which it is very desirable may be enforced on all inferior lords, who indeed themselves, it must be premised, in fact and law, held only of the crown.

SUITE, Fr., a suit, lot, or series of movements, in Music. At the beginning of the last century, there were two kinds of fonatas and concertos in Italy; the one was called *fonate et concerti da camera*; and the other, *fonate et concerti da camera*. The compositions *da camera*, 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 airs, as an allegro, corrente, minuetto, farandola, gravetta, and giga, or jig. Thence the French call suite; and Handel calls his two first books of lessons, *Suites des Pieces*. The first and third set of Corelli's fonatas were composed for the church; the third and fourth for the chamber. And his first eight concertos are *concerti da camera*, and the three last *concerti da camera*. And as it was very common in Italy, on great fesivals, for the principal violin to play foles between the several parts of the mas, or between the motetto song by great vocal performers, we believe that the first six foles of Corelli were composed for and played in the church; and the fix last for the chamber.

SVITEI, in Geography, a town of Selavonia, on the Save; 23 miles E.S.E. of Pofega.

SUK el Harf, a town of Arabia, in the country of Yemen; 28 miles S.S.E. of Sacole.

SUKAJOKI, a town of Sweden, in the government of Ulo; 12 miles from Braheftad.

SUKAIS, a town of Sweden, in the government of Abo; 23 miles N. of Birnberg.

SUKANA, or Sukka, a town of the desert of Syria, near which is a warm sulphurous spring; 140 miles S.S.E. of Aleppo.

SUKASERAY, a town of Hindooftan, in the ciriar of Chandere; 15 miles S.W. of Seronge.

SUKASSA, a town of Africa, in the Vled de Nun. N. lat. 27° 23'. W. long. 10° 10'.

SUKERRABA, a town of Arabia, in Yemen; 4 miles S.S.E. of Othuma.

SUKO-SHUEI, Shukeshiy, or Shubyfu. See Shu-usbic.

SUKI, a town of Asiatic Turkey, in Natolia, governed by an age; 12 miles N.N.E. of Milet.

SUKKONDA, a town of Africa, on the Gold Coast, in the district of Anta; where the trade in gold is very considerable, and where the English, French, and Dutch, have factories and forts.

SUKOR, or Sukar, a town of Hindooftan, in Sehwan, on the Indus; 5 miles W. of Behker.

SUKOS, a town of Bengal; 18 miles N.E. of Natore.

SUKOTYRO, in Zoology, a genus of the class and order Mammalia Bruta. Horn on each side near the eyes. There is only one species.

Species.

SUKOS. 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," according to Niehwoh, its only describer, and who has figured it in his *Travels to the East Indies*, "is a quadruped of a very singular figure. Its size is that of a large ox; the inout like that of a hog; the ears long and round, and the tail thick and bulky; the eyes are placed upright in the head, quite differently from those of other quadrupeds. On each side the head, next to the eyes, hang 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 Chinefe Sukotyro." Niehwoh was a Dutch traveller, who visited the East Indies about the year 1569, 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.

SUL TUEUERSKOI, a fortress of Russia, in the government of Irkakut; 128 miles S.S.E. of Nertchink.

SUKULSERAI, a town of Hindooftan, in Oude; 18 miles W.N.W. of Luckow.

SUKA, a river of Russia, which runs into the Vitchehda near Uiltifolk.—Also, a river of Russia, which runs into the Dnieper, 16 miles N.W. of Goroditche, in the government of Kiev.

SULA, 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 *anser balfinus*, or filand geese.

SULAK, in Geography, a river of Russia, which runs into the Caspian sea, 8 miles N. of Alktradian.

SULAPOUR, a town of Hindooftan, in Dowlatabad; 15 miles S. of Naldourouk.

SULASSA, a town of Peria, in Khorasani; 250 miles N.N.E. of Herat.

SULAT, a town on the E. coast of Sumar. N. lat. 12° 5'. E. long. 125° 30'.

SULAU, or Zulauf, a town of Silefla, which gives name to a lordhip, in the principality of Oels; 17 miles N.W. of Oels. N. lat. 51° 30'. E. long. 17° 10'.

SULAW, a town of Germany, in the Middle Mark of Brandenburg; 4 miles S.W. of Zolten.

SULBEK, a small island of Pruffia, in the Curifch Hafl, at the mouth of the Rufs.

SULCATED LEAF, among Botanifts. See LEAF.

SULDINGEN, in Geography, a river of the county of Hoya, which runs into the Wefer, 4 miles S. of Blackenburg.

SULDORF, a town of Weitphalia, in the duchy of Magdeburg; 8 miles S.S.W. of Magdeburg.

SULEG, a town of the duchy of Warlow; 45 miles N.E. of Gnefna.

SULEHIE, a town of Egypt, on the right bank of the Nile; 8 miles S.S.E. of Afnia.

SULEJOW, a town of Poland, in the palatinate of Sirdia; 50 miles E. of Sirdia.

SULEN, a river of the duchy of Berg, which runs into the Rhine, 7 miles above Cologne.

SULEN ISLANDS, a cluster of small islands in the North sea, near the coast of Norway. N. lat. 61° 5'. E. long. 4° 45'.

SULLENDORF, a town of the principality of Luneburg-Zelle; 9 miles E. of Ulten.

SULGEN, a town of Switzerland, in the canton of Zurich; 15 miles N. of Zurich.
SUL

SULGEN, or Sulgan, a town of Aulfridian Swabia; 21 miles N.E. of Salamanfweiler.
SULGREN, In, a river of the Tyrolese, which runs into the Adige, near Gmunden.
SULIAGO, or Suriago, a chain of small islands in the Pacific ocean, about 90 miles in length, and 12 in breadth. N. lat. 9° 24' to 10° 32'. L. long. 125° 27' to 128° 30'.
Suligao, 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'.
Suliaga, or Suriaga, a town of the north coast of Mindanao, in a bay between two protecting capes. N. lat. 9° 45'. E. long. 125° 31'.
SULIPACHA, a town of South America, in the province of Tucuman; 150 miles N. of St. Salvador de Jujuy.
SULISKAR, or Bara, 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'.
SULITELMA, 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, comprising 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, clustered with sharp-pointed pyramids of solid ice, which is perfectly clear and colourless; but its crystals appear blue. Near the base of this mountain the lake Lomenjauri, 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. A half degree farther north, the Virjaauri, at an altitude of 1909 feet, is covered with ice in the middle of summer. These observations agree very well with theory, which gives from 2325 to 2230 feet for the height of the mean boundary of congelation in these latitudes. A little below this limit we may place the ordinary site 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 "geyckla," the fame as the German "gaukele," to trick or bewitch the eye.
The term "Sultelma," and "Ben-la-di," the name of a remarkable mountain in Perthshire, have the same original; meaning, in the Lapland and Gaelic languages, "the hill of God;" the rude inhabitants of both countries being accustomed anciently, at certain feasons, to perform religious rites on their summits.
SULKAVA, a town of Sweden, in the province of Tauftland; 118 miles E.N.E. of Tavithus.
SULKENHAGEN, a town of Hinder Pomerania; 10 miles W.N.W. of New Stettin.
SULKUZA, a town of European Turkey, in Bella-ribia; 16 miles S. of Bender.
SULL, in Worcestershire, a term applied sometimes to a plough. (See Plough.) It is the name of the old plough, especially that of Devonshire.

SULL-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.
SULLAGE, in Rural Economy, a term applied to a drain of filth, or the dirt cleaned up from the streets.
SULLANE, in Geography, a river of Ireland, in the county of Cork, which runs into the Lee, 15 miles W. of Cork.
SULLFIELD, a town of the duchy of Holtem; 10 miles S.S.W. of Segebung.
SULLIVAN, 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 Oneida county; about 14 miles from north to south, and 53 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 1724. The southern part is hilly, but the northern and largest part is quite level. The Canaferaga and Chittenango creeks furnish good mills for abundance. Here are eight school-houses and a meeting-house. It furnishes iron-ore, but its chief mineral is granite. —Alfo, in New York, erected in March, 1809, from Ulster county; to erected in honour of General Sullivan, an officer in the revolutionary army. Its form is irregular, and the whole area may be computed at 623,000 acres. It is bounded north by Delaware county, east by Ulster county, south by Orange county, and west by the Delaware river, or the flate of Pennysylvania; situated between 41° 25' and 42° N. lat., and 71° and 72° 6' W. long. from New York. It contains, besides Thompson the capital, Bethel, including 737; Liberty, having 419; Cumberland, with 525; Manakating, with 1865; Naftick, having 953 and Rockland, including 309 inhabitants; the whole population consisting of 6168, 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 fame dillance 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 west 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 1557 spinning wheels, 262 looms, 5832 spindles, and 49,853 yards of cloth produced from household industry. Ulster and the county lend four members to the house of assembly.—Alfo, a township of Cheshire county, in New Hampshire, containing 516 inhabitants.—Alfo, a poll-town of Maine, in Hancock county, in Frenchman's bay; 12 miles N.W. of Goldsfborough; containing 711 inhabitants, —Alfo, a county of East Teneflee, in Washington district, containing 6847 inhabitants, of whom 773 are slaves. At the court-house there is a post-office.
SULLIVAN'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.—Alfo, an island in the Mergui Archipelago; about 35 miles in extent from north to south. N. lat. 10° 48' to 11° 24'.
SULLONIACÆ, in Ancient Geography, a station of Britain, in the second tier or route of Antoinn, placed between Verolanium 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 Brockley hills, where many Roman antiquities have been found. Mr. Baxter, and
and some others, think that this was the capital of the famous Cassivelaunos, which was taken by Julius Caesar.

SULLY, Maximilian de Béthune, Duke of, in Biography, marshal of France, and prime minister under Henry IV., was born at Roïn 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 sedulously adhered, even in some trying circumstances, 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 doomed. At this time Sully entered into the service of the king of Navarre; taking lessons in history and mathematics from the young king's preceptor, and habituating himself to military exercises. 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 infantry as 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 at his own expense 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 councillor of Navarre, and of many of his own chamberlains. During the time which he spent in the service of the duke of Anjou, brother to Henry III., and into 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 witting at this time for a confidential person, whom he could employ at the court of France to watch and penetrate the designs of the League, sent Roïn thither for this purpose in 1584. 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 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 Courtrai and Ivy he acquitted himself so well, that his fidelity and bravery were signalised 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, his 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, with 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 faithfull friends, and reduce himself to the necessity of fighting against them. Roïn, more confoundedly perhaps to principles of policy than to those of truth and integrity, 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 principles or professed; but he acted in this instance with a persuasion, that religion was a matter of little importance to Henry himself, and that the question, whether he was to be denominated 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 tranquill polliclion 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 this 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 maintain 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. Whilft he was refilling applications for oppressive edicts, to which the king, who was always disposed to listen to the requels of his favourites and favourites, inclined, his mildness, d'Entragues, the marchionesses de Verneuil, haughtily said to him, "To whom would you have the king to grant favours, if not to his relations, courtiers, and millets?"—"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 the pockets of the traders, the artisans, the labourers, and peasants? These people, who maintain him and all of us, find one master sufficient, and has no need of so many courtiers, princes, and millets." 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 sobriety 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 palled 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 persons of all ranks were admitted. The ecclesiastics of both religions were first heard; then came the turn of villagers, and persons of inferior condition; persons of quality were reserved till the last. When this was concluded, he usually resumed his labours till supper-time, when he excused his doors to be shut, and laying 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 bring you, said Henry to a courtier, to pafs such a life as that of Sully?—”Not all your majesty’s treasury,” was the reply. Sully was firmly attached to his religion, nor was any temptation that could be presented 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 “on his part he would not cease to pray God for his holiness’s conversion.” The faithful services of this excellent minister were further rewarded by the polls of governor of Poitou, and grand-matier of the parts and havens in France; and also, in 1606, by the dignity of a duke and peer, on which occasion he declined, and took his title from his estate of Sully-for-Loire. He continued at the head of affairs till the assassination 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 master. 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 amanuensis figure excited the mirth of some young courtiers. Sully, perceiving it, and turning to the king, said, “Sir, when your father, of glorious memory, did me the honour to call me to his presence, to consult me in petty 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-matier of the ordonnance. He died in 1641, at the age of 82 years. A statue 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 simple style. They have been several times printed; and the Abbé de l’Écluse gave an edition of them in 1745, which were arranged in better order, and the language was read more correctly. They have always been held in high estimation, on account of their historical and political information, and the interesting anecdotes of the persons and court of Henry IV., which they afford. Gen. Biny.

Sully, in Geography, a town of France, in the department of the Loiret, and chief place of a canton, in the district of Glen, situated on the Loire; 12 miles N.W. of Glen. The place contains 2109, and the canton 6180 inhabitants, on a territory of 345 kilometres, in 10 communes.—Allo, a town of France, in the department of the Saone and Loire; 7 miles E.N.E. of Autun.

SUL, or Sulmbach, a river of Wurtzburg, which runs into the Neckar, near Neckar’s Ulm.

SULM, or Sulme, a river of Wurttemberg, which rises near Merbach, and runs into the Neckar at Neckar’s Ulm.

Sulmona, anciently called “Sulmo,” the place of Ovid’s nativity, a town of Naples, in Abruzzi. Citra, the fee of a bishop, containing 11 churches and 12 convents; 21 miles S. of Civita Chieta. N. lat. 42° 3’. E. long. 13° 50’.

Sulow, a town of Poland, in the palatinate of Sanomirz; 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 presence of potash or ammonia in order to crystallization. The sulphates are feebly decomposable by heat alone, but when fused in contact with charcoal, or any carbromaceous matter, they are converted more or less completely into sulphates; which fuse. In pure alcohol they are all insoluble. All the solutions of these salts are decomposed by the other salts of barytes entirely, and nearly so by the fafts of lime, the acid forming a precipitate with these earths. A similar decomposition 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 sulphates are entirely decomposed at a moderate temperature by any other acid; the sulphuric standing the highest in the order of affinity, with very few exceptions. But some of the acids partially decompose 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 tartrate, with regard to the sulphate of potash. But the acids that are fixed in the fire, such as the boracic, phosphoric, and arsenic, decompose the sulphates 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. Vaquelin 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 uncrystallizable solution of sulphate of alumine, the crystallization will immediately commence. Sulphate of alumine is insoluble 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 doses of obstinate diarrhea, diabetes, and flux album; but Dr. Cullen says that it is not to be depended on in the two latter diseases. In intermittent it has been recommended as an auxiliary to cinchona, and also in confluent small-pox, when the pulse are bloody; and Dr. Percival regarded it as a prophylactic in colica pilorum, and a cure for lighter meals. It is used locally in gargles, and as the basis of injections in cases of gleet and leucorrhcea, and of collyria in chronic ophthalmia. The dose in hemorrhages is from gr. v. to g. j., repeated every hour or two, till the bleeding abates. It is sometimes administered dissolved in the forum of milk, in the form of whey, prepared by boiling a jof powdered alum in a pint of milk, and straining. The dose of the whey is j. (ffj or j. jf). The official preparations of alum are as follow: viz. alumenum fuscacutum, or dried alum of the London Pharm., prepared by melting alum in a carthens vell to the fire.
SULPHATE.

Fire, and increasing the heat until the ebullition cease; or, sulphate alumine exsiccatus, ohm, alumum ylum, 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, alumum ylum, 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 consist of 36.25 acid, and 63.75 alumine. It is chiefly used as an escharotic, to destroy fungus in ulcers, and has also been given internally to the amount of $\frac{3}{4}$ for a dose in cases of colic.

The liquor alumins compostus, or compound solution of alum 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 an useful collyrium in ophthalmia, and an injection in gleet, and in flux albumus, when the discharge proceeds only from the vagina.

Pulvis sulphatis alumine compostus, is described under Powder.

Solutio sulphatis copri composta, or compound solution of sulphate of copper of the Edinb. Ph., is prepared by boiling sulphate of copper, sulphate of alumine, of each 3 oz. in 2 lbs. of water, in order to dissolve them, and then adding to the liquor filtered through paper, 1/2 oz. of sulphuric acid. This is sometimes used as a paint for fopping hemorrhages; and, largely diluted, as a lotion in ophthalmia taret, and the purulent ophthalmia of infants.

Sulphate of Ammonia. See Sal Ammoniacae, and Salts.

This saline substanse 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 grains growing on a light sandy soil, in all cases, when used in a proportion which equalled one-thirtieth part of the weight of the water in which they were dissolved, but less so in this than 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 rain-water.

Sulphate of Barytes. See Barytes, and Salts.

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 alcohol hemorrhages, intermittent fever, epilepsy, and some other spasmodic affections; but other remedies, equally powerful and less injurious, should be employed, and the use of this discontinued. Externally it is employed as an escharotic, to confine fungus, and in solution as a stimulant to foul obstinate ulcers. It forms the basis of a very unchemical preparation, Bate's "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. 1/2 to xv, in f $\frac{3}{2}$ of water; but as a tonic, it should be given in the form of pill, beginning with gr. $\frac{3}{4}$, and increasing the dose to grs. 1/2. The official preparations are, solutio copri sulphatis comp. of the Edinb. Ph., and cuprum ammonium of Lond., Edinb., and Dub. Ph. For the preparation of the former, see Sulphate of Alumina, tupa. The latter, or ammoniated copper of the Lond. Ph., is prepared by boiling together in a glass mortar 1/2 oz. of sulphate of copper, and fixe drachms of subcarbonate of amomnia, until the effervescence cease; then wrapping up the amomiated copper in bilious paper, and drying it with a gentle heat. The Edinb. Ph. directs it to be prepared by rubbing thoroughly together in a glass mortar two parts of pure sulphate of copper with three parts of subcarbonate of amonnia, till the effervescence terminate, and they unite in a violet-coloured mass, which is to be wrapped up in biluous paper, and dried, first on a chalk-flone, and afterwards with a gentle heat. It is preferred in a well-steeped glass phial. According to the Dub. Ph. it is obtained by rubbing 1 oz. of sulphate of copper and 1/2 oz. of carbonate of ammonium in an earthenware mortar, till the effervescence cease, and they unite into a mass, which is to be dried, wrapped up in bilious paper, and preferred in a phial cloed with a glass stopper. This preparation has the odor of ammonium, a hot, fytic, metalline tafte, 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 antispasmodic; 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. $\frac{3}{4}$, increased gradually to grs. v, given twice a day, either in pills made with crumb of bread, or combined with valerian.

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 anthelmintic; it has been given with advantage in diabetes, in the latter stage of phthisis, and in amenorrhea, depending on a weakened action of the blood-veifs. The dose is from gr. 1 to v, combined with ammoniacum, rhubarb, myrrh, or bitter extratics. It has lately been used dissolved in water, as a lotion to cancerous and phagedenic ulcers. Its official preparation is tintura ferris muriatis. See Tincture and Infusion.

In reference to Agriculture, sulphate of iron is formed naturally in many places in great abundance, according to lord Dunonald, by the process of oxygenation, from fulphurous or pyritic substansees. These matters are generally found accompanying the coal strata, as well as in coal itself; particularly in such coals as are sulphurous. This salt is very soluble in water, and is in a high degree injurious to vegetation, when it abounds in folds conflitng of poor clay and siliceous matter, without any admixture of vegetable or calcareous substansees. It is decomposed by alkaline falls, forming with them vitriolated tartar, Glauber falls, vitriolic ammonium, gypium, and Epimol salt. When added to soils containing calcareous matter, and a due proportion of animal and vegetable substansees, it has been found, when not used in too great quantities, to have produced beneficial effects in promoting the growth of grass; 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 observanves have been lately made on this substanse, as contained in peat of Tintgrith-moor, Bedfordshire, by Dr. George Pearson, in a communication presented to the Board of Agriculture. And it is stated, in answer to several queries put by
by him to J. W. Willan, eq. 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 duft: the two last are objects of manure.

1. Peat.—The peat which is found after the removal of the turf 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 duft or ashes which may chance to be blown from it.

If these disagreeable conseqences could be obviated, it might be made an article of general consumption, as a substitute for coal, much to the advantage of the seller and consumer; 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 flake, in which case it could never 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 cut once in fifteen years.

11. Ashes.—The turf or surface, and such parts of the peat as do not appear to be of the belt 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 bushels, either on grases 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 grases; 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 willdouble or treble a crop of any new-fown grases, such as trefoil, &c. He has seen in the benefits arising from it on old pasture-land overgrown with moss, which it effectually destroys, and produces in its stead white or Dutch clover. You may, it is said, trace to an inch the efflorescence and commencement 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.

5. It is not mixed with lime, or any other manure.

6. The ashes are bought by a few of higlers, who carry them in bags loaded on asles to a considerable distance, where they are known to be in great repute: they must come exceedingly dear to the consumer by this mode of conveyance. The farmers in the vicinity fend for them in wagons, particularly Mr. Brumiger, near Sundon, in Bedfordshire, a considerable and intelligent farmer, who increases his consumption every year, both for his grases and arable land.

111. The Salt of Peat, or Duft.—1. The duft or grey salnie substance is produced by heating the earth containing this falt 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 said, in reputation and demand.

2. Fifty bushels 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 delirious.

3. It is used for cold lands. By cold lands are understood clayey or wet grounds.

4. It will much improve the vegetation of fown grases, and old pature, and is equally favourable to the production of corn; the ground, whether grases or arable, being of a cold nature.

5. It is not mixed with lime, or any other substance.

6. The duft is likewise bought by the higlers, and carried to great distances. The nearer farmers likewise fend for the duft in waggons, particularly Mr. Anfile, 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 duft, which are,

1. That it is a blackish-grey, coarse, and rather heavy powder; has no smell; tastes strongly hygetic; readily diffuses in the mouth; did not deliquesc on exposure to the air.

2. That it diffuses in four times its weight of water, of 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 muriatic acid.

3. To the solution (2) he added a little liquid praftis of vegetable alkali, in a perfectly neutral state, which occasioned immediately a most abundant precipitation of prafis of iron; and this test 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 perceivable 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 powder substance called the salt of peat, with concentrated sulphuric acid, produced no emission of fumes nor smell.

9. The solution (2) with muriate of barytes, immediately grew thick and white as cream.

10. The solution (2) with carbonate of potash deposited a very copious greenish sediment; and the same effect ensued with caustic volatile alkali.

11. The solution (2) with oxalic acid gave instantly a very turbid, bluish-green precipitation.

The preceding experiments, he says, manifest that the peat-falt consists of sulphate of iron, vulgarly called green vitriol of iron, mixed with a very minute proportion of siliceous earth and of lime, united either to sulphuric acid, or 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 falt of peat is almost pure sulphate of iron.

Remarks.—1. The falt 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
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 moor.

This is, says Mr. Willaume, exactly the fact. This fulphate of iron, the falt of peat, during the heat of summer is frequently found in a crystallized state, very white, and crackling 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 2550 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 manure, such as lime, alkaline salts, marine salts, nay, of the king 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 no article taken as food, or as salting, which is not a poison, if taken in certain quantities. A human creature may be poisoned, or alimented, by beef or pudding, according to the quantity of them taken into the stomach. He may be poisoned, or have digestion greatly afflred, by salt, or pepper, according to their quantity. In brief, 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 admissible contradictory evidence to the testimonies for the fertilizing effect of sulphate of iron, unless by subcontrary evidencing the quantity stated to be used exceed 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 and burning. It is usual to account for the effects of this process, by referring to supposed alkaline or other salts; but of these there is no evidence, nay, on trial, he has not detected them, or at least not in any sufficient quantity; but this he knows, that such earths and ashes contain oxied of iron, and as he suspects of manganese; which, from the analysis, and the effect of salt-peat, must now be admitted into the class of manures. This communication of Mr. Willaume affords evidence, he thinks, of the truth of this conjecture, for the ashes of the peat which afford 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 oxied of iron. A consequence of this reasoning, is, that the burnt earths of soils will, he supposes, ceteris paribus, fertilize in proportion to the oxied of iron it contains. Accordingly the ashes of the peat, says Mr. Willaume, have a surprizing effect; they will double or treble a crop of any new-sown gras, such as trefoil, &c.; and are fo beneficial, that in spite of the expense, they are carried in bags by higlers 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 of the metallic falt, and metallic oxieds in general, and falt and oxieds of iron in particular, are manures, if applied in proper doses. He is desirous that it may be understood, that he considers the fact of peat, and the after of peat, as operating in promoting vegetation, analogous to salting, or condiments, taken with food of animals; that is, analogous to mustard, cinnamon, ginger, &c., which are not of themselves, at all or necessarily, deleterious, 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 visble 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 perfous have asserted.

Alfo on the other two in fluences the doctor thus remarks:

2. The Peat.—It is a deufe 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 empiric oil, as to give a disagreeable taste to roasted provifions; hence, as we are told, it has been rejected from the kitchen. The fuel affords a valt quantity of what the chemiff calls lycine acid; hence it is rejected alfo from the parlour, as of very derructive to grates. He begs to luggeft that this lycine 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 ufeful pro ducts will be found, on examining the matters more accurately which are afforded by dibillation.

3. After.—If the peat were mere vegetable matter, the ashes afforded by it would be as trifling as thofe of wood; but foome parts of the moor contain fo much earth and oxied of iron, as to leave behind, on burning, a coniderable quantity of incombuscible matter; and fuch kind of peat, we are told, is not ufed as fuel; but, after burning, the refudary matter is an efficacious manure, much more fo 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 there are seeds buried in the earth for many ages, which yet remain alive, but do not grow until exposed to the fiumus of air, water, caaloric, and lifeless animal or vegetable matter. And other facts discovered by refpectable chemiff are added, which serve to fhew that other falt, besides 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 gras. It is flated in the 5th volume of Nicholson's Journal, that his much-valued friend, the Rev. William Gregor of Grampound, on examination of the ashes of coal from Liverpool, found them to contain both sulphate of magnesia and sulphate of lime, especially the former salt. He apprehends that these ashes also contain oxied of iron, or perhaps sulphate of iron. These ashes, fays Mr. Gregor, kneaded over gras, 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 fact with the unfriendy 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 magnesia) only
which this learned chemist found hurtful to vegetables, as
the discovery was made on the examination of Nottingly
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 cinis, is a durable and
efficacious manure. It is observed, that professor Mitchell,
of New York, in a letter addressed to Dr. Pearon on cinis,
or earth found in the ashes of wood, has remarked, that the
ashes of wood contain very commonly sulphate of potash,
also phosphoric acid, besides other well-known salts; but
after these salts are separated by lixiviation, there remains
a peculiar earth, and a small proportion of iron. This earth
differs from lime, barystes, magnesia, frontain, and every other
known species of earth. He would call it cinis, for plen-
tifful, common, and important as it is, science has not dig-
nified it with a name. To judge of the excellence of this
earth as a manure, after all the falls are extracted from soap-
boilers' ashes, the earth sells 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 sterile 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 cinis, or now-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 Syrians, it was one of the
materials forming the platter 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. vi. of Tilloch's Philosophical
Magazine.

4. Sulphate of iron in the peat of Russia. This was found
by professor Rubfon. And it is observed, that something else beside vegetable matter is necessary to form
peat or black mof of the moors. The smell of burning peat is different from that of vegetable matter. Peat-
ashes, says the professor, always contain a very great propor-
tion of iron; he has seen three places in Russia where
there is superficial peat-moss, and in all of them the vitriol is so abundant as to effluvise.
In particular, on a moor near St. Peterburgh, the clods dwe the vitriol (sulphate of iron)
every morning when the dew has evaporated. According
to this learned professor's observations, the sulphate of iron
in pit-coal may be accounted for in the following manner:
peat-mosses 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 compreferred
and rendered very solid; and remaining for ages in that
situation, might ripen into a substance very like pit-coal.
See Medical and Chirurgical Review for November 1805.

5. Use of peat-duff and peat-ashes. In answer to a letter
from Dr. Pearon, requiring to know what experiments
Mr. Anstie had made from the turf-duft taken from
Tingrith-moor; he affords the testimony of having made
use of the ashes and duff near thirty years, and frequently
laying on from eighty to a hundred bushels per acre. Our
land, says he, is dry and very thin-flaped, 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-pence per bushel, including all expenses.
We chiefly spread it over meadow, 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 grass meadow
made by the duke of Manchester at Prietly Bog, 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-duff and the vitriolic water acted chiefly by pro-
ducing the sulphate of lime, or a sublimate of that nature.
It is observed, that the foils 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 foils;
that the sulphate of iron consists of sulphuric acid and
oxyd 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 quits its oxyd of iron to unite with the lime;
and that the compounds produced are infufid, and com-
paratively insoluble.

Some of the deposition 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 sort, carbonate of iron, and insoluble sulphate of
iron. The principal grases in the above meadow are, it is
said, meadow fox-tail, cock's-foot, meadow fescue, firion,
and sweet-scented vernal grass. The ashes of three of these
grases, as the meadow fox-tail, cock's-foot, and firion,
have been examined, and found to contain a considerable
proportion of sulphate of lime, or a sublimate of that kind.
It is further noticed, also, that vitriolic impregnations in
foils where there is no calcareous matter, as happens in
some cafes, are injurious; but that it is probably in con-
sequence of their supplying an excess of ferruginous matter
to the sap. Oxyd of iron in small quantities forms, it is
said, an useful part of foils; and that it is found in the ashes
of plants, and is probably hurtful only in its acid combi-
nations.

This knowledge of the nature, formation, and uses of
this substance, may lead to many useful improvements
in lands which contain it, or the matters of which it is
composed, as well as to more fitable and proper applica-
tions 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 pre-
pared by heating any quantity of sulphate of iron in an
un glazed earthen vessel, on a moderate fire, until it becomes
white, and perfectly dry. The proceeds is nearly the fame
in the Dub. Ph. The degree of heat in these procediles
should not exceed 212° of Fahrenheit. Its official prepara-
tion is the "red oxyd of iron," which is rarely used, ex-
cept 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 foils. It is produced by the
decomposition of aluminous chaff, containing a due
proportion of calcareous matter; with which the ful-
phuric acid will join, as it is formed, in preference to
the earth of alum or clay. It is likewise formed by the decompo-
sition of pyrites, in such foils 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;
SULPHATE.

Sulphate: and it is found in immense quantities, constituting not only the soil, but the sublustrum, of some countries to a great depth. It is to be decomposed by alkaline faults; the sulphureous matter resulting with emulsion 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 sulphate, far from being hurtful to vegetation, when applied to certain foils, 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, whose 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 carbonate of lime, is applied for the purposes of agriculture in other combinations; one of which other compound substances is that of sulphate of lime. That this material consists of sulphuric acid, 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 seventy-five of sulphuric acid. That common sulphate of lime, or chalk, 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 demonstrated; 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 sulphate, free from water, is sometimes, it is said, found in nature, in which case it is called anhydrous saltpetre. It is distinguished from the common sulphate, by giving off no 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 more solubility 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 baritc 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 utility and advantage in some few districts of this country; and various species of (from Newfoundland 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 sulphate affords 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 mixed soil being mixed with about one one-hundredth part of its weight of this sulphate, (some very 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 progress appeared to be more rapid in the shade in which there was no sulphate present. Other similar mixtures were made, in which some cases larger, in other cases smaller, quantities of sulphate were employed; and in one instance, pigeon's dung was used instead of lefth, 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 substance 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 market, 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 their other constituent matters. These ash sulphates are much in use for top-dressing cultivated grases, particularly fainfoin and clover. In examining the ashes of these two, and those of other crops, it was found that they afforded considerable quantities of this sulphate, and that this sulphate, probably, is intimately combined as a necessary part of their woody fibre. If this be allowed, it is supposed easy to explain the reason why it operates in such small quantities; for the whole of a chiver, or of a fainfoin crop, on an acre, would, it is said, on the estimate which has been made, only afford, by incineration, three or four bushels of this sulphate. In examining the soil of a field near the town, which was taken from below a foot path, where this substance could not have been artificially furnished, not any of this sulphate could be detected in 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 supposed, because most cultivated soils contain it in sufficient quantities for the use of the grases. In the ordinary course of cultivation, this substance is, it is said, furnished in the manure; as it is contained in gladly dung, and in the dung of all cactic and animals fed on grases; but it is not taken up in corn crops, or those of peas and beans, and in only very small quantities in turn-up crops; however, where lands are exclusively devoted to palturage and hay, it will, it is said, be continually consumed.

Four different soils cultivated under a series of common crops of crop, have, it is said, been examined for this sulphate; of which, one was a light land from the county of Norfolk; another a clay, bearing a good wheat, from that of Middlesex; the third, a sand from Sussex; and the
the fourth, a clay from Eiflex. In all of them this sulphate is rated to have been found, and that in the foil from Middlesex it amounted to nearly one per cent. The writer, too, has been informed by Lord Dunadd, that having tried this sulphate on two of his estates in Yorkshire without any benefit, he was induced to have the soils of them examined for this substance, in the manner directed in speaking of soils, in both of which this sulphate was found. See Soil.

It is thought, that if these reasonings 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 that lands which have ceased to bear good crops of clover, or other artificial grases, 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, Somercettshire, Derbyshire, Yorkshire, and some others, and only stands in need of pulverization, in order to prepare and to be applied to the land.

It may be remarked, that although the ashes of certain peats, as seen above, afford sulphate of lime, it is not, it is said, to be concluded from that, that all peats 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 peats; and where the foil or fulbarum is calcareous, the ultimate result is the production of this sulphate. In general, when a recent ash of this sort emits, 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 coasts, this substance has been fown over clover in March, in the quantity of about six bushels to the acre, with great effect, but in other coasts without doing any good whatever, when fown over the fame foat of crop, and that of flain. In Kent, when fown over a large part of a field of lucern, and a part left without any, the superiority of the part fown with it was very great. In Suffolk, it has been fown on portions of natural grass, 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 other foats of foil, without any perceptible effect, either the fame or the following year, being produced by it. This would seem to shew that land, in some instances, is so much impregnated with it as to fland in need of more for giving luxuriance to the plants upon it.

Sulphate of Magnesia. See Magnesia, Effom Sal, Sal, and Salts.

By Dr. Home's experiments, sulphate of magnesia has been found to be of very high degree to promote vegetation. He states, that it made the garden-mound and the flowers of his experiments produce one-fourth more grain.

Sir Humphrey Davy, however, thinks, that though this substance has been rated by some inquirers as having 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, Ammoniac-Magnesian, a triple salt, composed of sulphuric acid, magnesia, and ammonia, by adding pure magnesia to sulphate of magnesia, in which case a great part of the earth is precipitated, and the rest remaining in solution, the falt is formed by evaporation. It is also procured more speedily, and with less los, by adding to a solution of sulphate of magnesia one of sulphate of ammonia, each somewhat concentrated. An abundance with water of the former, transparent, thinning crysalizations takes place immediately, which are the triple falt 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 it is by its precipitating on the addition of the two solutions. According to Fourcroy, it is composed of 68 per cent. of sulphate of magnesia, and 32 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-mound 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 ashes. This is sufficient, it is said, à priori, to prove, independently of Dr. Home's experiments, that vitriolated tartras is beneficial to vegetation. This sulphate is a refuse article in some branches of manufacture; but the quantity produced is in some degree, 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 peats, as those of Berkshire, is certainly an useful substance as manure, though the results of Dr. Home's trials have been questioned by Mr. Naismith, 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 form of fulbrance 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 Dunonald thinks, prove a more 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 or smell; nearly insoluble in water; not decomposed by any single acid; but barytes, alone or in combination, abstraacts 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 soluable in sulphuric acid, and precipitate thence by dilution with water. This salt is decomposed by fusion with carbon into a sulphuret. For the analysis of the native sulphate, see Strontian.

SUL-
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 *ous,* terminate in *ous,* instead of *us.* These salts have always a disagreeable sulphurous taste; they are decomposed by the nitric, muriatic, and some other acids, which do not affect “fulphates” 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 fust powder; sweetish to the taste, and then sulphurous; insoluble in water, but taken up by an excess of acid; not crystallizable. It is composed, according to Dr. Thomson, of

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<th>Component</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Sulphurous acid</td>
<td>- 32</td>
</tr>
<tr>
<td>Alumine</td>
<td>- 44</td>
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<tr>
<td>Water</td>
<td>- 24</td>
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but applicable to no use. See **Alumine.**

**Sulphite of Ammonia,** prepared by saturating a solution of caustic ammonia with gaseous sulphurous acid. See **Ammonia,** and **Sulphates.**

**Sulphite of Barytes,** may be prepared with either pure barytes, or the carbonate reduced to a fine powder; or it may be obtained, by compound affinity, from a mixture of an alkaline sulphate with muriate of barytes. It is in the form of a white powder, talkeels, and insoluble in water. By long exposure to the air, it is converted into sulphate of barytes. When strongly heated, sulphur is diffused, and the residue becomes sulphate. This salt may be dissolved in liquid sulphurous acid, and by evaporation, may be obtained in needle-formed crystals, or truncated tetrahedrons. These crystals are sometimes transparent, but often opaque; nearly infusible, and leaving on the plate a sulphurous flavour; sparingly soluble in water; and the solution is advantageously employed for purifying the sulphates from any mixture of sulphate. According to Fourcroy, the crystallized sulphite consists of

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<tr>
<td>Barytes</td>
<td>- 59</td>
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<tr>
<td>Sulphurous acid</td>
<td>- 39</td>
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<tr>
<td>Water</td>
<td>- 2</td>
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It is decomposed by the sulphates; by the alkaline phosphates; by the nitrate and muriate of fluorspar; and by the alkaline carbonates. See **Barytes.**

**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 diffusible; and by gradual evaporation, is deposited in the form of transparent, depressed, tetrahedral pyramids. To the talke 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 softens, and assumes the configuration of a viscous gum, and at length dries, having lost 45 per cent. which is nearly pure water; at a higher heat the sulphurous acid rифs 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>
<td>- 39</td>
</tr>
<tr>
<td>Magnesia</td>
<td>- 16</td>
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<tr>
<td>Water</td>
<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 **Magnesia.**

**Sulphite, Ammoniac-Magnefsian,** 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 less 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 off sulphurous acid, then acridulous sulphate of ammonia fumes, and pure magnesia remains behind. The proportion of its constituent parts has not been ascertained. It is decomposable by barytes, fluorspar, 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 process is finished, and the liquor, as it cools, generally deposits 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 yellowish tinge. It crystallizes either in the form of lengthened rhomboidal plates, or divergent needles. To the talke 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 two per cent. which appears to be water. When heated in a retort, it first deprecitates, and is converted into an opaque white powder, and on an increase of temperature 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 deprecitation ceases, a blue flame makes its appearance, occasioned by the combustion of the sulphur, after which the salt is found to have lost 22 per cent. as before. The component

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<td>Magnesia</td>
<td>- 16</td>
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<td>Water</td>
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parts
SULPHUR.

parts of this salt, according to Dr. Thomson's analysis, are

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<td>Sulphurous acid</td>
<td>43.5</td>
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<tr>
<td>Potash</td>
<td>54.5</td>
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<tr>
<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 assay the solution with sulphate 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 sulphate of lead, thus obtained, contains, according to Dr. Thomson, of 23 per cent. sulphurous acid, and 75 yellow oxyd of lead.

Nitrile acid converts this salt into sulphate of potash: oxymuriatic acid produces a similar 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 oxides 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 alumina; by the phosphates of foda, ammonia, alumine, and glycine; by the nitrites of foda, ammonia, barytes, frontanum, and magnesia; by carbonate of foda, 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 confudly 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 dihedral 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 foda 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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<tbody>
<tr>
<td>Sulphurous acid</td>
<td>31</td>
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<tr>
<td>Soda</td>
<td>18</td>
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<tr>
<td>Water</td>
<td>51</td>
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It is decomposed by the alkaline and earthy sulphates, with the exception of the sulphates of barytes and foda; by the earthy nitrates; by the ammoniacal and earthy muriates, phosphates, and nitrites; 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 sulphating 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 sulphure 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 bituminized 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 waters 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 six-sided pyramids. The crystals present several varieties by truncation of the points or edges. The octohedron, according to Hailly, is the primitive form of the crystal. The crystals are rarely perfect (thick 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 lute is more or less shining, between refrinos 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. Malacive native sulphur is both opaque and translucent, and has sometimes a rough and sometimes a conchoidal fracture, and generally a shining luster.

Native sulphur is also disseminated in small fragments in different rocks; 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-salt 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 slide which cover or alternate with gypsum. Native crystallized sulphur has been found on the under surface of coal beds, near winn-dykes, in the county of Durham. Sulphur occurs in the form of powder in the strata subjacent to coal in Derbyshire, and has sometimes been found malacite in Anglesea.

Native sulphur also occurs in veins which traverse fome of the mountains in Hungary, composed of gneiss and mica-flated. M. Humboldt mentions as an extraordinary fact, the existence of sulphur in a bed composed of quartz, falling into hornstone, and traversing a mountain of mica-flate, in the great mountain of sulphur in Quito, between Alaufi and Tucra, 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 sulphured 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 same naturalist says, that on the north of the Caspian sea, and
SULPHUR.

to the south of Saporiva, in Siberia, there are marshes and even lakes 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 flones at the bottom and sides of the spring. It has been discovered in crettes, herse-radith, and several other vegetables. It is also evolved from animal substances, 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 sublimed in small crystals in beds, or in a flake of powder in the cavities of lava, contiguous to the craters of volcanoes. It is sometimes mixed with decomposed lava. Sulphur is the product of all active volcanoes; but the most remarkable are the pyrites, or sulphur deposits, in Europe, are in Italy, Sicily, the Lipari islands, and Iceland. Solfatara, near Pozzuolo, 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 groups of mafive 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 Agano, the temperature of which is below that of boiling, but it is in a state of confluent 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 Solfatara has supplied a considerable part of the sulphur of commerce in Europe. According to M. Breislak, the sulphur is formed by the decomposition of sulphuretted hydrogen gas, which is plentifully diffused in this place. See SOLFATARIA.

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 flapped 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 instantaneously becomes solid. It is melted again, and call into wooden cylindrical moulds, forming roll-sulphur. Volcanic sulphur occurs also in other parts of Italy, in Sicily, the Lipari islets, 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. Sylvester 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 condensing among the cinder and other refuse on the surface, is found in an efflorescent form of a bright yellow colour. Muriate of ammonia is frequently found in the same situation in a sublimed form.

Sulphur is obtained in large quantities, at a small expense, from the pyritical copper-ore during the roasting which this undergoes previous to the process of smelting. At the celebrated Parys 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 mafles 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 in, and fresh parcels of ore being added from time to time, as the preceding parcels get lighted; a sufficiency of air for the flow of combustion required in this process, is let in 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 precipitately concretes, lining the sides and roof; each chamber has a door, by means of which, about once in six weeks, it is cleared of the sulphur. This rough sulphur is in fpangy pulverulent crusts, of a dirty greyish-yellow colour. For its purification it is melted in a boiler, the impurities are got rid of by fuming and sublimation, and the fluid mass is then laded into cylindrical moulds, to form the common roll-sulphur or brimstone, or into cones about two feet high, forming the loaves of sulphur. The impure dregs are also rolled in the flours under the name of sulphur vivum.

Besides the common sulphur, there are two other forms in which this substance appears in commerce, namely, the sublimed, or flowers of sulphur; and the precipitated, or mallefer 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 set of aludels; at a gentle heat the sulphur first melts, then rises in vapour, and concretes within the aludels in the form of a sparkling 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 acidulous from a mixture of sulphurous
SULPHUR.

fulphurous acid, on which account, an infusion of them in water reddens tincture of litmus; this acid, however, may readily 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 parings of warm water.

Magdalen of sulphur is prepared by decomposing by the fulphurc or any other acid a solution of alkaline fulpahrung; a copious white precipitate falls down, which is to be thoroughly edulcorated with successive portions of warm water. Sulphur in this state has a dull earthy appearance, owing to its extremely minute state of division; it is of a yellowish-white colour, is smooth and almost insensible 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 reaping 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 best 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, stop 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 flask containing the remainder 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; when being rubbed up with a little moistened 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 sulphur 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 fulphur) and entirely inodorous. The common English brimstone or roll-sulphur sometimes contains a full fifteenth of inoluble residue, chiefly orpiment; 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 arsenical odour when heated with charcoal. Aakin.

SULPHUR, in Chemistry, is a simple body, and unchangeable in composition. It is of a yellow colour, with a shade of green. It is very fragible, and easily powdered. It has a peculiar taste, if we may so call that grittiness which distinguishes it from all other bodies, and also finely, especially when rubbed. At the common temperature it is insipid, 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 negatively 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 1336. Its specific heat is found to be 1.85, 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 trelace, and the vapour will take fire, the inflammation spreading instantly to the whole mass. If kept some time in fuzion, 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 is 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 sulphur has been supposed to be an oxysulphur of fulphur 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 separative 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 fusing tides, as experienced in lighting the common brimstone-match. This arises from its combination with oxygen, a compound to be yet investigated. The atom of sulphur is 15, oxygen being 7.5, and hydrogen 2.

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 sulphures; which see.

Sulphur combines with oxymuriatic 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 oxysulphur, and called it fulphurreted muriatic acid. Under the consideration of the oxymuriatic acid being a simple body, this compound has been called sulphuric acid by Dr. Humphrey Davy, and chloro-sulphate of sulphur by Dr. Thomson. It is formed by palling 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 smells 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 reddens litmus, when perfectly dry. When water is added, the mixture becomes cloudy, Dr. Humphrey Davy, by the deposition of sulphur, he further observes, that the mixture
mixture 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 15 to 33, which would give rise to a atom of chlorine and 2 of sulphur.

Sir Humphrey Davy’s experiments showed their proportions to be from 10 grains of sulphur to 50 cubic inches of chlorine, which give their proportions 1 to 2.8, 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 states, that free sulphur was seen, and that oil of vitriol was found in the mixture. It appears unlikely, that in a solution where sufficient oxygen was present to convert all the sulphur into sulphuric acid, there would be free sulphur and sulphuric acid.

Some accurate experiments on the combinations 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 least sulphuret. This opinion cannot be founded upon the facts he gives for its preparation. He says it may be formed by passing 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. Marett, 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 subliling 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 sulphur of hydrogen. It boils at the temperature of 110° or 115°. The electrivity 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 potash 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 spark of a battery; but no water, 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 burned with oxygen, sulphurous and carbonic acids were obtained, and the reduvdum carbonic oxyd; but they found nothing to indicate the presence of any other element in this compound, than sulphur and carbon.

The last inquiry was to ascertain the proportions in which these elements exist in this compound. By passing its vapour through a red-hot tube filled with red oxyd of iron, the oxygen combined with carbon, forming carbonic acid, and perhaps carbonic oxyd. The sulphur combined with the iron. In order to ascertain the proportion of sulphur, the iron containing it was dissolved in nitromuriac acid. This converted the sulphur into sulphuric acid, which was then precipitated by barites, and from that fact the weight of the sulphur could be estimated. The result of this analysis gave

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<th>Substance</th>
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<tr>
<td>Sulphur</td>
<td>84.83</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>15.17</td>
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This is equivalent to two atoms of sulphur and one atom of carbon, which would be in the ratio of 30 to 54, and this would be

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>15.5</td>
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</tbody>
</table>

Berzelius has found that this substance combines with ammonia and lime, forming peculiar compounds. It will doubtless 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 cucurbit, and suspend within the same 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 vessel, 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 offical 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 halfam of sulphur. By long repose 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
are in daily use for lighting of fires, derive their principal utility from being tipped with sulphur.

Sulphur of Antimony, Golden. See Antimony.

Sulphur, in the Materia Medica, 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 lax in hemorrhoidal affections; and the diaphoretic, which it excites, renders it serviceable in chronic rheumatism and catarrh, and in acute gout, rickets, asthma, and other pulmonary affections untended with acute inflammation. It is superbly combined with hydrogen in the stomach. It manifesterly transpires through the skin, perhaps in the state of sulphured hydrogen; and this may be the cause of silver's being blackened in the pockets of those who take sulphur. It is specific in phthisis and some other cutaneous affections, in which it is applied externally, and taken internally at the same time. The dose may be from 3 to 5 gr., mixed into an electuary with syrup or treacle, or in milk. Its purgative power may be increased by combining it with super-tartrate of potash; and in hemorrhoidal cafe fe with magnesia. Its official preparations are as follow.

Sulphur latum, or washed sulphur. That of the Lond. Ph. is obtained by pouring upon a pound of sublimed sulphur boiling water; the acid, if there be any, may be entirely washed away, and then drying it. The sulphur fulminatum latum, 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 litmus; and then to dry the sulphur on bible or 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 mucic acid as may be sufficient to precipitate the sulphur; and finally washing this with repeated affusions of water, until it becomes tafeclefs. The precipitated sulphur is white, with a very slight greenish tinge; its whiteness being owing to the presence of a little water. It differs in no other respect from sublimed sulphur.

Oleum sulphuratum, or sulphured 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 thence the bulk of the ingredients. The colour of this solution of sulphur is very fetid, and the taint acid; its colour is a brownish-red; its consistence thick; and when heated, it emits sulphured hydrogen; when much concentrated, the sulphur crystallizes in ophichods. This oil is limulatant, and externally deterrent. It was formerly regarded as a balsamic, and recommended in catarrh, asthma, and phthisical affections; but its internal use is now properly exploded. When employed, its dose was from 1/2 to 1/3 v. to 1/1 v. taken in water. It is sometimes externally applied for cleansing foul ulcers. The official preparations are, emplastrum ammoniacum cum hydrargyro, et emplastrum hydrargyri. (See Emplastrum.) Unguentum sulphuris, et unguentum sulphuris compositum. See Unguent.

Sulphur Creek, 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 1779, about five miles long, in a N.N.E. and S.S.W. direction. The S. point is a high barren hill, flat-topped, 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° 40', E. long. 141° 13'.

Sulphur Mount, a mountain of Guadaloupe, famous for the exhalation of sulphur and ashes.

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 substance is said to be "sulphured," when it is combined with sulphur.

The several combinations, to which we now refer, are sulphured Hydrogen, and the Hydro-sulphures (see each article); the sulphures as above defined (see Sulphurets, and the articles infra); the super-sulphured hydrogen, or sulphured hydrogen, with a considerable, but in general an uniform, excess of sulphur; and the sulphured hydro sulphurets, or combinations of sulphur, sulphured 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 first turns yellow, and ultimately a blue-black. This gas was formerly denominated "hepatic air," by Berthollet and other French chemists; it is called "gas hidrogéné sulfuré," 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 lumps must be collected and kept in a clove-flopped bottle.

To one part of this sulphuret in a gas bottle, add two parts of water and one part of sulphuric acid. The addition of the acid causes the immediate evolution 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 100 to 99.8; 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 disgusting 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 digestible 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 1; the hydrogen gas not changing its volume. Hence its atom and specific gravity are each equal 10, 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 Sulphured Hydrogen and Gas.

This gas combines with an equal volume of ammonia, forming a fulminate 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 character.

Gay Lussac has on this account called it the hydrofulphuret acid, and its compounds with oxides, hydrophosphates. These have been formerly called hydrophosphates. If the idea becomes finally adopted, that acids may exist without oxygen, Gay Lussac's nomenclature is the most correct. This ingenious chemist foupplkes 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 family of which we are treating, the hydrogen may be considered the base of the acid, and the fulphur the acidifying principle. The same thing may be observed of chlorine and iodine. See Simple Bodies.

Sulphured hydrogen exercises a very strong action on some metals in sublimation, and on many more metallic salts. The metals that are not precipitated from their solutions by it, are iron, cobalt, nickel, manganere, and in some cases anthimony and arsenic. These solutions, however, are deeply coloured by the fulphur; that of iron becoming black; of anthimony, orange; of arsenic, yellow, &c.; but either no precipitate forms, or if formed, it is redissolved by an excess of acid. Thus, if sulphured hydrogen is added to a solution of the red sulphate of iron, the metal is immediately brought to the state of the green, or less oxygenated sulphate, but no precipitate is formed, unless the sulphured 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-sulphured 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 manganere, zinc, tin, and copper, are in the same solution, the first addition of hydro-sulphured water will separate the tin, after which the copper will fall, and then the zinc, while the manganere remains in solution.

In all the above circumstances, it is the simple hydro-fulphurated water which is meant, and not the alkaline hydro-fulphurates; for though the action of the latter is in general very similar to that of the simple hydro-fulphurates, there are some important differences; and in particular, the alkaline hydro-fulphurates precipitate all the metallic solutions without exception.

For an account of the alkaline and earthy hydro-fulphurates, we refer to the article Sulphured Hydrogen; supplying here the deficiencies of that article. For the hydro-fulphurate of barytes, see Barytes. The hydro fulphurate of fluoritane 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 salts of fluoritane. (See Strontian.) An hydro-fulphurate of magnesia is formed by diffusing pure magnesia through water, and palling through it sulphured hydrogen, and thus effecting a solution. (See Magnesia.) For the hydro-fulphurate of lime, see Lime.

The hydro-fulphurate 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 fulphuret of iron, and eight ounces of muriatic acid, previously diluted with two pounds and a half of water. The fulphuret of iron for this purpose may be conveniently made from purified rust of iron, three parts, sublimed fulphur, one part, mixed together, and exposed in a covered crucible to a moderate fire, until they cohere in a mass.

The hydro-fulphurate of ammonia of the Dub. Ph. is obtained by putting four ounces of fulphuret 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 this it is 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-fulphurate is of a dark-green colour, has a very fetid odour, and an acid disagreeable taste. It is decomposed by the acids. This preparation is a powerful sedative, lessening the action of the stomach, and of the arterial pulp, in a remarkable degree; and even in moderate doses producing sickness, 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 labouring under diabetes mellitus; and its subsequent use has been confined to the treatment of that disease. To the dose to an adult should not at first exceed 11/2, or 31/2, given in a large tumbler of water, three or four times a-day; and the number of drops should be gradually increased, until a slight degree of giddiness takes place, when any further increase must be stopped.

SULPHURES OF LIVERS, OR LIVER OF SULPHUR. See Liver of Sulphur.

When fulphur 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 diffusing in water, a certain quantity of sulphured 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 fulphurates therefore contain sulphur, alkali or alkaline earth, and sulphured hydrogen, so that they differ from the hydro-fulphurates of the same bases in containing a large excess of sulphur, and therefore give with acids a copious precipitate of sulphur, which the simple hydro-fulphurates do not.

SULPHURET OF LIME. See Lime.

SULPHURET OF POTAIS, or the common Liver of Sulphur, which see. See also SALTS.

The fulphuret of potas of the Lond. Ph. is prepared by rubbing together an ounce of wafted sulphur and five ounces of tubarbonate 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 fulphur, 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 fulphuret of kali of the Dub. Ph. is prepared by mixing
SULPHURET.

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 glazy fracture; is of a liver-brown colour, and flains 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 hydroguretted 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 expectorant and diaphoretic. It has been frequently given in chronic asthma and chronic catarrh, without much benefit; but has been found useful in arthritic, rheumatic, and herpetic affections; and in combination with cicutas, as a palliative in cancerous cases.

A theory founded on its chemical action on metallic soils out of the body, it has been strongly recommended as an antidote against arsenical, fatal, 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. ii or grs. iv, combined with soap, in the form of pills, for the first-mentioned cases; or from grs. v to grs. x, as an adjunct to cicutas in cancer, given several times a day.

Sulphurets of Barites and Strontiania, 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 diluting 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 distillation. The procefs for obtaining it, being an improvement of that of Banné, is as follows: Mix together in a mortar, and put into a retort, 3 lbs. of flaked lime, 1 lb. of fall 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 distillation with a gentle heat. The first drops that condense are nearly water, but those that follow are yellow; and when about 6 oz. of liquor have distilled over, a salt 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 can be 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 slightly red, during which about six or eight ounces more of liquid are obtained.

The product of this distillation 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 fall 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 fine oxides of water are added to the mixture, full double the quantity is obtained, the rest being expelled from the flaked lime by the heat. If left water is added, the product is still more fuming, and there is a still greater waste of incocerble vapour. This waite, 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 Antimony. (See Antimony.) The prepared sulphuret of antimony of the Edinb. and Dub. Ph. is an inodorous, insipid, blackish or deep leaden-grey dull powder, which flains 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 excessive vomiting and purging; so that the stomach and bowels should be evacuated previously to its use. It has been found efficacious in scrofula, chronic rheumatism, and herpetic eruptions. The dose is from grs. v to 3; mixed with honey or any convenient vehicle. The official preparations are, oxydum antimonii, oxydum antimonii cum sulphurettatum, antimonii sulphuratum precipitatum, and pultus antimonialis. See Antimony.

The precipitated sulphuret of antimony of the Lond. 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 pottas, 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 ironapot, 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 antimoniated sulphur" of the Dub. Ph. is obtained by mixing bicarbonate 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 mattras with four pints of water, and boil for a quarter of an hour; then remove the poff, stir the mixture, and cover it; when the liquor becomes liquid, after retting, decant it cautiously from the sediment. The antimoniated sulphur will partly separate as the liquor cools; add as much diluted sulphuric 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 fubfided, pour off the liquor from the sediment, which is to be washed with cold water as long as it lumes indicates the presence of acid in the effused fluid; finally, dry it upon bibulous paper. The result of these different formule is the same, viz., a sulphuretted hydrosofuret of oxyd of antimony. In the Dublin procefs, the precipitate thrown down whilst the decanted liquor cools is a powder of a brick-red colour, the well-known kerne mineral, 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 sulphur auratum antimonii, or a hydrosofuret of antimony with an excess of sulphur; and hence, by agitating the mixture, a compound, or intermediate product, is obtained, which is the sulphuretted hydrosofuret of the oxyd, as in the former.
SULPHURIC ACID.

former cafet. According to Thénard, the oxys in these
two powders is in a different state of oxidizement; an
opinion, however, which is at least very problematical.
The following are the proportions of their constituents
given by him: Kermes coalts of 72,750 parts of brown oxys of antimony, 20,298 of fulphuretted hydro-
gen, 4,136 of sulphur, and 2,786 of water and lofs: golden
fulphur of antimony contains 68,30 of orange oxys of ant-
mony, 17,377 of fulphuretted hydrogen, 12,20 of sulphur, and
1,823 of water and lofs—in 100 parts. But the real
difference appears to consist in the larger portion of sulphur
thrown down with the golden fulphur; the base being the
same in both as stated by Trommildorff.

The precipitated fulphuret of antimony, as it is called,
is an orange-coloured powder, slightly flyphic to the table,
moderous, and influrable in water. It readily catches fire,
and burns with a blue and greenish flame, exhales the odour
of fulphuric acid, and leaves the metal, after the combina-
tion, in a form of a greyish-white oxys.

This preparation of antimony is diaphoretic and expector-
ant. It was formerly much employed in althems, and in
catastbal 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 fulphuret of iron of the
Dub. Ph. is obtained by mixing fix 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 Ethiopis mineral.
See Mercury.

SULPHURET of Mercury. Red. See Mercury.

SULPHURETTED SULPHUR, Super, Hydro-
uretted Sulphur of Chenexix, Soufre Hyduretin, is a very curious
combination discovered by Berthollet, and confusing
usually of sulphuretted hydrogen, with a large excess of sulphur,
and without any alkane 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
fulphuret in small portions into the acid, during which moat
of the sulphur is precipitated as usual, but very little efferv-
sence takes place, and the sulphuretted hydrogen, instead of
eeaping in a gaseous form, unites with a portion of the
sulphur, and condenses with it into 2 liquid of the appear-
anice of oil, which gradually collects at the bottom of the
vessel in which the mixture is made. This fulphuret was
first noticed by Scheele.

When this sulphur is kept in a phial with water, on the
surface of which it flames, it is constantly in a state of
ebullition, and if the phial is uncorked, the whole of the
fulphuretted hydrogen exhales; and the sulphur returns
to its original state, and fails to the bottom of the water.
Alto, if a little of this liquid be taken in the mouth, it
gives a pungent, bitter, hydro-sulphuret taste, which soon
go's off, leaving nothing in the mouth but solid sulphur,
ticking to the teeth.

When a solution of potash is added to super-sulphuretted
hydrogen, a small portion of sulphuretted hydrogen exhales,
and the remainder unites with the potash, forming a solution,
which resembles in evry respect the common liquid sul-
phuret of potash.

SULPHURIC Acid, Vitriolic Acid, or Oil of Vitriol,
is formed by oxys 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

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SULPHURIC ACID.

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 sulphuric acid, are mixed together, and appears in shining crystals, like hoar frost. On the other hand, Mr. Humphrey Davy affirms, that when nitrous acid gas, and sulphuric acid gas, 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 Humphrey's, who employed the nitrous acid readily 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 rise 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 ascertaining 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 ascertaining 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 mercuorial 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 expressions of the specific gravity, instead of degrees of temperature. The first 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 solutions 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 equably dispersed through a mass of water, the excess of water not being combined but merely mixed. Such may also be the case with solutions 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 far from 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
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 deoxynaturated by the superior affinity of the charcoal; carbonic acid and carbonous oxides are produced, and the sulphate of soda is found to be converted into sulphuric acid, 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 proportions.

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 \( \frac{72}{100} \) parts of sulphur to 29 parts of oxygen. Berthollet, having ascertained that nitrogen 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 72 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 fumed unaltered, and 226 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 226 grains of sulphate of potash, 103 grains were sulphuric acid, composed of \( \frac{72}{100} \times 103 = 60 \) grains of sulphur, and 43 grains of oxygen: hence 100 parts of sulphuric acid consist of

Sulphur - - - 58.2  
Oxygen - - - 11.8  

Another method, followed by Berthollet, Thenard, and Chenevix, and which forms have thought to be upon the whole the best, is to digest a given weight of sulphur in nitric acid, till it is completely dissolved and acidified, (which, if performed with care, may be effected without the production of any sulphurous acid,) then to add a solution of nitrate or muriate of barytes as long as any precipitate takes place, by which the whole of the newly-formed sulphuric acid will combine with barytes into an infusible salt; then to evaporate and ignite the sulphated barytes, and from its weight to deduct that of the barytic base; the remainder consequently will indicate the amount of sulphuric acid produced, from which, by subtracting the known weight of sulphur, we get by inference that of the oxygen.

By compounding the results arising from the experiments of several skilful chemists, the composition of sulphuric acid seems to be, according to

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<td>24.3</td>
<td>37.4</td>
<td>41.2</td>
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<tr>
<td>Oxygen</td>
<td>75.7</td>
<td>62.6</td>
<td>58.8</td>
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By another Statement.

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<td>61.5</td>
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<td>42.6</td>
<td>38.5</td>
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By a third Statement.

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<td>55.56</td>
<td>59.1</td>
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<tr>
<td>Oxygen</td>
<td>58.2</td>
<td>44.44</td>
<td>40.9</td>
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100 100 100

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 out a white vapour. If water is added, the great heat that is thereby generated caues a very rapid and copious emission of the nitrous vapour, and sulphuric acid and water alone remain behind. Sulphuric acid, thus imregnated with nitrous vapour, after a time becomes nearly colourless, and then concretes into solid crysftals. In this state, when dropped into water, it acquires a green colour, and both the crysftals and water sparkle with the spontaneous and copious production of nitrous gas. When the crysftals 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 diffus'd through the acid in a state of half solution. This phenomenon, however, does not take place, as is generally supposed, on account of the re-action 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 silica, 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, diamant, potash, soda, lime, magnesia, amnonia, glycine, yttria, alumine, vircox, metallic oxides.

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 combination of sulphur; a circumstance which renders the process of manufacture much less simple than it otherwise might be.
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, and the oxygen it affords; 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 2.25, 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 supplied, which is doublets the atmosphere.

The combustion of the sulphur, which is facilitated by the presence of the nitre, first converts the sulphur into sulphurous acid; which, from its gaseous form, would soon be diffused, 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 fumes. The new-formed substance can now difpofe of an atom of oxygen, which the sulphuric 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 sulphuric acid, and then diffusing the sulphuric acid as it is formed. When the nitrous acid gas has difpofed of its atom of oxygen, it returns to the state of nitrous gas; and in rising, unites with more oxygen, which it again gives to sulphuric acid; thus continuing its receiving and giving office, till it is accidentally diffused through the same apertures 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 nitrous gas; and through the same, 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 Desformes. Sir Humphry Davy objects to it in some degree. He holds, that the union of the oxygen of the nitrous acid with the sulphuric 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 sulphuric acid without loss, but mixed with azote.

From another source nitrous gas and atmospheric air may be furnished. Thence 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 furnishe though in proportion 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 concentrated by evaporation. This acid to be performed in glass retorts, which are very liable to break. If this is so, another vessel formed, in which there is not 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. Wollaston has introduced vessels for the concentration of oil of vitriol made of platinum: 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 oxymuriatic 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 Bal- dafieri, in a concrete state, lining a grotto in mount St. Amiato, in Tuscany: 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 manufacturing English chemists, 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 B ley, 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 nearly 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 acidulous, is allowed to escape; and when it ceases to come over, the receiver with a little water in it is luted on the retort. The fire is now raised, and kept up brisk for 32 hours, during which time the acid rises to the form of dense white vapours, which fill the receiver, and are there absorbed by the water. These vapours 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 consequence of the vapour ceasing to rise. The red oxyd of iron, or coloathor, 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 luted all 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 coagulate upon cooling; hence it is called glacial sulphuric acid.

This acid used to be, and perhaps is still, prepared at Nordhausen, in Saxony: it is of a dark brown colour, and exhalles, when exposed to the air, abundance of dense, white, foaming vapours; its specific gravity is 1.95. For other properties, see Aikin, *ubi 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 congelation. It is incidentally mixed with fulphuric 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 fulphuric 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 closely, 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 sand 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 intermission 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 concentrated, it is more disposed to corrode and disolve 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 cleanness, it is poured out of the retorts into large globular glass bottles, surrounded with wicker-work fluffed 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 fulphorous acid, and a very minute portion of oxyd of iron, and of the earth of the retort. When loaded with fulphorous acid, it has a suffocating odour, and, when exposed to the air, gives out a white vapour like strong muriatic acid. It used 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, at a very moderate degree of cold. By dilution with a little water, and subfrequent boiling for few minutes in a glass vessel, the fulphurous 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, at the bottom 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, namely, a small door, by which the water and the sulphur and nitre are introduced, and a leaden pipe with a flap-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 bell contrived chambers, the combustion of the nitre and sulphur is effected in a separate stove, 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 of nitre, the more easily condensible will the acid vapour be, and the less sulphur will be lost in the form of fulphuric acid gas. If the nitre exceeds one-fifth of the sulphur, the combustion will be so rapid as to drive into the chamber a considerabe proportion of sulphur unalterd. It would conduc much to the purity of sulphuric acid, and might probably be found even to be an economical plan, to line the chamber with glas instead of sheet-lead: the general appearance of the chamber would then resemble a green-house, and all the wood-work should be faced internally with glass. A composition of wax, malachite, 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 dulled with powdered glas, 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 this 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 glas 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, viz. Acidum sulphuricum dilutum; acidum sulphuricum aromaticum; acidum citricum; acidum muriaticum; acidum nitricum; aqua super-carbonaxis potass; sulphus potass; phosphus sodi; maris antimoni; ferris sulphus; hydroargyri oxymuri; sub-phospho hydrargyri fluor; zinci sulphus; and other sulphurics.

The 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 Edin. Ph. directs one part of sulphuric acid to be mixed with four parts of water. The Dub. 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 that of water, as 1000 to 1000. The tonic and antiseptic powers of this acid render it extremely serviceable in low typhoid fevers, dyspeptic affections, diabetes, convulsions, and in cutaneous eruptions. It renews the colliquative sweat which attend hectic; locally applied, it is a common and useful adjunct to gargles in cachexy, and to check swallowing; and as a refrigerant, it is given with certain benefit in pellvic hemorrhages, 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 infusions of syrups, mucilages, or other sweetened with syrup. The usual dose is from 1/4 to 1/2, but in malignant erysipelas, with a tendency to hemorrhage, it has been given to the amount of 1/4 in twenty-four hours; and it has also been given with evident advantage, says Thomson, to the same amount, in violent uterine hemorrhages.

The acidum sulphuricum aromaticum, or aromatic sulphuric acid of the Edin. Ph., is prepared by dropping 6 oz. of sulphuric acid gradually into 2 lbs. of alcohol; digesting the mixture in a covered vessel with a very gentle heat for three days; then adding of cinnamon bark, bruited, 1/4 oz., and ginger root, bruited, 1 oz.; digesting again in a close vessel for five days, and filtering through papers placed in flasks funnel. The odour of this oil, which is generally regarded as an imperfect ether, is peculiar and aromatic, and its taste, gratefully acid: 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 1/4 to 1/2, in bitter infusions, or any convenient fluid vehicle, given three or four times a day.

The acidum citricum, or citric acid of the London Ph., is obtained by taking of lemon juice a pint, prepared chalk an ounce, or a quantity sufficient to saturate the juice, and nine fluid-ounces of diluted sulphuric acid; add the chalk by degrees to the lemon juice, and mix them, then pour off the liquor. With 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 crystals may form as it cools. To obtain the crystals pure, dissolve in water a second and a third time; filter each solution, boil it down, and put it apart to crystallize. (See Citric Acid.) The solution of this acid in water, in the proportion of 2/3 of the crystals to 1 of water, answers nearly all the purposes of recent lemon juice, and is even preferable for forming the common effervescing draught with subcarbonate of potash. A solution of 1/2 in 1 of water, sweetened with sugar that has been rubbed on fresh lemon-juice, forms a graceful refrigerant beverage, resembling lemonade, and equally useful in febrile and inflammatory complaints. It is probable that the crystallized acid may be equally useful in febrile as the fresh juice of the fruit; but we have not heard whether this point has yet been ascertained.

Acidum muriaticum, or muriatic acid of the London Ph., is prepared by taking of muriate of soda dried, 2 lbs.; 1 lb. of sulphuric acid; and 1 pint 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 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 expulse 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, distil from a sand-bath with a moderate fire as long as any acid comes over. The Dub. 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 raise the heat under the retort and decompose the muriate. (See 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 1/3 of to 1/3 in 1/3 of any fluid, in ulcerated fore-throats, and cancerous oris; and, in a very highly diluted state, 1/10 oz. in 1/10 of water, has been recommended as an injection in gonorrhoea.

This acid has even been regarded as an antidote in general phthisic 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 disorders, 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 1/4 to 1/2 in a sufficient quantity of water.

A very important property of muriatic acid, in the state of gas, is the power it poisons of neutralizing putrid miasma, discovered by Morveau in 1773. It is, therefore, used as an agent for destroying infection in sick rooms and hospitals, diluted by pouring sulphuric acid on common salt.

Acidum nitricum. (See Nitric Acid.) For the other articles above enumerated, see Antimony, Iron, Mercury, Potassium, Salt, Sulphate, &c.

For an account of the ether sulphuricus, or sulphuric ether, see Spirit.

The ethereal oil of the Lond. Ph. is prepared in the following manner. After the distillation of sulphuric ether, distil 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 oily part may float upon it. Let this be fummed off, and as much lime-water be added to it as will neutralize any acid it may contain; and shake them together. Lally, take off the ethereal oil after it is separated. The oily ethereal liquor of the Dub. Ph. is obtained by taking what remains in the retort after the distillation.
sulphuric ether, and distilling to one half by a moderate heat; the product of both these processes is a thick oily matter, of a yellow colour, less volatile than ether, but soluble both in ether and alcohol. It may be obtained more directly, though less economically, by distilling ether with a portion of sulphuric acid. It is used for the preparation of the compound spirit. See Spirit of Ether.

SULPHURIZED Muriatic Acid, a fingular compound resulting from the incomplete oxydation 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: charge a retort with common salt and oxys of manganese; annex to it a Wolfe's apparatus, with two or three bottles; put some dry flowers of sulphur into the first bottle, and into the next some carbonated potash, to absorb the superfluous 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; as soon as this is effected, the gas will be absorbed.

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 1.62, 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 pungent than those from strong muriatic acid. It is very volatile at 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 singular 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, 35.4 oxys of sulphur, and 4 sulphuric acid. The oxys of sulphur appears to be composed of 93.8 sulphur, and 6.2 oxygen. Aikin.

SULPHUROUS or SULPHUREOUS Acid, is formed when sulphur is burnt in the open air. At the common temperature it exists in the gaseous form. It is the peculiar suffocating 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 "phlogilicated vitriolic acid." Our knowledge of it was enlarged by Scheele, Priestley, Berthollet, Vauquelin, and Fourcroy; but we are indebted to Dr. Thomson for the full analysis of it that has yet appeared, and for the discovery of various interesting facts, which had been either overlooked or obscurely flated by preceding inquirers. The most simple way of obtaining this gas is by heating sulphuric acid with mercury, or bits of copper, in a glafl retort. If the heat of the retort be placed under a receiver filled with mercury, in a mercurial bath, the gas will be obtained.

It is elastic and effusives, like air. Its fircell is pungent and suffocating, and it is incapable of supporting either combustion or animal life. It first reddens vegetable bluses, but ultimately destroys their colour. It is employed for destroying the colour of silk, wool, and flax. These bodies are exposed to the fumes of burning brimstone, which is the cheapest way of forming this gas. This process is called flowing. Accordingly these forms are employed to discharge the natural yellow tinge from white woollen cloth, and to restore silk that has become yellow by long wearing, to its original whitenee: 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 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 20, or, as others say, 20 times 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 Clancet, if exposed at the same time to great pressure, and a cold equal to 31° of Fahrenheit, it loses its effluvism, and becomes a liquid fluid. By a slight exposure to this gas, without agitation or extraordinary pressure, absorbs, according to Priestley, about 44 times its bulk, or 7/12 of its weight; and, according to Thomson, at 01° Fahr., 35 times its bulk, or 97/12 of its weight; but if water be saturated with this gas, by means of a Wolfe's apparatus, the bottles of which are surrounded with ice, it will be found to have taken up, according to Vauquelin, about 5/12 of its weight. The specific gravity of this liquid acid is stated by Berthollet at 1.04, and by Vauquelin at 1.02; by Thomson at 1.05 at 68°.

We may learn from what has been observed, that this acid is constituted 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 sulphuric acid; according to which (if the analysis of sulphuric acid by Chennevi should be allowed as the most authentic) this acid consists of

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<th>Sulphur</th>
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The order of the affinities of sulphuric acid, as far as it has been ascertained, is the following: barytes, lime, potash, soda, magnesia, ammonia, and alumine. It is separable in the form of gas from its earthy and alkaline bases, by the sulphuric, muriatic, phosphoric, and tartaric acids.

Oxygenous gas seems to have no effect on sulphuric 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 proceeds 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 exerce no action on each other at the common temperature, but if a mixture of three
three parts, by bulk, of the former, and one of the latter, is made to pass through a red-hot glass tube, the sulphurous acid is totally decomposed, and the products are sulphur, water, and sometimes a little sulphuretted hydrogen.

Phosphorus, even when strongly heated in a glass tube, appears to have no action on sulphuric acid. Phosphuretted hydrogen, on the contrary, even at the common temperature, readily decomposes this acid; the mixture loses its flake of effusive fluidity, a white vapour makes its appearance, and the fide of the vessel are lined with a mixture of sulphur and phosphorus. Sulphuretted hydrogen has a similar effect to phosphpuretted hydrogen, and sulphur is precipitated from the decomposition both of the acid and of the inflammable gas.

Charcoal, at the common temperature, imbibes a considerable quantity of sulphuric acid gas, but appears to produce no material change upon it; at a red heat, however, the gas is decomposed, sulphur is deposited, and sulphuretted hydrogen is produced; the hydrogen, doublets, originating from the water, either of the acid gas or of the charcoal.

With camphor, sulphuric acid combines readily, and the result is a liquid, the properties of which have been but little investigated: this compound, when dropped into water, deposits again the camphor, which appears to have undergone scarcely any alteration.

Sulphuric acid, especially at a low temperature, absorbs a large proportion of sulphuric 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 diffusing, with a very visible effervescence, the greatest part of the sulphurous gas. Strong and colourless nitric acid, by being impregnated with sulphuric acid gas, acquires a deep orange tinge, and nitrous gas is diffused; the sulphurous being at the same time converted into sulphuric acid.

Water, when saturated with sulphuric gas, forms the liquid sulphuric acid: it is best prepared in a Woulfe's apparatus, with two or more bottles, into the first of which should be put a little water, to take up the sulphuric acid, with which the gas is generally more or less mixed, while the purified sulphuric acid is absorbed by the water in the second and succeeding bottles. This liquid acid absorbs oxygen from the air, and is gradually converted into sulphuric acid. But if a little of it is confined in a glass tube, hermetically 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, shewing 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 sulphuric acid, will be converted, for the most part, into sulphuric, and the crystals are sulphur. Hence it appears, that by the long continuance of heat, the oxygen of the liquid sulphuric acid quites one part of its bale in order to form sulphuric acid with the remainder.

Sulphurous acid combines, either directly or by compound affinity, with the different falsifiable bases, forming a genus of salts, which have obtained the name of sulphites.

These metals whole affinity for oxygen is weak, as lead, mercury, and copper, are not acted upon by sulphuric acid. Some metallic oxys are simply combine with the acid into a sulphate; others, as the black oxyd of manganese, give out a portion of oxygen to the acid, converting it totally, or in part, to sulphuric. Hence there is produced a sulphate, either mixed or not with a sulphite.

SULPHURWORT, MEADOWS, in Agriculture, the common name of a plant of the grape kind, often met with in meadows of the more moist description. See Hag-Fenel.

SULPICIA, in Biography, a Roman lady, wife of Calenus, lived in the reign of Domitian, and distinguished herself by her poetical talents. At the close of some editions of Juvenal, we have the fragment of a satire written by her, in easy and elegant language, against Domitian, when he expelled the philosophers from Rome; it is also to be found in the "Poetae Latini Minores," Leyd. 1731, and in Matraire's "Corpus Poetarum Latin." Her poem on conjugal love, addressed to her husband, and pronounced by Martial in one of his epigrams to be equally amiable and nervous, is still more celebrated. Gen. Blog.

SULPICIUS-SEVERUS, an ecclesiastical historian and presbyter of the second century. This is placed by Chrysostom about the year 401, and who is supposed to have died about the year 420. He was a native of Aquitain in 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 Phæadius, bishop of Agën, 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 refused for some time at Touloufie, and afterwards at Aesufio, in Gallia Narbonensis. Gennadius says, that in his old age he embraced Pelagianism; but being convinced of his error, married his repentance by perpetual silence afterwards: that is, as some suppose, by writing no more books. It appears from his own works, as well as from the testimony of Jerome, that he imitated some of the notions of the Millenniums. Dupin says that he was very credulous with regard to miracles; but Tillemont believes every word. It is recorded, much to his praise, that he was adverse to every kind of persecution, and that he disapproved the interposition of magistrates in the province of religion. His testimony to the books of the New Testament is very explicit, and he confirms many of the historical facts recorded in them. His general division of the sacred writings is into the law, the prophets, the gospels, and the apostles; the Old and New Testament. He was the author 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 summary account of the affairs of the Jews, and of the church, from the beginning of the world to the conclusion of Stileicho and Aurelian, A.D. 400. This history, after the period of the evangelical writings, is too 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, especially 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 curious particulars. His most entertaining work is one of his dialogues, which relates the mode of life of the ancient monks, and affords an instructive delineation of the state of monachism at that period. Some epistles to his father and other persons are also prefixed. His works have been several times republished. The best editions are those of Le Clerc, Lipl. 1709, 8vo. and of Hieron. a Prato, Veron. 4to. 2 vols. 1741, 1754. Dupin. Lardner.
The SULTAN, or Turkifh Scluain, See Sequin.

SULTAN, or Turkish Sequin. See Sequin.

SULTAN, in Geography, a river of Spain, in Valencia, which runs into the Xucar.

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 Ottoman princes, born while their fathers were in possession of the throne, and to those of the Gungufian family. It is bestowed, he says, on him who enjoys the right of succession; and this, by the Turkish 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 empress, which begins with these words "Sultan el Berein," i.e., sovereign of the earth, evinces the contrary.

It had its rise under Mahmoud, son of Sebecteuhin, the first emperor of the dynasty of the Kangevides, toward the close of the fourth century of the era of the Hegira: when that prince going to Seccidan to reduce Kalaf, governor of that province, who affected the sovereignty; Kalaf was no sooner advowed 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 over afterwards; and from it he passed to hisendants, and to other Mahometan princes.

Vatier will have the word Turkhi, and to signify king of kings; adding, that it was first given the Turkish princes Angolipex and Masquad, about the year 1055; others will have it originally Persian, alleging, in proof of it, an ancient medal of Cosroe; others derive it from foldanus, quaf quai dominus; others from the Hebrew סולטן, صلح. To rule, reign.

In the Roman ceremonial, we also find mention made of a soldan, or marshal, who is to attend the pope when he marches in state. He is also to apprehend mal-factors.

Sultans, Epochs of the. See Gelatin Erocha.

Sultan Flower, Cusanus, in Botany, a species of Centau- rea; which see.

Sultan-Scheriff. See Scheriff.

SULTANA, the wife of a sultan.

Travellers is observed, have improperly called sultanas the wives of the grand signior; 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 sultanas no longer bear any other name but that of "Kanoum-fultana." The grand signior, either from pride or political motives, must not marry like his subjects: he thinks himself too much 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 lovers 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 sultan, are raised to a rank above the others; they become his favourites; they participate most commonly in his pleasures; and sometimes acquire so small degree of influence over public affairs. They are distinguished by the name of "Kadaun." The slave who becomes the mother of a boy, or the favourite sultana, is called "Hfaseti-fultana," i.e., private sultan. (See Aseki.) She has a house and slaves; she obtains a distinguished rank; she is treated with the greatest respect; she enjoys a sort of liberty in the interior of the harem: and in a word, the 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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SUL

N. lat. 50° 25'. E. long. 73° 50'.—Alfo, a town of Bengal; 32 miles S. of Calcutta.—Alfo, a town of Hindoo-philan, in Guzerat; 30 miles S. of Gogo.—Alfo, a town of Hindoo-philan, in Oude; 50 miles N. of Allahabad. N. lat. 26° 18'. E. long. 82° 44'.

SULTE, or SULZ, a town of Mecklenburg, containing some falt-works and boiling-houfes; 23 miles E. of Rolfock. N. lat. 54° 8'. E. long. 12° 40'.

SULTZ, a town of France, in the department of the Upper Rhine, with a medicinal spring; 12 miles S.S.W. of Colmar.—Alfo, a river which rifes in the county of Cilley, and runs into the river Save, 7 miles E. of Reinh.

SULTZ, 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 Lautering.

SULTZBURG, a town of the duchy of Baden, celebrated for its wine; 20 miles N.E. of Bâle.

SULTZDORF, a town of the duchy of Wurzburg; 4 miles S.E. of Konighofen in the Grabfeld.

SULTZHEIM, a town of the duchy of Wurzburg; 2 miles N.N.W. of Gerolzhofen.

SULTZMATT, a town of France, in the department of the Upper Rhine; 9 miles S.W. of Colmar.

SULKEN, a river of European Turkey, which runs into the Reut, 6 miles S. of Ifakova.

SULZ, a town of Germany, in the margrave of Anfpaeh, on a river of the fame name; 12 miles W. of Anfpaeh.—Alfo, a river of Bavaria, which runs into the Altmouth, near Bârgren.—Alfo, a river of Anfpaeh, which runs into the Wernitz at Waffertrudingen.—Alfo, a river of Helfe, which runs into the Fulda, two miles N. of Hirfsfeld.—Alfo, a town of Wurtemberg, near the Neckar, with ample falt-works; 12 miles N. of Rothweil. N. lat. 48° 18'. E. long. 8° 46'.

SULZA, a town of Saxony, in the principality of Weimar, on the Ilm, near which are fome filver-mines belonging to the prince of Sax-Sparg; 14 miles N.E. of Weimar. N. lat. 51° 6'. E. long. 11° 42'.

SULZANO, a town of Italy, in the department of the Mela; 12 miles N.N.W. of Breclia.

SULZBACH, an imperial village of Germany, in the circle of the Lower Rhine; given in 1802, among the indemnities to the prince of Nâlncię Ufingen.—Alfo, a town of Germany, in the lordship of Limburg; 5 miles E.S.E. of Gildorf.—Alfo, a river of Wurtemberg, which runs into the Kirfch, near Deukendorf.—Alfo, a town of Bavaria, and capital of a principality to which it gives name, united with Neufburg. It contains churches for the Lutherans and Roman Catholics, and about 500 houfes. In the neighbourhood is an iron-mine. The tax to the chamber of Wetzlar was 48 rix-dollars 51 kreutzers; 48 miles N.N.E. of Ingolftadt. N. lat. 49° 30'. E. long. 11° 45'.

—Alfo, a town of France, in the department of Mont Tonnerre; 3 miles N.W. of Lautereck.

SULZBURG, a town of Bavaria, lately belonging to the abbey of Kempten; 6 miles S. of Kempten. N. lat. 47° 51'. E. long. 7° 47'.

SULZBURG, Ober, 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 Ratifbon. N. lat. 49° 8'. E. long. 11° 26'.

SULZER, John-George, in Biography, was born in 1720 at Winterthir, in the Canton of Zurich, and being the youngest of twenty-five children, and having lost both his parents in the fame year in the year 1734, his patrimony was fearely fufficient for defraying the expense of his education. In 1736, however, he was fent to the gymnafium of Zurich, where he was principally instructed in reftruction to John Gefner, and also to Bodmer and Dreiminger, who engaged and directed his taste; this time his attention was divided between the study of the Hebrew language, Wolf's philofophy, and the fystem of Linneüs. In 1739 he was licenced to preach by the fynod of Zurich. His firft publication was entitled "Moral Considerations on the Works of Nature;" and his account of a tour which he made in 1742 into the neighbooring 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 "Schenucher's Itineria 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 Joachimthaf collafe 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 Klopftock to Zurich, and on his return to Berlin in the fame year, he was made a member of the Royal Academy of Sciences, to the philological clasf of which he contributed various philofophical effays, which were afterwards translated into German, and published in a feparate 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 difftime his grief, he was allowed, in 1762, to revifit his native country, where he employed his time in preparing his "Theory of Schools and Academias." In 1763, on his return to Berlin, he obtained the king's conftent to resign his professorial chair, and retired to reside 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 eftabllifhed. He also granted him a piece of ground on the banks of the Spree, near the city, where he might erect a houfe, and amufe 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 preparation and完毕 his "Dictionary of the Fine Arts;" the firft part of this work appeared in 1771. In the fame year Sulzer made an attempt in dramatic writing, and prepared Mercier's "Defémenter" for the Berlin theatre; he also endeavoured to convert Shakipeare's "Cymbeline" into a regular piece for the fame purpose; but his talents did not appear fuitable to this kind of composition. In 1771 he was invited by the duke of Courland to Mitau, to establish a new gymafium, which proposal his bad health obliged him to decline, though he drew up the plan of this femi-inary, and made efforts for procuring able professors. In 1773 the fate 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 interefling journal of which has been printed. In the course of this journey he received the laft proof of the effeem of his sovereign, in the intelligence that he was appointed director of the philological clasf of the academy. The milde climate of Italy proved at firm
Umbriel 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 so 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; 3 miles S.S.W. of Kitzingen. N. lat. 49°43'. E. long. 10°52'.

SULZHEIM, a town of the duchy of Wurzburg; 7 miles S.E. of Schweinfurt.

SUM, Summa, in Mathematics, signifies the quantity that arises 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 S, which stands for suma or sumus; and sometimes by the letter S.

Summa 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 Delcates 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 ancient used sumach, instead of salt, for salting their meat: whence the Latins call the tree rubus oblongum: and from its use in dressing of leather, it has been called rubus coriaria.

SUMAC, in Myrtle-leaved. See Coriaria.

SUMADA, in Geography, a town of Switzerland, in the Upper Engadine; 3 miles S.W. of Zulz.

SUMAGA, a town of Italy, in the Friuli; 3 miles W. of Concordia.

SUMAGE, Sumagium, or Summagium, in our Old Writers, toll for carriage on horseback. "Pro uno equo portante summagium per dimitum ann. obolum." Chart. de Forell. c. 14.

SUMAN, in Geography, a town of Hindoostan, in the Doob; 10 miles N.E. of Etaya.

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 Myr, a sort of flute with two pipes, one of which, the shorter, is used for playing airs, and the longer, in a continued bass, just like the long pipe in the Bulgarian bagpipe. In Egypt they have a bagpipe, called "Sumara el Kurbe;" 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 Fe. N. lat. 30°50'. W. long. 105°30'.

SUMASINTA, a town of Mexico, in the province of Tabasco, on a river of the same name; 115 miles S. of Campeachy. —Allo, a river of Mexico, which rises about 20 miles S. of Zacatula, in the province of Chiapa, and runs into the bay of Campeachy, N. lat. 18°20'. W. long. 92°40'.

SUMATRI, in Hindoo Mythology, is the name of a beautiful damsel, expounded by Sagar: the latter being, like Sumudra, a personification of the sea. She is fabled to be the sifter of Superna, the animal half eagle half man, on which the god Vishnu 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 vernacular books. Being childless, she and her husband engaged, as is usual, in a course of sacred authorship, and was rewarded by a choice given her by the gods, of having one son or sixty thousand sons. She preferred the latter, and brought forth a grond (escrubia leguarus), whence it is said that number of male children, who were carefully brought up by their nurses in jars of butter. This will suffice as to the monstros legends of Hindoo romance. Something farther of this fable, on which hinges a great deal of incident, probably historical, highly embellished by poetical exuberance, is noticed under our article SUPERNA.

SUMATRA, in Geography, an island in the East Indian sea, the most westerly of those denominatied 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 in almost equal parts, one extremity being in 5°33' N. and the other in 5°56' S. lat.

Fort Marlborough, on the point of land called "Ooong Carrang," in S. lat. 3°46', the place on which the latitude has been determined by actual observation, is found to lie 102° E. of Greenwich; but the situation of Achen Head is also pretty accurately fixed by computation at 95°34'; and the longitudes in the latitudes of Sumatra are well ascertained by the short runs from Batavia, which city has the advantage of an observatory. Sumatra lies exproed on the S.W. side to the Great Indian ocean; the N. point stretches into the bay of Bengal; it is divided by the Mahabharata, the Mahaf fons, by the frats of Malacca; to the E. by the latitudes of Banca, from the island of that name; to the S.E. by the commencement of the Chincfie seas; and on the S. it is bounded by the latitudes 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 Cherveroneus of the ancients, conceiving it to be a continuation of the continent; and another writer describes the latitudes of Malacca 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 "Taborane." The idea that Sumatra was the country of Solomon's Ophir, is too vague to merit diffusion. (See Orth.) The Arab travellers, who, about the year 1173, penetrated into India and China, mention an island, which they call "Ramun," with which the situation and productions of Sumatra tolerably coincide. Marco Paolo, whose writings published in 1260, though condemned as fabulous, bear many signatures of authenticity, describes an island called "Java Minor," which was probably Sumatra. The name of Sumatra, the orthography of which is various, is of unascertained etymology. The appellation Samander, given to this island, has some resemblance to Sumatra; but the Nubian geographer, Edrefi, describes it as lying near to the river Ganges. M. d'Anville is confident, that the "Jabadda insula" of Ptolemy is Sumatra, though usually supposed to represent Java. The commentators of Arrian assert that this is the island meant by the "Islanda Simundia," or "Pakelimundi," of that writer, in his "Periplus Maria Erythræi." A friar named Odoricus, who in 1331 visited some of the Indian islands, speaks of Java and "Symulta," which perhaps may suggest the true etymology of Sumatra. Reland thinks, that Sumatra owes its name to "Sammara," given by him to signify, in the language of the country, "magna formica," 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. Marden'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 triple; 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 those 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 most 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 supplying most of the large rivers, those especially that discharge themselves to the eastward. Waterfalls and cascades are also not uncommon. The country is every where 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 82 and 85 degrees. At fun-rice it is usually as low as 70; but the evaporation of cold is much more perceptible than such a temperature would lead to indicate. Inland, as the country ascends, the degree of heat decreases rapidly, requiring 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. Fruit, 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 "caubot" by the natives, is dense to a surpising degree; it rises in the morning, and is seldom dispersed till about three hours after fun-rice. 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 season, begins about May, and slackens in September; the north-west monsoon begins about November, and the profile 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 a much greater proportion, remains an impervious forest. Along the western coast swamps abound, and have a considerable extent, and surroun'd 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. Marden 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 infinities of the ranges of mountains that occupy the interior country, and interrupt and collect the floating vapours. The earth is rich is 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, saltpetre, 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 isicatite. The mountain stone is a species of granite. Many curious fossils are discovered in cliffs, occa- tioned by the encroachments of the sea, such as petrified wood, and sea-shells of various forts. Here are also various kinds of coloured earth.

In this, as well as all the other islands of the eastern Archipelago, there is a number of volcanic mountains, and effects takes frequently occur. The convulsions which attend them, and the gradual recea 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 effort of nature, or the gradual attrition of the sea. The coast, however, where the shore is flat and shelving, is defended from the attacks of the sea by a reef or ledge of coral rock, against which the surf (a term erroneously laid by Mr. Marden not to occur in our dictionaries) exerts its violence, without any great effect. (See Suma.) The spring-tides on the west coast of Sumatra are estimated 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 six o'clock nearly, or the days of conjunction and opposition throughout 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 equator.

The inhabitants of Sumatra may generally be distributed into two classes: one comprehending the Mahomedan inhabitants of the sea-coast, and the other the Pagans of the inland country; and if we defer to the principal sub-divisions, we may distinguish the empire of Menangcaboerc, not Menangcaboerc (which see), and the Malays; the Abengs; the Battas; the Rejangs; and the Lampoons. The Rejangs, though inconsiderable in the political scale of the island, are placed by Mr. Marden 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 more especially over that portion principally connected with the English. These people, formerly of more extensive dif- fusion, have a proper language, and a perfect written char- acter, that is generally used in remote districts. The country of the Rejangs is divided, to the north-west, from the kingdom of Anac Soongey, of which Moc Moco is the capital, by the small river Oori, near that of Cattown; which last, with the district of Laboon on its bounds, bounds it on the north or inland side. The country of Mookee, where Palembang river rises, forms its limits to the east. Bengoolen river confines it on the south-east; though the inhabitants
inhabitants of the district called Lomha, extending from thence to Silehar, are entirely the same people in manners and language. The principal rivers, besides those already mentioned, are Luye, Pully, and Sceongeyelam; in all which the English have factories, the resident or chief being stationed at Luye. The persons of the inhabitants of the island, though differing considerably in districts remote from one another, may be comprehended in general under the following description; except the Achnese, 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 light, but well-shaped, and particularly small at the wrists and ankles. Upon the whole, says Mr. Mardten, they are gracefully formed; and among the natives there is scarcely one deformed person to be seen. The women, however, have the prepossessing custom of flattening the noses and compressing the heads of children newly born, which, as the fluid is cartilaginous, increases their natural tendency to that shape. A similar practice prevails at Uhetas. They likewise pull out the ears of infants, in order to make them fland 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 confection and use of cocoanut oil. The men wear their hair short, but that of the women is long, reaching in some instances to the ground. The men are beardless, but the Malay prelates display a little tuft, which is sufficient to shew that nature has not withheld 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 chin, upper lips, and those parts of the body that are subject to superfluous hair, with chunam (quick-lime), especially of shells, which destroys the roots of the incipient beard. The few pigtails that afterwards remain are plucked out with tweezers, which they contemptuously 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 whiteness. The sides of the face are distinguished, but some of them exhibit an appearance that is strikingly beautiful. Persons of superior rank encourage the growth of their hand-nails, particularly those of the fore and little fingers, to an extraordinary length; occasionally tinging them red, with the expressed juice of a rhubarb, called "chih," as they do also the nails of their feet, which are always uncovered. The natives of the hills, through the whole island, are subject to those monstrous warts from the throat, of which influences occur in Europe. (See Guittre.) The inhabitants of the country are superior to the Malays of the coast in respect of size and Araguet, and finermof of complexion. The inhabitants of Pafsumana are also described as being more built 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 generally called Otaian-cloth. The dress of the men consists of a cloke 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 "badjoon," which resembles a morning gown, open at the neck, but fastened close at the wrists and half way up the arm, with some buttons to each sleeve, usually made of blue or white cotton-cloth; for the better part of chintz, and for great men of flowered silks. 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, sewed together at the ends, forming, as some have described it, a wide sack without a bottom. This is sometimes gathered up, and flung over the shoulder like a sash, or folded and tucked about the waist and hips: and in full dress, bound 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 fallen a kind of turban, which is a fine coloured handkerchief; the country people usually twilling a piece of white or blue cloth for this purpose. The crown of the head remains uncovered, except on journies, when they wear a "toodong," or umbrella hat, completely screening them from the weather. The women have a kind of bodice, or rather short waitcoat, 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 "talle-pending," or zone, is worn about the waist. This is usually of embroidered cloth, sometimes fastened with a plate of gold or silver, about two inches broad, and in front with a clasp of filagree work, with some kind of precious stone, or reliance of it, in the centre. The badjoon is like that of the men and a "fakendang," 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 for 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 fancielly arranged. Among the country people, particularly in the southern mountains, the virgins (orang-gaddees, or goddefles, as it is usually pronounced) are distinguished by a fillet, which goes across the front of the hair, and falls behind. This is commonly a thin plate of silver, about half an inch broad: those of the first rank have it of gold, and those of the inferior clafs use the leaf of the ipapab tree. Besides this peculiar ornament, their plate 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 fame metal, passing 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 made of gold filagree, fastening, not with a clasp, but in the manner of thongs.

The bouses 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 villages, or "doosouns," are always situated on 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 houfe commonly form a quadrangle, with palleys or lanes between the buildings, occupied, in the more considerable villages, by the lower clafs of inhabitants, and where their padde-house or granaries are erected. In the middle of the square stands the "bath," or town-hall, which is a room about
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50 to 100 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 fix or eight feet in height, which have a sort of capital, but no base, and are wider at top than at bottom. For their floorings, they lay whole bamboos, four or five inches in diameter, close to each other, and fallen 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 neepah. The mode of ascent to the houses is by a piece of timber, or from 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 doofoons, 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 mythic 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 falvers, round each of which three or four persons dispose themselves; and on these are laid fras waters, which hold the cups that contain their curry, and plantain leaves, or matted vellets, filled with rice. Their mode of fitting is either on the haunches, 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 frutilites for them: they take up the rice and other viéituals 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 vellet, with a wide rim and narrow bottom: they have some coarse chins, and a species of earthen pippkins, 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 vellet for boiling rice, is the bamboo, which the fire almost wholly defroys before the rice is dreefed. They have occasion for fire, chiefly in cooking their viéituals; but their houses have no chimneys, and their fire-places are merely temporary contructions of a few loofe bricks or ilones: their fuel is wood: flint and steel for striking fire are common, but they are chiefly ufed in travelling, when they take up their habitations in the woods or deforeted houses. They frequently kindle fire by the friction of two ilicks;Selecting a piece of dry, porous wood, and cutting smooth a spot of it, and they then apply a smaller piece of a harder Sabundance, with a blunt point, in a perpendicular position, the other lying horizontally, and then it quickly round, between the two hands, as chocolate is milled, prefing it downwards at the fame 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 almost all prepared in that mode of dreeffing called "curry:" but whatever be the quantity or variety of their meat, the principal article of their food is rice. Their meat is dreefed immediately after the animal is killed, except when they prépare it in the mode called "dinding:" this is done by cutting the flesh of the buffalo into small thin flakes, and exposing them to the heat of the fire, generally on the thatch of their houles, till the meat becomes to dry and hard, as to refiil putrefaction, without the use of salt. Fift 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 cocoa-nut tree, which is applied to a variety of purposes. To these we may add the "penang," or betel-nut tree, of which the natives make large plantations. The island also is richly floored 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.

They catch, birds, reptiles, and insects, are too various for recital. Of these productions of Sumatra, which are regarded as articles of commerce, the most important and abundant is pepper, of which the natives dilligently three species, which are called in different places by different names. Among other commodities of the island, a conspicuous place belongs to the campshire, to which we might add the benjamin or benzoin, the caffia, rattans, and canes, cotton, coffee, turpentine, and gums. As varieties of wood, we may enumerate the chony, pine, sandal; aloes, teak, manchineel, iron-wood, and the banyan-tree. Besides those 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, arfenc, and saltpetre, bees-wax, ivory, and birds'-nests. The general articles of import trade are the following: from the coast of Coromandel, salt; long coats, 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, Bugguefs clouting, a coarse, striped, cotton manufacture, much worn; guns, called rattakers, creees, and other weapons; silken creeve-belts, toodongs or hats, bald of a large grain, and sometimes rice, especially from the island of Bally; from Europe, silver, iron, lead, cuttery, and other hardwares, brafs-wire, and scarlet cloth. Among the manufactures of Sumatra, we may mention the filagre (which fee), the forging, &c. of iron, the carpenter's work, carving in wood and ivory, cane and bafket work, and the manufacture of mats, of felt 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, prevails in the inland country of Menangacbow and its immediate dependencies, and is understood almost in every part of the island. This language has been much and juftly celebrated for the smoothness and sweetness of its sound, infomuch 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 confonants; and these qualities render it peculiarly adapted to poetry, to which the Malays are passionately ad- diction. The characters ufed by the Malays in writing is the Arabic; their books are, for the most part, either transcriptions from the Koran, or legendary tales, of little merit as compositions.
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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 considerble length, or folded together in figures, each figure or fold answering for a page. On common occasions they write on the outer cost of a joint of bamboo, with the point of their crece or other weapon, which serves the purpole of a styalus. 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 perfon. The Malay, it is observed, may be compared to the buffalo and tiger. In his domestick state, he is indolent, stubborn, and voluptuous as the former, and in his adventurous life, he is insidious, blood-thirly, and rapacious as the latter. The original Sumatran is mild, peaceable, and forbearing; but when his repentent is railed, 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 infensible, they are remarkably continent; they are modest, guarded in their expressions, courteous in their behaviour, grave in their deportment, being seldom excited to laughter, and to a great degree patient. On the other hand, they are litigious, insolent, addicted to gaming, dishonest in their dealings with strangers, fupicious, regard- less of truth, mean in their transactions, lewd, cleanly in their perrons but dirty in their apparel, which they never wash: improvident 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 dooffoons, under the government of a magistrate, called "dupatty." His dependents seldom exceed 100. A cer- tain number of the dupatties belonging to each river, are chosen to meet in a legislative or judicial capacity, at the qualloe or river's mouth; and over the whole prevides the "pangeran," or prince of the country. All the govern- ments 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 exacts an undue authority, they conceive them- selves at liberty to relinquish their allegiance. The powers of the pangeran, though he claims despotic sway, are very limited, and he is seldom able to punish a turbulent subject, otherwise than by private affliction. He levies no tax, nor has any revenue. Appeals in all cafes lie to him, and none of the inferior courts are competent to pronounce sentence of death. All punishments and caues are by the laws of the country commutasIe for fines, and appeals being expensive, seldom occur. Although the rank of dupatty is not strictly hereditary, the fon generally suc- ceeds the father at his decease.

The Rejangs are distingushed into tribes, the descendents of a different ancestor. Of these tribes there are four prin- cipal 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. Paffummah, which nearly borders upon Rejang to the S.W., is an extensive and comparatively populous country, bounded on the N.W. by that of Lamattang, and on the S.E. by that of Lampoon, and distingushed into the broad Paffummah, which lies inland, and extends within a day's journey of Palaenbang river; and Paffummah on the W. side of the range of hills, whether the inhabitants are said to have money removed in order to avoid the government of the Dutch. Paffummah is governed by four independent pangerans, who acknowledge a kind of soverignty in the sultan of Palaenbang; and in almost every dooffoon there is an inferior pangeran.

Among the Rejangs, there is not any perfon or chaf of perfons regularly invested with a legislative power. In all their disputes they are governed by traditoary 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, attennbled together, at flated times, for the purpole of distributing jurifcence. They settle litigations with respect to property by a kind of arbi- tration. The Rejang laws have not long ago (in 1779) been collected into a code, and committed to writing. The modes of marriage, according to the original inftitutions of the Sumatrans, are by joojour, ambel-anu, and femudo: the first is a certain sum of money, given by one man to another, as a condiferaion for the perfon of his daughter, whose fituation differs little from that of a slave to the man who marries, and his family. Chalitly is a prevalent virtue in Sumatra. In the country, prostitution for hire is unknown, and is confined to the Malay bazaars at the sea-port. Adultery is punishable by fine, but the crime is rare. In the second mode of marriage, by ambel-anu, the father of a woman makes choice of some young man for her husband, generally from an inferior family, and it is taken into the houfe of his father-in-law, who kills a buffalo on the occasion, and receives 20 dollars from the son's relations. In this cafe, 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 no property. The third mode of marriage, called femudo, has been adopted from the Malays. It is a regular treaty between the parties, on the footing of equality. The nature of marriage consists simply in joining the hands of the parties, and announcing them mero and wife, without much ceremony, except the enter- tainment given on the occasion; and a little apparent court- ship precedes marriage. The customs of the Sumatrans permit their having as many wives by joojour as they can afford to purchase and maintain; but they have seldom more than one. A man married by femudo 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 addict themselves to cock-fighting, and to qual-fighting. Fencing is a common diversion, so is the diversion of toflying a ball. Smoking of opium is a common practice, and the use of it is general and pernicious. (See Amoor.) Betel and tobacco are also much used. The Sumatran females bear children at an early age, wise, before 15, and they are generally paft it at 30, and grey-headed and tithered 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 or 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 scrupulously abhains from pronouncing his own name. He can never change the name given them at their birth. A Sumatran scrupulously abhains from pronouncing his own name. The boys are circumcized, when Mahometanism prevails, between the iriftth and tenth year. At their
The Rejangs are said to be totally without religion, nor can they be denominated Pagans, if that appellation conveys the idea of mistaken worship. They worship neither God, devil, nor idol. Nevertheless, they have some confused notion of superior beings, who may render themselves visible or invisible at pleasure; but they have no name for the Deity. The superition 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 tombs and tombs of their deceased ancestors. The Sumatrans have an imperfect notion of a metempsychosis; and in some parts, chiefly southward, they superstitiously believe that certain trees, particularly those like the banyan, of venerable appearance, are the refidens, or material frame of spirits of the woods, a notion resembling that of the dryads and hamadryades among the ancients. The inland people are said to pay a kind of adoration to the sea, and to make it an offering of cakes and sweetmeats on their first beholding it, deprecat«ing 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 inhabitants of other districts of Sumatra; but where any very remarkable diffimilitude occurs, it will be found noticed in the sequel of this article, or in others to which we refer. For an account of the Lampoon country, see Lampoon; of the Malay government and Menangcabow; see Malacca and Menangcabow. The country of "Batta" may be considered in general as bounded to the N. by that of Achien, and to the S. by Paffaman and the independent district of Rou or Aru; or more precisely, as extending from the great river of Sinkell to that of Tabooyong, on the sea-coast, and inland, as far S. as Ayer Bongey, at the back of which the Rou 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 land, on extensive plains between two ridges 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 follows: viz. Ancola, Padambola, Mandeling, Toba, Selendong, and Sinkell. The inhabitants are subdivided into tribes, of which Ancola has five, Mandeling three, and Toba five; the others are not ascertained. The English settlements in this part of the island are at Natal and Tappanooy. See NATAL and TAPPANOOLY.

The productions of the country are, camphire, gum benjamin, caflia, cotton, and iadjoo. The domestic animals are hores, cows, buffaloes, goats, hogs, and dogs of the cur kind; with the wild ones that are common to all parts of Sumatra.

The Batten are in their persons below the stature of the Malays, and their complexions are fairer. Their dress is commonly of a species of cotton-cloth, which they themselves manufacture; this they adorn with fringes of beads; and the covering of the head is usalby 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 rajahs and persons of superior rank indulge themselves with rice; and on public occasions they kill cattle for food. Their horses they esteem 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 horse-hair. Their towns seldom consist of more than twenty houses; and in each of these is a kind of town-hall, for the transaction of public business, festivals, 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 fencing and dancing; and below it is a kind of orchestra for music. The men are allowed to marry as many wives as they please, each of whom has her separate apartments; the parents of the young 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 plantations, wulish 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 Sumatrans. They are much addicted to gaming, which they pursue to such an excess, that when a person loses more than he can pay, he is confined and sold as a slave. Horse-riding is not a favourite diversion. The Batten have a language and written character peculiar to themselves.

Dr. Leyden (see Asiatic Researches, vol. x.) confiders the Batta language as the most ancient language of Sumatra, and as having considerable claims to originality; though it is not only connected with that of the Malay, but also with the Bugis and Bima languages. In point of construction it is equally simple as the Malay; but its most intimate connection is with the Bugis, which may be reckoned the original language of the island of Celebes; the alphabet consisting of twenty-two letters, varied by the fixed vocalic sounds, a, o, y, e, o, u, ang. 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; the Lampoon or Lampon, by mixing Malay and Batta with a proportion of the Javanese. The Karrows, who are subject to Achin or Achin, use only a slight variation of the Batta language, while the language of Achin proper consists of a mixture of Malay and Batta, with all the jargons used by the Moors of the East. The Achinefe resemble the Mapillas of Malabar more than any other tribe of Malay; having been long connected with them as a people, and using many Mapilla terms currently in their language. The dialects of Neas and the Poggy islands have perhaps greater pretensions to originality than any of the dialects of Sumatra, but resemble the Batta more than any other dialect. The Batta language has been cultivated by writing from the earliest times, and numerous books are said to exist in it. The Batta alphabet is peculiar, both in the form of its characters, and in the order of their arrangement. It consists of nineteen letters, each of which is variable by six vocalic sounds, like the Bugis. The Batta character 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 Chinefe, from the bottom to the top of the line, as the Mexicans are said to have arranged their hieroglyphics. The material for writing the Batta, or the branch of a tree, and the instrument with which they axe written is the point of a kine or creefe. The Battas sometimes read their bamboo horizontally instead of perpendicularly, as the Chinefe and Javanese do their books, but the Chinefe consider the correct mode of reading to be from the top to the bottom.
bottom of the page, and the Battas from the bottom to the top. The Battas characters, when arranged in their proper position, have a considerable analogy to the Bugis and Tagalas. The Lampung and Rejang characters coincide in power with those of the Battas, though the arrangement is different.

In their dealings with each other, the Battas are strictly honest, but plundering from strangers is not considered as a crime. Audacity in the men is punished with death; but the women have their heads shaved, and are sold for slaves. The Battas are anthropophagi; the objects of their barbarous practice being, according to Mr. Marsden, prisoners taken in war, and offenders convicted and condemned for capital crimes.

Dr. Leyden, (ubi supra) says, that the Battas themselves declare, that they frequently eat their own relations, when aged and infirm, considering the practice as a pious ceremony. Thus, when a man becomes infirm and weary of the world, he is told to invite his own children to eat him, in the faction when salt and limes are the cheapest. He then sets a tree, round which his friends and offspring assemble, and as they shake the tree, join in a funeral dirge, the import of which the faction is composed in the following lines, and it must dsequently. 'The victim defends, and those that are nearest and dearest to him, deprive him of life, and devour his remains in a solemn banquet. This inhuman custom, incredible as the account of it may seem, is not without a precedent in history, for Herodotus positively affirms that the Phady, or Phadani, about five hundred years before our era, were not only addicted to the eating of raw flesh, but accustomed to kill and eat their relations when they grew old.

(Herodotus, lib. iii. c. 99.) Leyden observes, that Battas or Battys seem to be the very word which, in Greek, is rendered Padaioi, the letter B being always pronounced, B among several of the Indo-Chinese nations, as in Pah, almost always pronounced B. Hence it is not improbable that Herodotus refers to the ancient Battas.

The government of the country is divided into a number of chiefships, the heads of which, called rajahs, are elected by the inhabitants 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 fines adjudged in judicial proceedings; their litigations as suits are kept by a magistrate, appointed for that purpose, and from him there is no appeal to the rajah. Notwithstanding the independent form of the Battas, they pay great respect to the sultan of Melangabow. With regard to war, they are in a state of perpetual hostility, and they are always prepared for attack and defence. Their campaigns or 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 paille de campfire timber, and beyond this a hedge of prickly broom. At each corner of the fortitres, instead of a tower or watch-tower, they contrive to have a tall tree, which they ascend to reconnoitre, and from which they fire. The battle dress is a horse's head, from which hangs a long mantle or tail of hair. Their arms are matchlock guns, barbot--guns, and a side-weapon, like a fowards or large knife. They very no crease, like the Malays. They have machines, commonly carried, for holding their bullets, and others for a piece of gunpowder, which they manufacture for themselves. In trade, the natives of the sea-coast exchange the iron and camphire for iron, steel, brass, wire, and salt. Theirs they barter again with the more inland inhabitants, for the products and manufactures of the country, particularly their cotton-cloths. Having no coin, all value is estimated among them by certain commodities. Their religion, like that of all the other original inhabitants of the island, is not easily traced, and it is difficult to determine whether they have any; but they have somewhat more of ceremony than the people of Rejang or Pallimniah; and they have among them an order of priests, who bury their dead, and foretell lucky or unfortunate days, with regard to which they are very superstitious. They have some idea of a powerful Being, benevolently disposed, and of another, the author of ill to mankind; but they pay no worship to either, nor do they appear to entertain any notion of a future state.

For an account of "Acheen" we refer to that article; and for further particulars with regard to the island of Sumatra, to "Marsden's History of Sumatra."

SUMBAWA, SUMBAWA, or Sumbawa, one of the Celebesian islands, opposite to Bonton (which face), consists of several petty states, viz. Bima, Dompoo, 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 cell end of Sumbawa, about 45 leagues S. of the S.W. point of Celbes; it is a free state, under whole jurisdiction are comprehended the faids of Sappy, the whole of Mangery at the W. point of the island of Ende, childbedly denominated Flores by the early Portuguese navigators, and also by succeeding voyagers and geographers, and the island Goenong-api, which 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 of Ende. 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 Sumbawa, which prevails in the districts of the island of that name, which are not subject to the sultan of Bima, is of a more mixed character; and though it appears to contain many original vocabularies, yet the mass of the language seems derived from other sources, as Bima, Javanese, and Bugis. Neither the Bima nor Sumbawa have any peculiar character, but use, indifferently, the Bugis or Malay. Dr. Leyden (Af. Ref. vol. x.) has investigated the relations of both these languages.

SUMDI, a province of Africa, in the kingdom of BenGuila, near the coast.

SUMBOE, a town on the S. coast of Suderoe, one of the former islands.

SUMBUL, a district of Hindooftan, in Oude, lying between the Ganges and the Ramgonga, about 80 miles long and 30 broad. The chief towns are Sumbul and Nijibhabad.---Also, a town and capital of this district, 45 miles W.N.W. of Bercilly. N. lat. 28° 30'. E. long. 78° 55'.

SUMBULPOUR, a district of Hindooftan, in Orissa, lying on each side of the Mahanady, S.E. of Ruttumpour.

SUMBULPOUR, or Semilpoor, capital of the above-mentioned district; 142 geographical miles from Cattack. N. lat. 21° 34' 32'. E. long. 83° 49' 53'. In the vicinity of Sumbulpour there is a diamond mine. On the west of Bocai, a fort near the Mahanady, is a town called Baturag, having a diamond-mine in its neighbourhood.

SUMDEAH, a town of Bengal; 10 miles S.E. of Dinagpur.

SUMEER, a town of Hindooftan, in Guzerat; 40 miles E.S.E. of Chittapur.

SUMEH, a town of Afghan Turkey, in Natolia; 14 miles E. of Pergarao.

SUMELIBENI, a town of Egypt, on the left bank of the Nile; 27 miles S. of Cairo.

3 U SUMEN,
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 Rullah, 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 capitalia of Matto Groce, which runs for some distance underground, and thence derives its name. It empties itself on the S. side into the Arios; and as its source is at a short distance from that of the Sypotabue, a large western branch of the Paraguay, there is an easy communication from the one to the other.

SUMISSOR, a town of Napaúl; 70 miles from Macampon.

SUMISWALD, a town of Switzerland, in the canton of Berne; 12 miles W. of Berne.

SUMITRA, in Hindu Mythology, was the mother of Lakhimian, half-brother to the heroic Ramachandra; Daratha being the mortal father of both. Both, however, are flated to be in fact of divine origin, Rama being an incarnation of Vishnu, and Lakhimian of Setha, the mighty many-headed serpent, on which Vishnu reposest, in his parable called Vaikontka.

SUMMAH, in Geography, a town of Algiers; 12 miles S.S.E. of Constantina.

SUMMARO, a small island in the Baltic, S.E. of Aland. N. lat. 59° 59'. 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.

SUMMATRIOUS CALCULUS, the method of summing differential quantities; that is, from any differential given, to find the quantity, from whole differing the given differential results.

This method we more usually call the inverse method of fluxions; and forgers, integralis calculus. See Calculus and Fluxions.

SUMMEI-KIEOUTH, in Geography, a town of the Birman empire, on the Irawaddy, in which is a manufacture of salt petre and of gunpowder; 60 miles S.S.W. of Ava.

SUMMEMTHOH, a town of Birmah, on the Irawaddy; 6 miles N. of Dencébow.

SUMMER, a small river of Brabant, which runs into the Decher near Halleft.

SUMMER, one of the seasons of the year, commencing in the northern regions, on the day the sun enters Cancer, and ending when he quits Virgo.

Or, more briefly 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 the year.

It is said, that a frothy 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-Cold, 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-cold rides.

**SUMMER-Cypress, in Botany.** See Chionesodium.

**SUMMER-Fatt, in Agriculture**, a provincial word signifying to make use of as a pasture that is fallow, or to fummer-feed.

**SUMMER Eve-Milking, for Chefs, 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 cheesce thus produced. The fummer eve-milking for this use, formerly commenced, it 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, in order that the more sheep might be gained: 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 infrequently needs additional female-servants for performing the businesse of ewe-milking. This form of milking is a severe service; as fix or seven scores of ewes are often allotted to each milkers: 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 in is a fort of inclosure of the fold-dike kind, with whins inserted below the coping-folds, in order to prevent the ewes from breaking or leaping over it. At one side of the dike, a pen or bought is formed by means of fold-dike or paling of wood, including an oblong square, open at one end, and of a breadth to admit all the milkers to flande by side. Into this bought or pen, as many ewes as it can contain are driven at a time; when the milkers entering prevent them from getting out, and immediately proceed to businesse. Each milkers seizes the ewe that is nearest to her by the haunches, drawing it backwards until it flamps its hinder legs straddling across the milking-pail; the milkers then, with both her hands, seizes the teats, and milks, by squeezing them betwixt the first joint of the thumb bent in, and the middle of the fore-finger; when milked, the ewe is turned out behind her, the shepherd taking care that the milked ewes do not mix with the unmilked ones, on their coming from the pen. It is said, that from the position of the ewes in milking, whatever drops from them may, without much care, fall into the milking-pail; and that the solid refuse is separated by draining and deposition, but no chemical process is in use for separating any diluted matters that may be present. Probably the peculiar pungency of this form of cheese may be partly owing to such matters. It is noticed, that before the ewes are florn, the cheese is peculiarly dark in colour, and has a particularly high taine, or haute gour, as the French term it, in consequence of the sweat or other matters from the wood, which is provincially called cèk, mixing with the milk; this is called cheese made under the wood.

It is observed in respect to sheep's-milk cheese, that in regard to it, as well as to other kinds of viands, it conduces little to the appetite of the consumer to pry into the secrets of the kitchen. The manner of making it is, however, nearly the same as in other kinds of cheese. See Cheese.

**This sort of cheese is, however, in great request, and of high...**
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 mercerdl of their cheese.

The cheese, when become old, is, it is said, accounted one of the best medicines that can be used as food. It is paid off late to have fetched an enormous price, which is recalling the practice of ewe-milking and making of cheese and butter.

The wages of ewe-milking usually amount, it is said, to above half-a-crown a week, with board; such milk being allowed, besides, a piece of coarse cloth, which is called an "ewe-milkers' brae," 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 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 decomposing 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 foliage as it is in a foil 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 prococes, which are purely of a natural nature. It is thought that the benefits arising from fallows, or fallowing, have been much overlooked; that a summer-fallow, fallowing, or a clean fallow, may sometimes be necessary on lands overrun with weeds, especially if they be lands which cannot be ploughed and burned 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; none of them unite with azote; and such of them as are capable of attracting carbonic acid, are always saturated with it in these soils on which the practice of summer-fallowing is adopted.

The vague ancient opinion of the use of nitre, and of nitrous falls in vegetation, seems, it is said, to have been one of the principal speculative reasons for the defence of summer-fallow, or fallowing. Nitrous falls 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 diffipated in the atmosphere.

The action of the sun, too, upon the surface of the soil or land, tends, it is said, to disengage 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 pre-colored capable of absorbing or drinking it up, by which much waste 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 summer'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 fruit and ice, the gradual dissolusion 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 waste 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, in the practice of florists, is that which consists in the proper cleaning, watering, directing their growth, and exhibiting them when necessary. See Summer Stage.**

**Summer Solstice.** See Solstice.

**Summer Stage for Flowers, in Gardening, that which is contrived for the purpose of exhibiting different sorts of flowers at this season. These stages, for the curricula 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 so formed as to have a port of shutters for shutting 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 draining canvas, sheets, or mats over, for defending and protecting the flowers from cold winds, night-frosts, and too great sunny heat, 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 nine
and a half feet, or rather higher, if thought proper. It
should be close, rather thick, and durable, in order to pre-
vent the fun from penetrating too much through it, which would draw up the flower-plants of the plants too
much, and render them weak, as well as injurious to the
wood. The lowest shelf, in such flanges, 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 flanges 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 flage, when completely full, holds from about
eighty to ninety such pots of flowers, which are mostly suf-
cient. Such flower-flages 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
inkles, as well as the outsides of such fummer flages, 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 belt contrast,
are probably the most proper, by rendering their appearance
the most lively and beautiful.

The proper aspects for such flages, are such as best suit
the particular forts of flowers. For the auricula, they
may often front a full northern exposure with advantage.
See Auricula.

Summer-Stir, and Summer-Working, in Agriculture, terms
applied to summer-following.

Summer Tree. See TaRe.

Summer Teal, in Ornithology, the name of a bird, the
smallest of all the duck-kind, called by Genfer the anas
circus. See Cracca under Duck, and Teal.

Summer Wheat, in Agriculture, the triticum aestivum
of botanical writers. See Spring Wheat.

Summer, formed from the French hoummier, which fig-
nifies the same thing, in Architecture, is a large flone, the
first that is laid over columns and plasers, beginning to
make a cross vault; or it is a flone, which, being laid over
a pedrast, or column, is hollowed to receive the first
bauce of a plainband.

Summer, in Carpenter, is a large piece of timber, which,
being supported on two flone piers, or pelfs, serves as a
lintel to a door, window, &c.

There are also summers used in various engines, &c.
for to sustain the weight, &c.

Summer-Tree, denotes a beam into which the ends
of joists are fattenfed, 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.

SUMMELY, in Agriculture, a term provincially signify-
ing a turnup follow, autumn or naked follow.

Summit, formed from the French sommit, which fig-
nifies the same, in the vertex or point of any body or figure;
as of a triangle, a pyramid, a pediment, &c.

Summit Level, the highest point of a canal.

Summits of Flowers, the fame with the antehy, or
tops of the flamos. See Flower.

Sumoner. Sumoniter, an apparritor, 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 Apparitor, and Summons.

Summons, Sumonitio, in Law, a citing or calling
a perfon to any court, to answer a complaint, or even to
give in his evidence.

This is the fame with the vocatio in jus, or the citatio,
of the civilians; hence also our old word fummer, or summoner.

Summons in terris jacta, is that made on the land which
the party, at whose ftate the summons is fent out, fcorkts to
have. This warning on the land is given, in real actions,
by erecting a white flick, or wand, on the defendant's
grounds (which flick, or wand, among the northern nations,
is called the baculus nucautorius); and by flat. 31 Eliz.
c. 3, it must also be proclaimed on fome Sunday before the
door of the parish-church.

Summons ad Warrantiaundum is a process, by which
the vouchee in a common recovery is called.

Summons to Parliament. See Parliaiment.

Summons, in War. To summons a place, is to fend a
frum, or trompet, to command the governor to furrender;
or, in cafe of refufal, to proteft to make an affault, and
to lay all in fire and blood. See Capitulation, and
Chimade.

Summulgur, in Geography, a town of Bengal; 28
miles E.N.E. of Burdwan. N. lat. 23° 21'. E. long. 88° 26'.

Summun Bosum, in Ethics. See Chief Good.

Summun Genus. See Genus.

Summunaut, in Geography. See Uttan-Summun.

Sumner, a town of America, in the dijit of Maine,
and county of Oxford, containing 641 inhabitants.

Sumner, a county of Wel Temelles, bounded N. by
Kentucky, E. and S. by the Indian lands, and W. by
Dawson county, watered by Cumberland river, and very
fertile. It contains 31,792 inhabitants, of whom 3734
are flaves. This county has a Presbyterian, Baptift, and
two Methodist churches.

Sumnum, a rich district of Perfa, in the province of
Khorafan, bounded on the N. by mount Elburz, and S.
by the Great Salt Defart. It contains 50 villages; and
Summer, the capital, is a small town, 28 furfings from
Tebran. "Dangun," 12 furfings from Surnum, is suppoited to be the ancient Hecatompylos, for fome time
the metropolis of the Paffian empire. This is the chief
town of a district of the fame name. It is a fparce
plain, famous for a victory gained by Nadir Shah over the
Afghan. The town of " Bilgan," called also Sharoot,
yields, with its dependancies, a revenue of 1660 tomans.

Sumokgur, a port of Bengal; 11 miles N. of
Callcutta.

Sumoom, Hade, in Meteorology, a pelletind wind of
Perfa. See Great Sandy Defart.

Sumorokof, Alexander, in Biography, the founder
of the Kuffian theatre, was the fon of Peter Sumorokof, a
Ruffian nobleman, and born at Moscow in the year 1727.
From his father's houfe, where he acquired the elements
of literature, he was removed to the feminary of cadets at
Peterburgh, where he difplayed a peculiar genius for
poetry, as well as great zeal in the prosecution 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 emprince Elizabelh, and taken under her fpecial
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 fielf tragedy, intitled " Korem.'
This was exhibited at the court-theatre, and the applauze
it gained induced the writer to proceed in the fame career,
till he had produced nine tragedies, feveral comedies, and
fome operas. In his tragedies, Racine was his model; and
though
though he fell short of the perfection of his exemplar, he was in many influences a successful imitator of his excellencies. His comedies pleased 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-lyrics, idyls, fables, fatures, anacreontics, elegies, versions of the Psalms, and Pindaric odes. In the latter species of composition he was far inferior to his contemporary Lomonosof, being deficient in that elevation and fire which characterize those of the latter: but the tenderne:s 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 perplicity of style, though they abound too much in ornament. Sumorokoff entered the favour of his female sovereigns. Elizabeth raised him to the rank of brigadier, appointed him director of the Russian theatre, and setted upon him a pension of 400£. per annum. Catherine II. created him a musettor of state, honoured him with the order of St. Anne, and disinguished him by her munificence. He died at Moscow in October, 1777, in the 57th year of his age. "In his private character," says one of his biographers, "he exhibited the virtues and the faults of exquisite lenity; equally alive to benefits and injuries; open and unassuming; polite when treated with respect, but opping prose by haughtine:s; irascible and inconfiderate." With Lomonosof he contributed to diffuse a taste for poetry and elegant literature among his countrymen, and they have produced a numerous c:las of followers. C:cox's Travels in Russia.

SUM, in Metallurgy, a round pit of stone, lined with clay without, for receiving the metal on its first fusion from the ore.

SUM, in the English Salt-Works, where sea-water is boiled into salt, is used as the name of a fort of pond, which they make at some distance from the saltern on the seashore, between full sea and low water-mark. From this pond they lay a pipe, through which, when the sea is in, the water runs into a well adjoining to the saltern; and from this well they pump it into troughs, through which it is carried to their cullens, in order to be ready to supply the pans. See SALT.

SUMPH, in Mining, denotes a pit funk down in the bottom of the mine, to cut or prove the ledge still deeper than before, and in order to slope and dig it away if necessary, and also to drive on the ledge in depth. The fump principally serves as a bason or reser:voir, to collect the water of a mine together, that it may be cleansed out by an engine or machinery.

SUMPTER, or SUMTER, in Geography, a district of South Carolina, containing 19,054 inhabitants, of whom 11,638 are slaves.

SUMPTER-HARJE, is a borough that carries provisions and necessaries for a journey. Ruit.

SUMPTERSVILLE, in Geography, a town of South Carolina, in Clernont county; 319 miles from Washington.

SUMPTUARY LAWS, Legal Sumptuary Laws, are laws made to refrain excess in apparel, costly furniture, eating, &c.

Most ages and nations have had their sumptuary laws; and some retain them till. But it is observed, that no laws are modern sumptuary laws.

Political writers have been much divided in opinion with respect to the utility of these laws to a state. Baron Montelgue 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 still 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 it has for relative sumptuary laws. The richer a state is, the more it derives 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 so numerous, and the means of subsisting 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 relation there is between the number of people and the facility they have of procuring subsistence. In England the soil produces more grain than is necessary for the maintenance of those who cultivate the land, and of those who are employed in the woolen manufactures. This country may therefore allow 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 Lorican legislator Zaleucus, are famous: by these it was ordained, that no woman should go attended with more than one maid in the street, except she were drunk: that she should not go out of the city in the night, unless she went to commit formation; that she should not wear any gold or embroidered apparel, unless she proposed to be a common prostitute: and that men should not wear rings, or tisious, except when they went a wharing, &c.

The English have had their share of sumptuary laws, chiefly made in the reigns of Edw. III. Edw. IV. and Hen. VIII. against picked fishes, short doublets, and long coats; though all repealed by statute 1 Jac. I. c. 25. As to excess in diet, there remains still one law unrepealed. See DIER.

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 toe. 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 private members and buttocks.

Among the Romans, the sumptuary and cibar laws were very numerous: by the lex Orcoma, the number of guests at feasts was limited, though without limitation of the charges of them. By the Faunian law, made twenty-two years afterwards,
wards, it was enacted, that more than ten siles should not be spent at any ordinary feast: for the solemn feasts, as the Saturnalia, &c. an hundred siles 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 sumptuous laws should be of force, not only in Rome, but throughout all Italy; and that, for every transgression, not only the matter of the feast, but all the guests too, should be liable to the penalty.

SUMRAH, in Geography, a town of Syria, in the pachalie of Tripoli, anciently called Simyla, or Taxmra; 18 miles N. of Tripoli.

SUMSERAH, a town of Bengal; 53 miles S. of Dofa.

SUMSERNAUR, a town of Hindooftan, in Bahar; 52 miles S.W. of Patna.

SUMSKO, a town of Ruffia, in the government of Olonetz; 16 miles S. of Kemi.

SUMULPOUR, a town of Hindooftan, in Orissa; 18 miles W.S.W. of Cattack.

SUN, Soz, in Astronomy, the great luminary which enlightens the world, and by his presence constutes day. For his real apparent diameter, density, and distance, see these 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 fun, would fee 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 fee the sun as small as we fee a star, divided of all its circlingvolums; 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, pooffs gravitation, and the other general properties of matter: they are supposed, like the fun, to emit heat as well as light; and it has been conjectured with great re xen, 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 supposfed to be placed in the lower focus of all the planetary orbits. Strictly speaking, however, if we confider 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 foci of the orbits of all the planets, except those of Saturn and the Georgium Sidus, will not be feplibly removed from the centre of the sun; nor will the focsi of these orbs 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 fun, though thus eafed 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 fun, 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° 12' 20"; which is hence deduced to be the period of the fun's rotation round his axis; and, therefore, the periodical time of the fun's revolution to a fixed star is 28° 15' 16"; because in 27° 12' 20" of the month of May, when the observations on which this calculation is founded were made, the earth decribes, according to the elder Cafini, an angle about the fun's centre of 26° 29'; and, therefore, as the angular motion of 363° + 26° 29' is to 360°, so is 27° 12' 20" to 25° 15' 16''. Others fix the period of the fun's rotation on his axis, with respect to the fixed stars, at 25° 10'; and they obverse, 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 solar spots, their caufe, &c. see Macule 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 conftruction of the fun and the spots observed on his surface; we shall here prezent 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, promenors, facula, and luculi, because they are figural expreptions which may lead to error. Instead of these, he adopts the expreptions of openings, shillows, ridges, nodules, corrugations, indentations, and pores.

Openings, he says, are those places where, by the accidental removal of the luminous clouds of the fun, its own solid body may be seen; and this not being lucid, the openings through which we fee it may, by a common telescope, be mistaken for mere black spots, or their nuclei.

Shillows are extensive and level depreflions of the luminous folar clouds, generally surrounding the openings to a considerable distance. As they are less luminous than the rest of the fun, they seem to have some diñtance, though very imperfect, resemblance to penumbrae; which might occasion their having been called 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, on account of their being brighter than the general surface of the fun, and also differing a little from it in colour, have been called facela, and luculi.

Corrugations, he calls that very particular and remarkable unevennesses, ruggedness, or asperity, which is peculiar to the luminous folar 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 dish of the fun 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 folar clouds.

Pores
Pores are very small holes or openings, about the middle of the indentations.

That the appearances, which have been called spots in the sun, are real openings in the luminous cloud or the solar atmosphere, he evinces by a number of observations. His next series of observations is adduced to prove, that the appearances which have been called penumbrae, are real depressions, or shallow s. These are followed by others, alluded to above, that ridges are elevations above the general surface of the luminous clouds of the sun; that nodules are small, but highly elevated, luminous places; that corrugations consist of elevations and depressions; that the dark places of corrugations are indentations; and that the low 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, shallows, 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 still more ready to fill up the low places, and to 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 stratification of clouds; the under stratum, or that which is next to the sun, confining 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 ours, subject to considerable agitations. These agitations indicate, that there is some clear atmospheric space, between the solid body of the sun and the lowest region of the clouds. It also appears, that the gaseous 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 shallows which they surround and illuminate. In order to explain the generation of shallows, it is presumed, that the 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, retire there, and occasion decompositions which produce the appearance of corrugations, the elevated parts of which are small self-luminous nodules, or broken ridges.

Between the interstices 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 motled 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 produces great openings; then, spreading itself above them, it will occasion large shallows, and, mixing afterwards gradually with other superior gasses, it will promote the increase, and still in 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 quantity of light and heat emitted from the sun at different times.

From other observations, which we cannot detail without far exceeding our preferred limits, Dr. Herchel 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 shallows, which our author considers as parts of an inferior stratum consisting of opaque clouds, are, as he thinks, capable of protecting the intermediate surface of the sun from the excessive heat produced by combination in the superior stratum, and perhaps of rendering it habitable to animated beings. But if stars are suns, and funs are habitable, a very extensive field of examination is thus opened to our view. Dr. Herchel'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 combination 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 retire upon it, their own weight would present an insurmountable 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 obliquely, must appear considerably the brighter; 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 Zodiakal Light.

Those who have maintained that the substance of the sun is fire, argue in the following manner: the fun shines, and his rays, collected by concave mirrors, or convex lenses, 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
SUN.

ing lens, or mirror, as if we were at such distance from the sun, where they were equally dense. The sun's rays, therefore, in the neighbourhood of the sun, produce the same effects, as might be expected from the most vehement fire: consequently, the sun is of a fiery sublimity.

Hence it follows, that its surface is everywhere fluid, that being the condition of flame.

Indeed, whether the whole body of the sun 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, consuming, melting, calcining, and vitrifying; they do not see what should hinder, but that the sun may be a globe of fire, like our's, invested with flame; and supposing that the macule are formed out of the solar exhalations, they infer that the sun 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 sun, with which, whether we consider them as substances or qualities, they are intimately connected, and on which they feel 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 densities. These particles, they say, act upon the minute constituent parts of bodies, not by impact, but at some indeterminate 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, attribute fire to a substance not visible, intangible 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.

The matter of this fire is not supposed to be derived from the sun 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 rate of uniform diffusion. According to this explanation, which attributes heat to the matter of fire, when driven in parallel directions, a much greater must be given it, when the quantity so collected is amassed into a focus; and yet the focus of the largest speculum does not heat the air or medium in which it is found, but only bodies of densities different from that medium.

M. De Luc, in his Lettres Physiques, is of opinion, that the solar rays are the principal cause 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 sun. He does not admit the emanation of any luminous corpuscles from the sun, or rather self-luminous substances, but supposes all space to be filled with an ether of great elasticity and small density, and that light conflicts in the vibrations of this ether, as found conflicts in the vibrations of the air. Upon Newton's supposition, says an excellent writer, the causes by which particles of light, and the corpuscles constituting other bodies, are mutually attracted and repelled, is uncertain. The reason of the uniform diffusion 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 sun vibrate. Of these several opinions concerning elementary fire, it may be said, as Cicer. remarked concerning the opinions of philosophers concerning the nature of the soul: "Harem tentantur qua vera sit, Deus aliquis videtur; quod verifimilis est magna quaedam cit." Wat. Phys. Edin. vol. i. p. 164.

For a farther account of these opinions, see Fire, Heat, and Light. Dr. Herschel's opinion has been stated at large in this article, and also under Macule, &c.

The figure of the sun is a spheroid, higher under its equator than about the poles. This we prove thus: the sun 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 ret, 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 sun; it will really recede from the centre more under the equator than under any of the parallels; and hence the sun's diameter, drawn through the equator, will be greater than that passing through the poles, i.e. the sun's figure is not perfectly spheroidal, but spheroidal.

Besides the sun'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 system, which accompanies the motion with the orbit of the moon: a body revolving round the sun, 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 system must therefore be, where it is most remote, at four times the distance of the moon from the earth.

The sun, 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 all question 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 sun may have such a motion. But Dr. Herschel 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 Arcturus and Sirius, which are probably the nearest to us, have, as they ought to have, the greatest apparent motions. Besides, the star
Cælor appears, when viewed with a telescope, to consist of two flars, of nearly equal magnitude; and though they have both a considerable apparent motion, they have never been found to change their distance a single second; a circumstance which is easily understood, if both their apparent motions are supposed to arise from 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: Denfity, Diameter, Diflance, Magnitude, and Parallel 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.

Sun's Altitude, Tables of the. See Dihel.

Sun: Angle at the. See Angle.

Sun: Diurnal and Natural Arc of the. See Arc.

Sun: Cycle of the. See Cycle.

Sun: Declination of the. See Declination.

Sun: Eclipses of the. See Eclipse.

Sun: Nadir, Place, Retrogradation, and Vertical of the.

See the several articles.

Sun: Raisins of the. See Raisin.

Sun-Burning, in Medicine. See Ethelis.

Sun-Dew. See Droscura.

Ros folis is recommended by some as a great cordial, and good for consumptions, convulsions, and the plague. Formerly a cordial water, in which this herb, with several spices, as a principal ingredient, was in great repute, under the name of repugn, though now almost out of date. Miller's Bot. Off.

Sun-Fish, Mola, the Tetraodon mola of Linneus, and a species of gtfacion in the Arcted fynim, 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 conferred 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, hard, and rough skin. Its back is black, and its belly white; the fUSES 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 belet 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 gritty and tender. The skin flicks very firmly to the flesh, and is not easily taken off. It is caught in the Mediterranean, and sometimes in the British seas. Willughby's Hist. Pisc. p. 151.

Mr. Pennant describes the sun-fish of Mount's Bay, under the title of the oblong diebon. In form, he says, it resembles a bream, or some deep 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 filament 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 these two fins; the colour of the back is dusky and dappled; the belly silvery; between the eyes and the pectoral fins are streaks pointing downwards; the skin is free from scales; the meat of the fish is uncommonly rank; it feeds on shell-fish. Carr, 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 tetraodon mola of Linneus, which he calls the flaut diebon, differs from the other 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 fish, of five hundred weight, was taken in 1734, near Plymouth; and on boiling a piece of the flesh, to try how it would taste, (as some authors have described it as a fine fish for the table,) it was found, instead of a firm mafs, 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 confluence this jelly resembled boiled tripe when cold, and had little or nothing of a filthy flavour, but a very agreeable taste; it stuck firmly to the lips, however, and to the fingers, appearing very remarkably glutinous; and as the ancients had no other glue than one made of fish, this jelly was tried, as to its sticking quality, on leather, and on paper, and was found to answer as well as common paste; 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 ichtyocolla may not be prepared by boiling down its jelly. Philol. Trans. No 456. p. 343. Abr. vol. ix. p. 73. &c.

Sun-Fish is also a name sometimes given to the basking 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 suppos'd 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 seen wild, though of small growth, in the southern districts of Africa; to be not unknown in China; and to be extremely common in the East Indies, where it is designated the fooroje moo-ky, or sun-flower.

Soil and Situation.—The plant, which is of a hardy nature, thrives well, and, raised by feed, 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 constantly be open, and exposed as much as possible to the warmth of the sun; as the crops in lux not only ripen and fill the feed better, but the plants are of a considerably larger growth than in those which are close and confined. In preparing the ground for this fornt of crop, it should not be rendered light by too much ploughing, but be in a rather firm rate of mould in the more superficial parts; being always, however, as clean and free from all other kinds of weeds as possible. Where manure can be spared, it may be ploughed in, in preparing the land, as near to the time of sowing the feed as may be convenient.

In choosing feed for this crop, as in most other crops, the hardiest, finest, fullest, and plumpest, and that which has been the belt ripened, should always be preferred as much as possible; as it is from these that the belt and most perfect crops are raised. The feed for this purpose, too, should constantly be kept and preferred in a dry, airy situation or place, so as not to have had any tendency to throw

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out spies 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 feeds that may be present.

Three or four quarts of feed, 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 feeding the plants, the feed and those which are in the mold open exposures should be chozen for the purpose, letting them remain until they are perfectly well ripened, and chiefly making use of the large principal heads only; the feeds, when threfhed out, being safely kept out of the way of moisture.

The time of fowing the feed muft, 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 fowing. It is probable that, in many cases, it might be most conveniently fown in flight drills, made at the distance of about a foot, or eighteen inches, according to the nature or quality of the foil, by an implement confructed for the purpose, fo as to form the drills, and drop two or three feeds only, at each dibbled space, into them, covering them by a following chain or light roller, as practiced for turnip feed. Or they might be fet by the dibble, as practiced for wheat, at such distances apart; or in the quincunx order, as form have proposed, which, it is said, augments the distances of the plants nearly a foot, but is not so convenient in cleaning the crops. But others think, that the feed should be dibbled in after the manner of beans, the ground being previously levied by means of a light barley-roller, and one, or perhaps two, feeds being then dropped into each hole; then the roller should be again passed over the ground, in order to clofe the holes in upon the feed, and prevent its being disturbed by the harrow, which should afterwards follow and conclude the bufinefs.

Any mode which is capable of affording the means of placing the feed at an equal and proper regular depth and distance, and of covering it well from being destroyed in any way, as enforing a more regular, perfect, and certain growth in the plants, and promoting their more equal fizing, would be of advantage, as the plants which would thereby be made to ripen more uniformly together, be fooner dry in the fneaf or bundle, and the work of threfhing 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 purpofes of plants of this fort, which, though they do not transplant or re-move well without balls of earth about their roots, may still be raifed from feed in small beds only, or be threfhed out from the general crops, in that way, for fupplying and filling up any breaks or defects that may ariw or take place from the failure of feed, or on other caufes. This fort of work muft, however, in all caues, be carefully done; and a little water be given at the fame time, and for fome days afterwards, if the weather be not moif.

The plants being fupposed to ariw, 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 fort, the land between the plants is, from the firt, to be kept quite clear from all forts of weeds, but especially while they are in their infant state of growth. And as soon as they are rifen sufficiently above the surface of the land, the supernumerary plants should all be well threfhed out by the hooe, where they are not wanted for filling up any vacancies that may have occurred in the crops; but where this is the caufe, it should be done by a small fpad, or garden-trowel with a long handle, fo as to preserve the mould about their roots as much as poifible, as they do not transplant well without this. In all caues where there are proper distances or spaces preferred between the rows, the work of after-culture may be re-ally accomplished by means of a single horfe-hoe plough, contrived for the purpose, fo as to cut up the weeds, flir the mould well, and lay it up a little to the roots of the plants. The parts between the plants in the rows, where neceffary, 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 off early, with great advantage to the crops in their growth, and the production of feed.

As to the best mode of harvefling crops of this fort, some have thought that pulling up the flalks 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 fattering of the feed, especially where they are not grown upon a very fliff bound foyl. The roots are to be well cleared from all dirt, before threfhing the feed out, for the fake of the fample. As the feeds readily quit the heads when perfectly dry, they can be easily threfhed out.

After being pulled or cut, they may probably remain out until quite dry, as rains have been seen to be imcapable 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 fizes; 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 flacked up somewhat in the manner of other grain, or, in caues where they are only of small extent, be headed and collected gradually, from time to time, as the flowers or heads become ripe, into a fack, proper balfeft, or other contrivance; depositing the heads, where neceffary, upon a fort of hurdles or racks, ar ranged in tiers one above another for the purpose, and placing them under a full, open, airy flhed-building; or, in foul weather, they may be flacked on green roofs, or farther sheltered, by means of holes made through the middle of each head; being thus fuspended in the open air and fun, fo as to have the full drying influence of the atmosphere.

When well cured and sufficiently dry, the feed may be threfhed out, and put by for future ufe; being preferred, in a fimilar manner to corn, either in granaries, or other convenient dry places. Where the heads are cut into facks, they may be fafely houfed with little or no fofs of feed. Crops of this kind may fland out in the field, in cafe of neceffity, until late in the autumn, without much danger.

The gradual taking off the heads, too, as they become ripe, where that method is pracftied, 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 fofs may fometimes be futfained. Crops of this kind are not much expoed to defeases, fimilar to bight, mildew, or others of a fimilar fort; but are, for the moft part, in a blooming healthy state. And though fome infects may fix and felter themfelves on the flowers or heads, they cannot, from the close compact fate of the feeds in them, lodge in their intericles; consequently the tom-efits, which are per-
hops the greatest enemies of these crops, may not only feed the
seeds as their food; but at the same time plunder the
feed 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 pollefs
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 inides of the
seeds from the outer coats of them, in somewhat the same
manner as squirrels do nuts, confusing the inner parts, and
rejecting the hulls: they should, therefore, be well secured
from them.

The expence of these crops cannot be very great, either
in the preparation and culture of the land, or in the managemen
and securring of the produce afterwards. As to the
produce of this sort of crop, it must be very different, ac-
tording to the season, 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 circum-
stances of less importance. But when grown with care, in
a suitable open manner, and in good feafons, the produce
will mostlikely be very abundant. Some have flated 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
feed; 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 fas-
tening many sorts 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 purpo tents; for the purpose of fuel in the
roots, naked items, and some other parts; and probably
for some other uses and purpo tent s, 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 nearly all sorts of cattle, horfes, sheep, pigs, rabbits, and
poultry of all forts.

In the feeding of next 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 some-
times to be cultivated in America, as green food for cattle.

For horfes 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 digeting more
readily, and going much farther, but as improving the talfe,
and rendering the substance more acceptable 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 pro-
viding for all sorts of working animals of this kind.

As to sheep, they must have this sort of feed given to them
in the mealy state, or that of the husky matter, them
being mixed with suitable quantities of wheat-bran or pol-
lard. 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 wath.

For rabbits this sort of food may be made use of in differ-
ent 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 benefite. 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 molt 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.

Peafants, in the domestic rate, are said also to have
been often fed with this sort of food; as well as tame
pigeons, in some cafes, and partridges, and some other
birds, with complete success, and in a superior manner to
molt forts of corn-feeding.

The refute plants may be employed as the foundations in
littering of farm-yards, as well as for some other purposes
about them, as wadded eheads, coverings, divisions, fences,
and temporary coverings for 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 expressed from these
feeds, 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
funny situation. There is a cake left in the proses of
making it, which may be made use of as noticed above.

The manufacturing of this oil has also been already prac-
ticed 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 of feed, two of which would be
more than the weight there flated; 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 residue, or cake, would amply repay the expences
incurred in the proses 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 whiggy fallad oils; the animal oils being unfit
for this purpose. It is, of course, worth four or more shil-
lings 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 bufnets by 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, thinning, silver, fibrous sub-
stance, which is contained in a large proportion, is more
delivering of the attention of the manufacturer than any
other part.

The large roots, naked items, and some other wafle parts,
may, in many places, be converted with advantage to the
purposes of fuel. They may be made use of in the billet or
\( \times 2 \)}
other forms, for drying malt, and other similar 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 flake, 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 purpuses. It may also be found useful and beneficial with hemp, in the cultivation and improvements of land of the fen and marsh kinds, as drinking up and throwing off a large quantity of moisture. It may conseqently hereafter be found a plant of great utility and consideration to the farmer and manufacturer, as well as to the gardener.

Sun-Flower, Dwarf. See Helianthemum. Sun-Flower, Dwarf, Helianthemum, or Cifus. 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 altringent, and a good demulcent, in the form of a decoction, particularly in diarrheas, hemorrhages, and discharges of the fauces. J. Bawine says, it is good in all disorders attended with a flux of any kind.

Sun-Flower, Dwarf American. See Rubbeckia.

Sun-Flower, Tick-seeded. See Coreopsis.

Sun-Plant of Hindooistan. See Son.

Sun-Spear, a term used by our Gardners, in some parts of England, to express a diftemperance 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 spring sun, and only open to the summer's, and it may be always cured by proper waterings.

Sun-Spurge, in Botany. See Euphorbia.

SUNAMOKY, in Geography, a town of Bengal; 12 miles N. of Biplonpour.

SUNAPEE, a lake and mountain of America, in Cheshire county, New Hampshire. The lake is about 8 or 9 miles long and 5 breadth; and communicates by Sugar river with Connecticut river, at the distance of 14 miles W. The mountain is situated at the S. end of the lake.

SUNBURSAH, a town of Hindooistan, in Bahar; 58 miles E.S.E. of Hajpur.

SUNBURY, a county of New Brunswick, on the river St. John, at the head of the bay of Fundy, containing eight townships, viz. Conway, Gaagetown, Barton, Sunbury, St. Anne's, Wilton, Newton, and Mangerville. The three last were settled from Massachusetts, Connecticut, &c. The lands are generally level, tolerably fertile, and abounding with timber.—Alias, the chief town of Northumberland county, Pennsylvania, situated on the E. side of Susquehanna river, just below the junction of the E. and W. branches of that river, in N. lat. about 40° 53'. The town is regularly laid out, and contains a court-house, brick gaol, a Presbyterian and German Lutheran church, and 790 inhabitants; about 76 miles above Reading.—Alias, a township of Delaware county, in the district of Ohio, containing 621 inhabitants.—Alias, a post-town and port of entry in Georgia, pleasantly situate in Liberty county, at the head of St. Catherine's Sound, on the main, between Medway 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. Helena and St. Catherine's islands; between them is the bar and entrance into the Sound: the harbour is capacious and safe, and has 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 flycky feaon. It has been rebuilt since the war, when it was destroyed by fire. An academy was established here in 1783; 40 miles S. of Savannah.

SUNBUY, a town of Hindooistan, in Bahar; 12 miles S. of Patna.

SUNCHEULLI, a mountain of Peru, in the jurisdiction of Lariaces, in which is a gold-mine.

SUNCOOK, a town of America, in Oxford county and district of Maine, now called Lovell; containing 365 inhabitants.—Alias, a river of New Hampshire, which runs into the Merrimack, N. lat. 43° 57', W. long. 71° 26'.

SUNCOPULLY, in Natural History, a name given by the people of the East Indies to a kind of spary inhbitance of a whitish colour, which they calcine, and afterwards give in aegus, and other intermittent cafes.

It is erroneously by some supposed to be a species of arfice; for it has none of its qualities.

SUND, in Geography, a town of Sweden, in East Gothland; 40 miles S. of Linkoping.—Alias, a town of Sweden, in the province of Warmeland; 26 miles N. of Carlstad.

SUNDA, a town of Hindooistan, in Oude; 30 miles N.N.E. of Kairabad.

SUNDA Islands, a group of islands in the East Indian sea, the largest of which are Bornoe, Java, and Sumatra.

SUNDA Straits, 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 Varhans, or Hog Point, is 15 German miles; and on the Java side, from the Firth point or Java head, to the point of Bantam, full 20. In the mouth of this strait lies Prince's Island, which lies.

The entrance of the strait on this side affords an unusually 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 Reizers, or Emperor's island, lifting its high and lofty summit; and still further the islands Creteenas (which foe), Nysbven, and Pola Bice, or the Iron island, shewing their mountains covered with ever-vertand woods; and the opposite coast of Java not inferior in agreeable objects, and affording a good anchorage, which is not to be met with on the Sumatra side.

The numerous groves of cocoa-nut palms, and the rice-fields in the back-ground, suggest the most pleasing ideas of the fertility of the soil. The narrowest part of the strait, opposite to Hog Point of Sumatra, is divided by an island, lying in the middle of the channel, and hence called "Dwarvs 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 sailing 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.

SUNDÆV, a fortress of Russia, on the Ural; 60 miles S. of Urialk.

SUNDAL, a town of Norway, in the government of Drammen, on the Driva; 66 miles S.S.W. of Drammen.

SUNDAMINUM, a town of Hindooistan, in Mylore; 25 miles E. of Rydroog.

SUNDANA. See Sandel Boch.
SUNDAY.

SUNDAY, a town of Persia, in the province of Segelitan or Seitan; 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, which the ancients deemed in their religion.

It is now more properly called the Lord's day, or Dominicus, because kept as a fast 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. 

See Sabbath.

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 name, 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 the "Lord's day," was meant the "first" day of the week; because we find no traces of any division of days, which could entitle any other to that appellation: accordingly this appellation was applied both by the Greek and Latin churches. So it is styled by Clemens Alexandrinus, by Ignatius, by Didymus, bishop of Corinth, by an African lynod, and by Tertullian. Sometimes, indeed, it is simply called "Sabbath," and "Dominicus," that is, "the Lord's," without the addition of the word "day," as it is thus called τοῦ Χριστοῦ, by Ignatius, and "Dominicus" by Cyprian. Some have conceived, that it was so called in commemoration of the resurrection of Christ. To this purpose, Clemens Alexandrinus writes: "that a true Christian, according to the commandment of the gospel, observes the Lord's day, by calling out all evil thoughts and entertaining all good ones, glorifying the resurrection of the Lord on that day." 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 we keep the Lord's day, on which our life arose through him." And St. Justin Martyr also 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 purposed, 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. Julian 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." For throughout all their writings they early declaim against sabbatizing, or keeping the sabbath-day, that is the Judicial observation of the seventh day, which we must always understand by the word "Sabbath" in the writings of the ancients, not the observation of the first day, or the Lord's day; for that was constantly celebrated: and by those who condemn the observance of the Sabbath, the sanctification of the Lord's day is approved and recommended, as by Julian Martyr and Tertullian, and also by Ignatius, who says, "let us no longer sabbatize," and in another, "instead of sabbatizing, let every Christian keep the Lord's day, the day on which Christ arose 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 feasts solemnized in his time; though, on the contrary, some of the Western churches, that they might not seem to judeize, failed 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 find that by the fourth commandment, a strict abstinence 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. xxxii. 14.) Beliefs, the seventh day was to be solemnized by double facrifice in the temple. (Numb. xxvii. 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 contrivance, could be deemed labour; as from dicing meat, from travelling beyond a sabbath-day's journey, or about a single mile. In the Maccabean wars, 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 enemys, 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 purpose of hearing the law rehearsed and explained, 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 transfiguration in the wilderness, 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. Whilst 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 distinction and appropriation of the seventh day, mentioned in the book of Genesis, as not having been made till many ages after the time of the wilderness. He adds, that the words do not assert that God then "blessed" and "sanctified" the seventh day, but that he blessed and sanctified it, because he had on that day rested from the work of creation, and for that reason; and if it be asked, why the sabbath, or sanctification of the seventh
seventh day, was then mentioned, if it was not then appointed, our author replies, that the order of consecration, and not of time, introduced the mention of the sabbath in the history of the subject which it was ordained to commemorate. This interpretation, he says, is strongly supported by a passage in the prophecy of Ezekiel, where the sabbath is plainly spoken of as given, or, as the expression is supposed to mean, as first instituted, in the wilderens. (Ezek. xx. 10, 11, 12.) Nehemiah also accounts the promulgation of the sabbatic law among the transgressions in the wilderens, and this circumstance is considered as assigning 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 not without address to the whole human species alike, 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 wilderens, 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 support 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 people of Israel, unless the observance of it 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 feasts 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 these are recited together. It is further argued, that the observation 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 creation," 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 distinction between positive and natural duties, like other distinctions of modern ethics, was unknown to the simplicity of ancient language; and that there are various passages in scripture, in which duties of a political or ceremonial, or 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. xviii. 5-9; and Acts, xx. 28, 29.

If the law by which the sabbath was instituted be considered a law solely 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 assemblies upon the first day of the week was to early and universal 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 26th verse of the first 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 first 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. 6, 7.) The practice mentioned in this passage seems now to have been familiar and established. (See also 1 Cor. xvi. 1, 2.) From these pabilities 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, 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 command to their disciples for a discontinuance upon that day of the common offices of their respective professions. This reference cannot be construed as a defect in the Christian institution by any who consider, that in the primitive condition of Christianity, the observance of a new sabbath would have been useless, or inconvenient, or impracticable. During Christ's personal ministry, his religion was preached to the Jews 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 enjoy another day of rest in conjunction with this.

Archdeacon Paley deduces from his whole inquiry on this subject the following conclusion; viz. that the assemblies upon the first day of the week for the purpose of public worship and religious instruction, is a law of Christianity, of divine appointment; and that the resting on that 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, upon 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 observance of it promotes; and recommended, 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 subjection to many of the same ules.

We may observe, in general, that if the design of a religious assemblie require that it be held frequently, it is most expedient that it should return at stated intervals; and that the same seances should be observed throughout the country. That part of the religious distinction of seances, which confines in a general intermission of labour and business during times set apart for the exercise of public worship, is founded in the reasons which make public worship itself a duty. As the celebration of divine service never occupies the whole day, the other interval of Sunday, that is not spent at church, must be considered as a mere rest from the ordinary course of civil life; and he, says Paley, who would defend the institution, as it is required to be observed in Christian countries, unless he can produce a command for an "Christian sabbath," must point out the ules
SUNDAY.

ues of it in that view. First, 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 there any thing lost to the community by the intermission of public industry one day in the week; nor is it, in countries tolerably advanced in population, and the arts of civil life, there is always more than enough of human labour. Secondly, 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 mediation and inquiry. And thirdly, they whose humanity embraces the whole sentient creation, will e’en it no inconsiderable recommendation of a weekly return of public rest, that it affords a reprieve to the toil of brute.

Having stated 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 fulfils these uses, and conforms the nearest to this practice. The uses of this institution are to facilitate attendance upon public worship, or to mitigate the condition of the laborious classes of mankind, and by a general suspension of business and amusements, 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 null, therefore, be violated; supplication, 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, wiving 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 ought to afford to the inferior orders of the community. Thirdly, by such recreations as are customarily forborne, out of respect to the day; as hunting, shooting, fishing, public diversions, frequenting taverns, and playing at cards or dice.

It was Constantinian the Great who first made a law for the proper observation 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 Constantinian'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 be allowed the country people to follow their work. In 358, the council of Orleans prohibited this country labour; but because there were still many Jews in the Gaul, 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 food, or to do any thing necessary to the cleanliness and decency of honest or profane persons, favours 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 forbidding ferocity and savage selfishness of spirit; it enables the industrious workman to pursue his occupation in the ensuing week with health and cheerfulness: it impresses on the minds of the people that sense of their duty to God, so necessary to make them good citizens; but which would be worn out and defaced by an unremitted continuance of labour, without any varied times of recalling them to the worship of their Maker. Accordingly, the laws of king Athelian (c. 24.) forbid 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 Sunday, (except the four Sundays in harvest,) on 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 32. 4d. a pair; and by 1 Car. I. c. 11, no perfons 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 must pay 32. 4d. to the poor. By 29 Car. II. c. 7, no perfon is allowed to work on the Lord's day, or use any boat or harge, (unless allowed by a justice of peace,) nor forty watermen allowed to ply on the Thames, (11 & 12 W. c. 21,) or expose any goods to sale; except meat in public houses, milk and mackerel at certain hours (10 & 11 W. c. 24.), and works of necessity or charity, on forfeiture of 5L. Or if any butcher, by himself, or any other for him by his priory or convent, shall kill or fell any victuals on the said day, he shall forfeit 6s. 8d. Nor shall any drover, carrier, or the like, travel upon that day, under pain of 20s. (3 Car. c. 1.) Fifth-carriages (for the supply chiefly of the markets within London and Westminster) shall be allowed to pass on Sundays or holidays, whether laden or returning empty. No arrest can be made nor processe served upon a Sunday, except for treason, felony, or breach of the peace: nor can any proceedings be had, nor judgment given, nor suppression 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 chimney, to ply and stand with their coaches and chairs, and to drive and carry the fame respetively on the Lord's day, within the limits of the bills of mortality.

By 21 Geo. III. c. 409, 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 subject whatever, upon any part of the Lord's day called Sunday, 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 200L. 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, or president, or chairman, in any such capacity, 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.
By 34 Geo. III. c. 61, 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, fo as the perfon requiring the baking thereof shall carry or fend the fame to and from the place where such meat pudding or pie is baked, the penalty is 10s., and prosecutions are to commence within six days after the offence is committed.

By 48 Geo. III. c. 70, which principally adjuits the penalties annexed to offences, any maker or mistress baker is allowed within the limits of the weekly bills of mortality, and within ten miles of the Royal Exchange, to deliver tocustomers on the Lord's day bakers, until half an hour past one in the afternoon of that day.

In the breviary, and other offices, we meet with Sundays of the first and second clasfs. Those of the first clasfs are, Palmis, Exalter, Adventi, 4th Sunday, those of Quinquagesima and Qua- dragesima; each of which fee under its proper article. Those of the second clasfs are the common Sundays. Anciently each Sunday in the year had its particular name, which was taken from the introt of the day; whereof custom has only been continued to some few in Lent: as Reminifceres, Oculus, Letare, Judicata.

Sunday, Quinquagesima. See Quinquagesima.
Sunday, Trinity. See Trinity.
Sunday Letter. See Dominical Letter.
Sunday River. In Geography, a river of Southern Africa, on the south coalt of the Cape Colony, which falls into Algoa, or Zwart Kop's bay, opposite to the island of Saint Croix. It riles in the midst of the Snowy mountains, and continues 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 land. This, as well as the other rivers of the colony, is well rocked with perch, eels, and small turtle, and, to a certain distance from the sea-coalt, abounds with almost every kind of sea-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 Wellen.
Sundborn, a town of Sweden, in Dalecarlia; 5 miles N.E. of Falun.
Sundeh, a town of Bengal; 6 miles N.E. of Ramgur.
Sunddeep, or Sundiva, an island at the mouth of the river Megna, or Burhampooter, about 100 miles in circumference; anciently belonging to Arakan. The Portuguese, in 1602, finding it naturally strong, took it from the Moguls; but the king of Arakan, jealous of their growing power, compelled them in the next year to retire. N. lat. 22° 28'. E. long. 91° 33'.
Sunder, To, in Agriculture, a provincial term, signifying to air and expofe to the sun and wind, as hay that has been cocked up without being fully dry, and is reprend out.

Sunderagoda, in Geography, a town of Hindooflan, in the circur of Ciacole; 6 miles S.E. of Kmedy.
Sunderborg. See Sonderborg.
Sunderbunds. See Delta of the Ganges.
Sunderdoo, or Melunday, a fortified island in the Indian sea, near the W. coalt of Hindooflan, 10 miles to the N.E. by N. of Vingolla rocks, and reduced by commodore James in 1765. N. lat. 15° 52' 30". E. long. 73° 16' 30".
Sundereren, a town of the duchy of Welfphalia; 25 miles W. of Brilon.
Sundergaunt, a town of Bengal; 28 miles S. of Calcutta.
Sunderham. See Sonderham.
Sunderkioiping. See Soderkoping.
Sunderland, a borough-town in the north division of Easington ward, and county-palatine of Durham, England, is settled on the south-well bank of the river Wear, and on the high road which branches from thence to Durham, Stockton, Newcastle, 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 1634, 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 not issued. At the restorafion of Charles II., letters patent were granted for the erection of a light-house and pier, and for the preservation of the harbour; for which purpose, various acts of parliament had already paffed, since the reign of Henry VIII. Till the year 1719, this town was comprised within the parifh of Bishop's-Wearmouth (see Wearmouth); but the population having then so greatly increased, an act of parliament was procured for making the town and township of Sunderland a distinct parish; upon which a church was erected here, on 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 1762. 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, glafs, glafs-bottles, grind-flones, and copperas. The coal trade, the principal occupation of the inhabitants, employs about 520 ships, exclusive of 492 keels, which convey the coal from the fiafts to the larger vessels. This coal is chiefly carried 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 26,000, on the Wear only. A good deal of lime 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 glafs, copperas, and white and brown earthenware. There are also various freestone 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 diffenters; the barracks; the theatre, and the assembly-room. The town also contains several charitable institutions, among which is 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 confifled, in 1811, of 12,289 persons, occupying 1684 houfes. At the extremity of the town, towards Bishop's-Wearmouth, is the celebrated iron bridge over the Wear, for a particular description of which, fee 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.
— Also, a township of Massachusetts, in Hampshire county, on the Earl side of Connecticut river, about 20 miles N. of Hadley; containing a handsome congregational church, and 551 inhabitants, and incorporated in 1718.

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.— Also, a cape on the E. coast of England, and county of Northumberland, in the German sea. N. lat. 52° 27' W. long. 1° 44'.

SUNDERSHAUSEN. See SUNDERSHAUSEN.

SUNDGAW, formerly a district of Germany, on the left bank 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 SUNDI.

SUNDSTO, a town of Sweden, in the province of Jamtland, on a branch of lake Storioro; 10 miles S.S.E. of Otterfors.

SUNDWALL, 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 Hernoland. N. lat. 61° 47'. E. long. 17° 5'.

SUNECOSS, a river which rises in Bootan, and runs into the Barmahpolder, a little below Rangamatt, in Bengal.

SUHERAMPUR, a town of Bengal; 40 miles N.E. of Dacca. N. lat. 24° 2'. E. long. 91° 9'.

SUHREGONG, SUNGERGAUM, or SONEFGONG, 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 Barmahpolder; 14 miles S.E. of Dacca.

SUNGRA, a town of Persia, in the province of Shiran or Segelan; 50 miles W. of Meimend.

SUNGA, a town of the duchy of Warfaw; 27 miles S. of Posen.

SUNGRA, a town of Bengal; 26 miles S. of Gidore.

SUNGUMNER, a town of Hindooftan, in Baglana; 35 miles W. of Bahbelgong.

SUNGWAH, a town of Hindooftan, in Baglana; 14 miles N. of Amednagor.

SUNHARETE, a town of France, in the department of the Lower Pyrenees; 7 miles S. of Mauli.

SUN-NIM, a town of China, of the third rank, in Pe-utch-lia; 27 miles S.E. of Paoting.

SUNISA, a town of Asafic Turkey, in Natah; 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 Surn Head.

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SUNK-Pit Drain, in Agriculture, a term sometimes applied to that fort of drain which is funk large and deep, for the purpose of drawing off the wetness of the land, or for collecting, receiving, and holding the water of it, until it can be removed by other suitable means, small common superficial drains in the land being made to communicate with it, so as to render the ground perfectly dry. Drains of this fort are sometimes formed of very considerable sizes and dimensions and depths, being often walled, or otherwise secured on the sides, so as to have machinery for lifting or raising and discharging the water they may contain, fixed in them.

SUNKAR, in Geography, a river of Hindooftan, which runs into the bay of Bengal, N. lat. 22° 5'. E. long. 20° 58'.

SUNK. See SUNDI.

SUNKEERAH, a town of Hindooftan, in Guzerat; 25 miles S.E. of Chitpore.

SUNKFRA, a town of Hindooftan, in Guzerat; 20 miles S. of Champaner.

SUNKERS, a town of Hindooftan, in Bahar; 38 miles N. of Hajiypour. N. lat. 26° 8'. E. long. 85° 25'.

SUNMAR, a town of Thibet; 10 miles W. of Painom Juing.

SUNN Plant or Hemp, in Agriculture. See CAROT-ARIA Juncea, and SUN or SUN Plant.

SUNNAGUR, in Geography, a town of Hindooftan, in the circuit of Sumbulpour; 40 miles S.S.E. of Sumbulpour.

SUNNAM, or SOONAM, a town of Hindooftan, in the circuit of Hiflar; about 60 miles to the S.W. of Sirhind. See Sooman.

SUNNANSKAR, a small island on the E. side of the gulf of Bothnia. N. lat. 61° 25'. E. long. 21° 8'. See Sunapee.

SUNNEMO, a town of Sweden, in the province of Warmeland; 10 miles N. of Philippsflad.

SUNNOUL, a town of Hindooftan, in Bahar; 13 miles S. of Bettish. N. lat. 26° 33'. E. long. 84° 49'.

SUNOUT, a town of Hindooftan, in Bahar; 55 miles S.S.W. of Patna.

SUNPAT, a town of Hindooftan, in the subah of Delhi; 27 miles N.N.W. of Delhi.

SUND, a town of Hindooftan, in Guzerat; 20 miles S.W. of Amedabad.

SUOMUSJARVI, a town of Sweden, in the government of Abo; 42 miles E. of Abo.

SUOMUSALMI, a town of Sweden, in the government of Uleaa; 53 miles N.N.E. of Cajana.

SUONATA, in Music. See Sonata.

SUONATINA, or SONATINA, in the Italian Music, a little, short, caryl sonata.

SUONIOI, in Geography, a town of Sweden, in the government of Kuopio; 27 miles S.S.W. of Kuopio.

SUONY, a town of Hindooftan, in Vifiapour; 9 miles E. of Currer.

SUONO. See Sound.

SUOPA, in Geography, a river of Ruffia, which runs into the Sem, near Lgov, in the government of Kurk.

SUOVETTAURILIA, or SOLITAEURILIA, a solemn sacrifice among the ancient Romans; in which they offered three victims of three different kinds, viz., a bull, a ram, and a boar.

Livy, describing it, calls it suovetaurilia; as composed of fast, out, and iurum; the names of the three victims sacrificed.

Dion. Halicarnassius, describing the same, calls it felicatu- rilha;
S I P E T A T I O N E S. See Ratio.

SUPERBUSB Musculus, in Anatomy, the superior braak muscle of the eye. See Eye.

SUPERBACULO, an officer charged with the accounts of the cargo, and all other commercial affairs in a manchester.

SUPERCILIAR, 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.

SUPERCIJJ CORRUGATOR, a small muscle of the eye-brow. See Eye.

SUPERCIUM, in the Ancient Architecture, denotes the uppermost member of the cornice; called by the moderns corona, crown, or lormier.

Mr. Evelyn conceives, it should rather have been called fillicium, or drip; to denote its office of shattering the order from rain, &c.

SUPERCIUM is also used for a square member under the upper tore, in some pediments.

Some authors confounded it with the tore itself.

SUPERCIUM 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 firenously for works of supererogation; and maintain, that the observance of evangelical counsels is such. By means of these, a flock of merit is laid up, which the church has the dipposol of, and which the distributes in indulgences to such as need.

This monstrous and absurd doctrine was first invented towards the close of the 13th century, and modified and embellished by St. Thomas in the 15th; 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 dispencer 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 store 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 supererogation; 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 alluded in the article GENERATION, under the head of "Phylogeny of the female organs," which justify that doubt. The following has been since published, under the title of "A cafe of supererogation," 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 12th of Nov. 1807, another male child, which was brought forth under circumstances peculiarly distressing, being dropped 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 22d of February, 1808, (not quite three months from the former accomplish,) the 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 Superficies, Area, and Measuring.

SUPERFICIAL. Foursquare, in Fortification, the same with caisson, which is a wooden chest, or box, with three, four, or five 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 expence, even where stones or bricks are plentiful. They may be employed with effect, either to collect water from the subsoil, or to receive rising waters through the perforations at their bases. In forming them, a wider trench having been sunk through the soil and the subsoil, if any, a narrower groove is, it is 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 grass lands, and cut five or six 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 fort, they may be these: 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 creeps or touch upon a vein, or a stratum, of loose earth, as in which 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 shooting in, and thereby choking up its channel. In performing this more 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 fods are let 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 filter freely into the trenchlet or pipe of the drain, and clofe enough
enough to prevent any grouty matter from entering it, and thereby filling it up.

Superficial. **Horizontal-Draining Auger.** That kind of tool of the auger sort, 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 Auger.**

**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 feasible magnitude, as some have imagined, but it is the termination, or boundary of a body; neither is a line to be considered as a surface of the least feasible breadth, but as a termination or limit of a surface; nor is a point to be considered as the least feasible 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 **Maurin's Fluxions,** vol. i. p. 245; and Mr. John Bernoulli's Letter to Monfieur Crousaz, concerning his Comment on the **Analyse des Infinitesim Petit.** Jo. Bernoul. Oper. vol. iv. p. 162, f. q.

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, Plane,** is that which has no inequality, but lies evenly between its bounding lines.

**Superficies, Convex,** is the exterior part of a spherica or spheroidal body.

**Superficies, Concave,** is the interior part of an orbicular or spheroidal body.

The measure or quantity of a surface is called its **area,** which fee.

The finding of this measure, or area, is called its **quadrature,** which fee.

To find the surfaces of the several kinds of bodies, as spheres, cubes, parallelepiped, pyramids, prisms, cones, &c. see **Area** and **Sphere.** 

In order to give the use of fluxions in finding the superficies of solid bodies: let **FACFG** (**Plate XIV. Analys.** fig. 6.) represent a solid generated by the revolution of an given curve **F** about its axis **AH:** also, let a circle, whose diameter is the variable line (or ordinate) **RBR,** be conceived to move uniformly from **A** towards **F,** and to dilate itself so, on all sides, at the same time, as to generate, by its periphery, the proposed superficies **RAR:** then, the length of that periphery, or the generating line, being expressed by $3.141592 	imes R 	imes R$ (**fig. 2**), and the circle with which it moves by $\frac{1}{2}R,$ the fluxion of the superficies **RAR,** or the space that would be uniformly generated in the time of describing $\frac{1}{2}R,$ will therefore be truly represented by $2\frac{b}{a}R.$

Hence, if $w$ be taken to represent the whole surface **RAR,** generated from the beginning, we shall have $w = 2\frac{b}{a}R \sqrt{b^2 - \pi^2} + \pi^2$; whence $w_a$ itself may be found: as in the following examples.

1. To determine the convex superficies of a cone. The semi-diameter of the base **BOD** or **CD** (**fig. 7.**) being put $= b,$ the slanting line, or hypotenuse, $AC = c,$ and **FG** parallel to **DC** $= y,$ &c. we shall, from the similarity of the triangles **AOD** and **Gmg,** have $b : c :: (mg) : z \quad \text{or} \quad \frac{b}{c} = \frac{z}{(mg)}$; whence $w = 2pH^2 \frac{c}{b}$; and consequently $w = \frac{b}{c}$. This, when $y = b,$ becomes equal $\frac{b}{c} \cdot \frac{c}{b} = b$.

For the superficies of a cone, &c. see **Conoid.**

2. To find the superficies of a sphere **AEHB** (**fig. 8.**)

In this case, putting the radius **OH = a,** **AF = x,** **HM = x,** &c. we shall (by reason of the similar triangles **OHF** and **HmB**) have $y' (FH) = a \quad (OH) :: x \quad (HM)$

$\frac{y}{x} = \frac{a}{b}$; therefore $w = 2pR^2 \frac{c}{b}$; and consequently the superficies ($w$) itself is $2pR^2 \times AF \times$ periphery **AEHB:** which, if the whole sphere be taken, will become $AB \times$ periph. **AEHB** is four times the area **BEAHO.**

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.

3. To determine the superficies of a spheroid. — Let **ACFHG** (**fig. 9.**) represent one half of the proposed spheroid, generated by the rotation of the semi-ellipsoid **FAG,** about its axis **AH:** put **AH = a,** **FA** or **HG = c,** **BH = x,** **BC = y,** **FC = z,** and the superficies generated by **FC** or **GD** $= w$; then, from the nature of the ellipsoid, we have $y = \frac{c}{a} \sqrt{a^2 - x^2}$; whence $y = \frac{c}{a} \sqrt{a^2 - x^2}$; and consequently $z = \frac{\sqrt{a^2 - c^2} \cdot x}{a} = \sqrt{\frac{a^2 - c^2}{a^2 - x^2}}.$

But the same fluent may be otherwise very easily exhibited by means of the area of a circle: for, if from the centre **H,** with a radius equal to $\frac{a}{b},$ a circle **SER** be described, and the ordinate **BC** be produced to intersect it in **E,** it is evident that $BE = \sqrt{a^2 - x^2}$, and that the fluxion of the area **ESHB** will be expressed by $\frac{\sqrt{a^2 - x^2}}{b}$; which

$$\sqrt{b^2 - \pi^2}.$$
which being to \( \frac{2 \dot{p} \dot{p} e \dot{x}}{a} \times \sqrt{x^4 - x^2} \), the fluxion before found, in the constant ratio of \( r \) to \( \frac{2 \dot{p} \dot{p} e}{a} \), their fluents must, therefore, be in the same ratio; and for the latter expressing the superficies C F G D, will consequently be
\[
\frac{2 \dot{p} \dot{p} e}{a} \times \text{BESFH} = \frac{2 \dot{p} \ddot{F} H}{\text{HS}} \times \text{BESFH}.
\]
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 \( b \left( \sqrt{a^2 - c^2} \right) \) will be impossible; hence, in this case, \( \text{H F} \) is greater than \( \text{H A} \). But if we, here, put \( b = \sqrt{a^2 + c^2} \), and \( d = \frac{a^2}{b} \), the value \( \dot{a} \dot{w} \) (found above) will become \( \frac{2 \dot{p} \dot{p} e \dot{x}}{a^2} \)
\[
\sqrt{a^2 + b^2 + x^2} = \frac{2 \dot{p} \dot{p} e \dot{x}}{d} \sqrt{d^2 + x^2} = \frac{2 \dot{p} \dot{p} e \dot{x}}{d} \sqrt{a^2 + x^2};
\]
whose fluxion 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
\[
\frac{2 \dot{p} \dot{p} e \dot{x}}{d} \sqrt{d^2 + x^2} = \frac{2 \dot{p} \dot{p} e \dot{x}}{d} \sqrt{a^2 + x^2}
\]
the first term \( \frac{1}{2} d^2 x \dot{x} \dot{x} + x^3 \dot{x} \) (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
\[
\frac{1}{2} \sqrt{a^2 + x^2},
\]
for the true fluent of the first term; to which adding the fluent of the other term \( \frac{1}{2} \sqrt{d^2 + x^2} \), we find
\[
\frac{1}{2} \sqrt{d^2 + x^2},
\]
there arises \( \frac{1}{2} x \sqrt{d^2 + x^2} + \frac{1}{2} d^2 \times \text{hyp. log.} \)
\[
x + \sqrt{d^2 + x^2},
\]
for the fluent of \( \sqrt{d^2 + x^2} \); and this corrected and multiplied by \( \frac{2 \dot{p} \dot{p} e}{d} \), gives \( \frac{2 \dot{p} \dot{p} e \dot{x}}{d} \sqrt{d^2 + x^2} \)
\[
+ \dot{p} \dot{e} \ddot{d} \times \text{hyp. log.} \ 
\]
\[
x + \sqrt{d^2 + x^2}
\]
for the superficies in this case, where the proposed spheroid is an oblate one. Simpson’s Fluxions, vol. i. p. 187, &c.

Superficies, Line of, a line usually found on the lector, and Gunter’s scale. The description and use of this see under Sector and Gunter’s Scale.

Superficies 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 nourishment which they afterwards give to animals. This internal superficies of the earth is the superficies of the pores, cavities, and interfaces of the divided parts of the earth; and these are of two kinds, natural and artificial. Tull is the first who has used this term, and he justifies himself from the imputation of having used an absurd phrase, as it might at first seem, the adjective expressing something within, and the substantive something without, by observing, that though the vegetable is within the earth, yet it is also on the outside of the divided parts of the earth.

Of the natural and artificial superficies of plants, or the natural and artificial cavities, pores, and interfaces of the earth, the natural alone will suffice to furnish a country with vegetables for the maintenance of a few inhabitants; but if the artificial, that is, if agriculture, the noble business of which is the making this artificial superficies for plants, were abolished out of the world, it is much to be feared, that the people of all populous countries, especially of those toward the borders of the frigid zones, (for there the trees often fail of producing fruit,) would be reduced to the utmost necessity for this proper kind of food.

The artificial superficies of plants is that inner superficies of the earth, which is made by dividing the foil by art. This, on all parts of the globe where it is used, maintains more people than the natural one; in the colder countries it maintains ten times as many as the natural one; and when the art of agriculture is more advanced to perfection, it will maintain twice as many as it does at present; and this improvement is easy, and to be done by simple means.

The natural superficies is not only less than the artificial, in an equal quantity of ground; but the little there is of it consisting also of the superficies of the pores and cavities not having a free communication with one another, they are less pervious to the fine roots of all vegetables, which require a greater force to break through their partitions; and by that means roots, especially of weak plants, are excluded from many of those cavities; so that the benefit of a great part of the superficies of the earth, which is in the soil to the husbandman.

The artificial superficies, on the other hand, contains in superficies of cavities that are pervious to all roots, and give them free passage throughout the whole extent of the cultivated place; and, consequently, the fine horizontal roots of plants, which run much farther than is generally supposed, those of a turnip, for instance, running fix feet distant from the main root every way (see Root), will find an easy passage in every part, to the utmost extent to which nature allows them to run.

The internal superficies of the earth, which is the superficies of plants, is not like the external surface, which is the superficies 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 islands of superficies or artificial superficies of land, may be enlarged without addition, or more land, only by division of the same earth: and this artificial superficies may be increased in proportion to the division of the parts of the earth, of which it is the superficies.

A cube of earth of one foot has but fix 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 seventy-two superficial feet. Divide these cubes again into such others, as bear the same proportion to an inch, that an inch does to a foot, and then the same quantity of superficial feet, which had at first only fix feet superficies, will have a superficies of eight hundred and sixty-four feet of natural superficies; and in the same manner is the soil divisible, and consequently this superficies inerme is ad infinitum.

Poor land does not afford an internal superficies so well stocked with those 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 soil is by dyke, or by tillage, or by both; and none of the natural patterns is ever lost, or injured by the use of the artificial means, but, on the contrary, it is improved by such means, a free communication being made by them between pore and pore. Tull's Hortoeconomic Husbandry, p. 18.

SUPERFINE, in the Manufacturer, a term used to express the superfine filaments of a flax. 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 left and right, is at length brought to be no bigger than a hair.

SUPERFLUOUS Interval in Music, is that one that exceeds a true diatonic interval by a femitone minor. See Interval. Thus the

SUPERFLUOUS Second, or Tone, contains a femitone minor more than a tone, or greater second; and will therefore be expressed by \( \frac{5}{4} \) or \( \frac{5}{4} \). The first of these expressions is a tone minor, and a femitone minor; since \( \frac{4}{5} \cdot \frac{5}{4} = \frac{5}{4} \), and the other is a tone major, and femitone minor; for \( \frac{5}{4} \cdot \frac{4}{5} = \frac{4}{4} \). This last occurs in practice, and is one of the intervals of the chromatic tonalum. See CHROMATIC and SECOND.

In the temperate scales these two superfluous tones coincide. Thus from B♭ to C sharp, or from F to G sharp, are superfluous tones.

SUPERFLUOUS Third is greater than the third major by a femitone minor, and will therefore be expressed by \( \frac{4}{3} \) or \( \frac{4}{3} \). It is not in use. It seems a fourth on our harmonic chords. Thus from B♭ to D sharp is, properly speaking, a superfluous third; but D sharp and B♭ being confounded, it pales for a fourth.

SUPERFLUOUS Fourth. This interval is expressed by \( \frac{3}{2} \). It is by practitioners, and in temperate scales, confounded with the tritonus. See INTERVAL.

SUPERFLUOUS Fifth is expressed by \( \frac{4}{3} \). This is equal to two thirds major, for \( \frac{4}{3} \cdot \frac{3}{4} = \frac{4}{4} \). The superfluous fifth occurs in practice, as from C to G sharp.

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 superfluous interval, which is that interval which exceeds the fifth major by a femitone minor, and is therefore expressed by \( \frac{4}{3} \). But the other interval, which is a comma more than the former, and is a femitone major less than the octave, is chiefly used in harmony, as between B♭ and A sharp, where it has a fine effect. It is expressed by \( \frac{4}{3} \). See INTERVAL and DIMINISHED Third.

SUPERFLUOUS Seventh is expressed by \( \frac{5}{4} \). This is a disjunct leaft than the octave. See INTERVAL.

SUPERFLUOUS Octave is a femitone minor more than the octave, as from C to E sharp. It sometimes occurs in the cadences of instrumental pieces.

SUPERINCESSUS Bases. See SLIDING.

SUPERINSTITUTION, Superinstitutio, denotes one upon another. As A. be admitted and inluted to a benefice upon one title, and B. be admitted, inluted, &c. by the preestation of another.

SUPERINTENDENT, in the French Cujionus, 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 dioecesan 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 dif- use; and at present, none but the superintendent of Wirtemberg assumes the quality of superintendent general.

SUPERIOR, or Superiour, 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, not his infallibility; as all the other Roman churches do. See POPE, ABBOT, and PRIOR.

SUPERIOR Auris, in Anatomy, a muscle of the external ear. See EAR.

SUPERIOR Capitis Obliquus. See Obliques.

SUPERIOR Oculi Reclivi et Obliques, two muscles of the eye. See EYE.

SUPERIOR Serratus Pollicis. 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 1500 miles in circumference. According to Mackenzie, its greatest breadth is 120 miles, and its circumference, including the bays, 1200. 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 trouts of three kinds, weighing from five to fifty pounds, sturgeon, pike, red, white carp, black bass, herrings, &c. &c. and the largest and least of all, the "ticamang," or white fish, which weighs from four to sixteen pounds, and is of a superior quality in their waters. This lake may be denominated the grand reservoir of the river St. Lawrence. The principal rivers that discharge themselves into it are the St. Louis, the Nipigon, the Pic, and the Michipicatan. Although it receives ample supplies, it is said that not a tenth part of its waters pass off by the straits 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 streams on this large expanse of water are not less dangerous 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 "Mi no ng," or " Isle Royale," is about 100 miles in length, and in many places 40 broad; they are supposed by the savages to be residues 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 driving against the high barren rocks on the N. and W. shore, diffuses in torrents of rain. It is very generally said that the streams on this lake are denoted by a smell on the preceding day; but the phenomenon does not seem to be regular, as the swells more frequently subsided without any subfluent wind. Along the surrounding rocks of this immense lake, evident marks appear of the decrease of its water, by the lines observable upon them. The interval, however, between the highest and the lowest is not so great as in the smaller lakes, as it does not amount to more than fix feet, the former being very faint. In the year 1668, when the first missionaries visited the south of this lake, they found the country full of inhabitants. About this time a band of the Ne pingues, 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 overgrown by fires, and the flunted timber, which once grew there, is frequently seen lying along its surface. Indeed, as there is little appearance of soil, vegetation to any great degree cannot be expected. Between the fallen trees there are briars, with bumble-berries, and 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 mole and fallow-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 connexion mark. It continued thus falling and rising for several hours, gradually decreasing, till it stopped 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, 300 or 400 feet in height, and crowned by others of a greater altitude, is the fort, picketed in with cedar palisades, and inclining houses constructed of wood, and covered with thingles. 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 fog of the lake, and the moisture of the ground from the springs that issue 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. 46° 4′ to 48° 45′. W. long. 84° 49′ to 91° 59′.

SUPERIORIS Labii Levator, in Anatomy, a muscle of the upper lip. See Declination.

SUPERIORITY, in Agriculture, a sort of tenure of land, in some places, as in some parts of Scotland. It is that kind of tenure, or nominal sort of security in land, which the lord or superior had, in early times, given to or bestowed 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 Peebree states, that superiority is merely that nominal title to land, which confers the right of franchise. That as 4000 valuation of superiority gives this right of franchise, 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 fictitiously conveyed in any given portions, it is evident that, in creating votes, the superiority of the whole valuation, 51,957l. Scots, would, it is said, give one hundred and twenty-nine voters at the county election: as, however, the number commonly upon the roll of freeholders 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 code. Such a sort of nominal tenure should, however, now be done away; since circumstances have so much changed the nature of property in land.

SUPERIURARE. Anciently, when a criminal, endeavoured to excuse himself by his own oath, or by that of one or more witnesses, and yet the crime was so notorious, that he was convicted by the oaths of many more witnesses; this was called Superiurare.

SUPERIUS, in Music, in early days of counterpoint, signified the treble or highest part.

SUPERLATIVE, in Grammar, an inflexion of nouns adjective, serving to augment and heighten their signification, and flew the quality of the thing denoted to be in the highest degree.

In English, the superlative is usually formed by the addition of most, as richest, holiest, &c. rarely by the addition offfffffo, as generalfimalis, more frequently by the prefixing of most, as most honourable, most amiable, &c.

The French are generally forced to form their superlatives by prefixing of le plus, sometimes of tres, and sometime 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 jater and medd; sometimes by the preposition minus, and sometimes by redoubling the word; of which we find frequent instances in the Bible.

SUPERNA, in Hindoos Mythology, is a name of a bird of great celebrity in the legends of the Ealit, usually employed to carry the peron of the god Vifhnu. The Hindoo deities have different animals assigned them as vehicles, when journeying. These are called in Sanscrit, va, or van, which is one of the commonest names of Superma or Garuda, sometimes pronounced Garoo, by which a large species of falcon, well known in all parts of India, is also called. The English usually style it 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 superlition; 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
SUPERNATURAL Part of the Ship, that part which, when afloat, is above the water.

SUPERNATURAL GRACE. See Grace.

SUPERNATURAL THEOLOGY. See Theology.

SUPERNUMERARY, in the latter times of the Roman empire, soldiers added to the legion after it was completed. These were the fame with those in former times called Arcens.

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 exchequer, to be ready to supply vacancies, when they fall: these have but half-pay.

SUPERNUMERARY, in Ancient Muses. Preframbanomenos, the loved found in the Greek scales, said to have been added by Pythagoras to complete the octave, was termed supernumerary, as it implies adjunct, or addition. It answers to & re, 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 by this appellation 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 often 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 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. Winslow.

See CRANIUM.

SUPEREROGATION Pasture. 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, dilatants, as the Pythagoreans did, but concinnous, as if they were of a middle nature between consonant and dilatant. 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 diatessaron, expressed by 8 : 5, from the number of concords, because its proportions were superpartient; yet his own doctrine is equally precarious. Vide Euler, Tentam. Nov. Theor. Musici, p. 63, 64.

SUPERPARTIEN Ratio. See Ratio.

SUPER-PRÆROGATIVA REGNE, a writ which formerly lay against the king's widow for marrying without the fuscultur's licence.
SUPERPURGATION, Hypercatharsis in Medicine, an excessive, over-violent purging.

SUPERQUADRIPARTIENS. See Ratio.

SUPER-SALTS, in Chemistry, salts with an excess of acid; as super-tartrate of potash. See SALTS.

SUPERSCAPULARIS, Superior and Inferior, in Anatomy, old names for the muscles of the scapula, commonly known under the terms supraspinatus and infraspinatus; which see.

SUPERSEDEAS, in Law, a writ issued in divers causes, importing in general, a command to stay or forbear some ordinary proceedings in law, which, in appearance, ought to be done, or purblind, were it not for the cause on which this writ is granted.

Thus, a man regularly is to have a fortune of peace against him of whom he will swear he is afraid; yet, if the party be formerly 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.

SUPERSEDING a Commision of Bankrupt. If such a commission issues, 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 superedeas.

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 officer, that disfains in the king's highway, or in the lands anciently belonging to the church.

SUPER-STATUTO judicio Senechal & Marshal de Roy, &c. a writ that lies against the Seward or marshal for holding plea in his court, or for treipas or contracts not made, and arising within the king's household.

SUPER-STATUTO servus Servantum & 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.

Superition 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 false and sullen temper.

The author of the article Fanaticism in the Dict. Encyclop. 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 blame, but even with certain internal feelings of joy and comfort; from which he concludes that fanaticism is really nothing more than superstition fet 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 indiscriminate and unregulated, 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 disreputable fear that he will not be pleased without the addition of something which such notions neither require nor justify.

Superition, says Dr. Hartley (Obf. 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 conduct, 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 cases, incrase 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 gree the mind, to check natural benevolence and compassion, and to generate a bitter perverting spirit. These effects are much augmented, where superstition and enthusiasm pass alternately to each other at intervals, which is no uncommon case.

Superition 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 esse operat; religiosum nefas."

It was a piece of superstition in the ancient Romans to observe the flight of birds, the charms of victims, &c. It has been observed by some excellent critics, that the Greek word ἐπίστασις, 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 religion, and not superstition, in Acts, xxv. 19, alleging, that it cannot be supposed Fellus would speak contemptuously to Agrippa the Jew; that is, of Agrippa's own religion, when Agrippa was come to Cesarea, with his litter Berenice, to salute him. Thus also it is apprehended that the word ἐπίστασις, Acts, xvi. 32, should be translated very dvo, 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 hath sense of the word is inconsistent with the whole design of St. Paul's argument. Lard. Cred. vol. i. p. 429. note s. Dodd. in loc.

Mont. Thiers has an express treatise "Des superflueitons 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 superflitious, is to fall a month to prison.

SUPERSTITIOUS Magic. See Magic.

SUPERSTITIOUS Uscis, in Law. See Mortmain.

SUPER-SULPHATE of Potash. See SALTS.

SUPERVISOR signifies a surveyor or overseer. It was formerly, and still remains, a custom among fome, especially of the better sort, to make a supervisor of wills; to overlook the executors, and see their wills truly performed: but it is to 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 EXTRINSICS.

SUPINATOR, the name of two musculs of the fore-arm, which have the effect of bringing that part and the hand into the supine attitude.

The supinator radis longus (humero-fus-radial) is a narrow but
SUPINO, in Geography, a town of Naples, in the county of Mohile, formerly the see of a bishop, removed to Boiano; 13 miles S.S.E. of Mohile.

SPLITZBACH, a river of Saxony, which runs into the Elbe, near Torgau.

SUPLOUR, a town of Hindooostan, in Allahabad; 27 miles E.S.E. of Gazyhour.

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, fleeting, and butter-milk, which is given to them instead of being converted to the use of pigs, as it usually the cafe, by which forms lofs may probably be fulfilled by the farmer.

SUPPLANTALIA, or Suppledanes, among Physicians, plasters, or other medicaments, applied to the soles of the feet; generally made of leaven, multrum, horfe-radish, falt, foap, gunpowder, &c.

SUPPLE. To fupp the horfe in the manege, is to make him bend his neck, shoulders, and fides, 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 femicircle: 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.

Supplicium has written divers supplements, to restore the books of several ancient authors, part of which had been loft. 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 witnefs (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 adminifler to him what is called the supplery oath; and if his evidence happens to be in his own favour, this immediately converts the half proof into a whole one. Blackli. Com. vol. iii.

SUPPLICATION, SUPPLICATION, in Antiquity, a religious folemnity obferved on account of some remarkable fuccesfs against an enemy; and efpecially when the army had conferred the title of imperator on their general, in whole 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 imperator fent meffengers crowned with laurel with letters to the facade, which were likewise adorned with laurel, to demand of them the title of imperator, and the honour of a fupplication. This folemnity conftituted in sacrificing and fefting in the temples, with giving thanks to the gods for fuccesfs obtained, and praying for the continuance of their afliance. At firft there were only a few days taken up in fuch fefcalia; but afterwards they were increased gradually, till they came to ro less than fifty. On fubdue the Sabines, in the year of the city 304, a fupplication of one day only was ordained; on the taking of Veii, Camillus had a fupplication of four days deere him; Pompey had twelve on putting an end to the Mithridatic war; Caesar had fifteen, and afterwards twenty, for reducing Gaul: Octavianus and Pafuo had fifty days of fupplication for delivering the colony of Mutina.

SUPPLICAVIT, in Law, a writ, influing out of the court of king's bench, or chancery, for taking furry of the peace when one is in danger of being hurt in his body by another.

Vol. XXXIV.
SUPPLIES, called also aids and subsidies, 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 ways 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 propose 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 mended man will scruple to advance to the government any quantity of ready cash, on the credit of a bare vote of the house of commons, though no law be yet passed to entitle 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 Blackburne, 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 when once influenced 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. Blackfi. Com. vol. 1.

**SUPPLY, in Ser. Languages, a freeth rent of provisions or flores lent to a flum 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 interfering matter: but 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 busines, 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, shew 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

<table>
<thead>
<tr>
<th>Produce</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat and flour</td>
<td>182,021</td>
</tr>
<tr>
<td>Barley and malt</td>
<td>66,455</td>
</tr>
<tr>
<td>Oats and oatmeal</td>
<td>82,661</td>
</tr>
<tr>
<td>Rye</td>
<td>29,799</td>
</tr>
<tr>
<td>Pea and beans</td>
<td>41,248</td>
</tr>
</tbody>
</table>

The whole of the annual average imports exceeded the exports by 1,145,584

<table>
<thead>
<tr>
<th>Produce</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat and flour</td>
<td>409,666</td>
</tr>
<tr>
<td>Barley and malt</td>
<td>33,351</td>
</tr>
<tr>
<td>Oats and oatmeal</td>
<td>618,643</td>
</tr>
<tr>
<td>Rye</td>
<td>44,899</td>
</tr>
<tr>
<td>Pea and beans</td>
<td>23,772</td>
</tr>
</tbody>
</table>

The whole of the annual average imports exceeded the exports by 1,191,131

The average of the paid 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 2,269,346 qrs. of corn, we shall discover, it is paid, that the average of the eleven years was annually 1,268,452. This quantity is equal to the bread-corn of nearly as many persons; or to the entire produce of (in acres of land) 423,600

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 156,000

Hedge-rows, scite of buildings, yards, roads, ponds, gravel-pits, &c. 70,000

Allow for inferiority of quality between commons and old inclosures; one-fifth of 790,000 is 158,000; but lay only 150,000

1,010,000

The average quantity and price of all sorts of grain may be found thus:

<table>
<thead>
<tr>
<th>Produce</th>
<th>Acres</th>
<th>Qrs.</th>
<th>Qts.</th>
<th>L.</th>
<th>L. s. d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>6</td>
<td>2,217</td>
<td>7</td>
<td>12</td>
<td>13 0</td>
</tr>
<tr>
<td>Barley and</td>
<td>1</td>
<td>3</td>
<td>15</td>
<td>3</td>
<td>7 6</td>
</tr>
<tr>
<td>Rye</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>21</td>
<td>10 0</td>
</tr>
<tr>
<td>Oats and beans</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>21</td>
<td>10 0</td>
</tr>
</tbody>
</table>

Dividing 17½ qrs. by 6 acres, gives a bare 3 qrs. per acre; and dividing 26½, 10s. 6d. by 17½ qrs. gives a bare 30s. per quarter, that is, 5 qrs. at 30s. is a full average of the corn, exclusive of the straw, feed, and waife. The proportion which the number of acres bears in each foot of grain, will be seen below.

It
SUPPLY.

It is further noticed, that the whole deficiency during the said 11 years, was not less annually than that which could be grown by cultivating our common, 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 dearth became so great as to occasion the death of about 100,000 inhabitants. The present system of parcelling local acts, every section of parliament, for enclaving a few thousand acres of waste land, is altogether, it is thought, unequal to the task of warding off the return of dearth, 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>£1,983,856</td>
</tr>
<tr>
<td>1795</td>
<td>£1,535,672</td>
</tr>
<tr>
<td>1796</td>
<td>£3,920,484</td>
</tr>
</tbody>
</table>

In the three years was paid £7,447,012

Average annually £2,482,004

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 20,000,000 herling 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 dry, and waste, I can impute it to little less than to a species 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 horeses and sheep, which are kept or made use of; the quantity of animal food; and the various other products of the soil which are cultivated, together with the weight and value of wood; and the total amount of all sorts of agricultural produce.

It is laid, 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 bell opinion appears to be, that all those who eat wheaten bread, confume annually eight Winchelter 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 equivalent, it is thought, to the average net produce of half an acre of land; that is, after deducting feed, los by vermin, accidents, &c. from the gross produce, the remaining net quantity is 16 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

1. Nine million inhabitants confluence the corn which grows on

2. Half an acre of land in Great Britain, rather upwards of 500,000 quarters of barley are, it is said, used in this manufacture, 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

Distillery.—In the whole of Great Britain, rather upwards of 500,000 quarters of barley are, it is said, used in this manufacture, 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

Bread and spirits exported, the produce of—

<table>
<thead>
<tr>
<th>Item</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land employs about one horse to every 15 acres, which on 15,000,000 acres</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Grazing land employs one horse to every 100 acres, which, on 20,000,000 acres, is</td>
<td>200,000</td>
</tr>
<tr>
<td>Number of horses used in agriculture</td>
<td></td>
</tr>
<tr>
<td>Horses kept for pleasure, and taxed</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Pea-fallow horses, mail-coach horses, stage-coach horses, hackney-coach horses, &amp;c. supposed to be about</td>
<td>200,000</td>
</tr>
<tr>
<td>Horses used in waggoners, carts, in mills, canals, and navigable rivers, in caravans, and for all the other purposes of draught, not before described</td>
<td>240,000</td>
</tr>
<tr>
<td>Cavalry of all the various descriptions</td>
<td>60,000</td>
</tr>
<tr>
<td>Number of horses not used in agriculture proper</td>
<td>600,000</td>
</tr>
<tr>
<td>Total number of horses</td>
<td>1,800,000</td>
</tr>
</tbody>
</table>

Carry forward | 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 druggists, canary-feeds for birds, and with dyers', physic and culinary herbs; cultivated by the plough... 
Clove, rye-grafs, &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 possibly 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-tenths divided by 3, gives us for
  fallow 2, wheat 2, oats and beans 2, together 
Second position, 3-tenths divided by 4, shews 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-tenth divided by 3, produces for oats and beans 0.5, roots 0.25, and clover 0.25, together 
General proportion, fallow 2, wheat 0.75, oats and beans 0.5, barley and rye 0.75, roots 0.25, clover 0.25, 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>Crop</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2,575,000</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>Clovers</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Fallow</td>
<td>3,000,000</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 six 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>Crop</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>4,125,000</td>
</tr>
<tr>
<td>Barley and rye</td>
<td>1,525,000</td>
</tr>
<tr>
<td>Oats and beans</td>
<td>3,750,000</td>
</tr>
</tbody>
</table>

Carry forward 9,000,000

Brought forward 5,020,000
3,600,000
1,500,000

Clove, rye-grafs, &c., one year's lay, 15,000,000
Turnips and other roots, 1,500,000
The arable land, producing at least one crop annually, 12,000,000
Fallow, as aforesaid, 3,000,000

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 clear year was 1787, being a period of 14 years; and the average produce of these 14 years was 8937.5 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 8937.5 tons could not have been continued. The average product of 12 years, ending with the year 1800, has been 9668 tons; therefore the consumption in this latter period must have increased 207 tons, and they are now much more on the decline, as drugs are used for the purpose of curing beer, in lieu of hops,

Nurture grounds about 1000
Fruit and kitchen gardens cultivated by the ippe 50,000
Pleasure-grounds, the dressed and unprofitable parts only, the rest being either patured by cattle, or mown for hay; plantations, belts, and clumps 25,000
Land departed by cattle; lays of more than one year; meadow of natural grasses, meadow of sown grasses, and water-meadow and orchards on grass-land, which includes the cider counties 20,000,000

This quantity of grass-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.

<table>
<thead>
<tr>
<th>Description</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated land in England and Wales</td>
<td>39,100,000</td>
</tr>
<tr>
<td>Commons and waste land</td>
<td>7,816,000</td>
</tr>
<tr>
<td><strong>Total in England and Wales</strong></td>
<td>46,916,000</td>
</tr>
<tr>
<td>Horse-food equivalent to 1,500,000 horses, at 5 acres each</td>
<td>7,200,000</td>
</tr>
<tr>
<td>Fellows</td>
<td>3,000,000</td>
</tr>
<tr>
<td>Ways, waters, buildings, &amp;c.</td>
<td>1,980,000</td>
</tr>
<tr>
<td>Pleasure-grounds</td>
<td>25,000</td>
</tr>
<tr>
<td>Manufactures, vermin, damp, muft, &amp;c.</td>
<td>80,000</td>
</tr>
<tr>
<td>Nursery-grounds</td>
<td>10,000</td>
</tr>
<tr>
<td>Hedge-rows, copses, woods</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Druggists' physical herbs, roots, &amp;c.</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Commons</strong></td>
<td>14,305,000</td>
</tr>
<tr>
<td><strong>Together</strong></td>
<td>22,121,000</td>
</tr>
</tbody>
</table>

#### For Middlesex

<table>
<thead>
<tr>
<th>Description</th>
<th>Stone</th>
</tr>
</thead>
<tbody>
<tr>
<td>100,000 sheep, at 10 ft. each, is</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Lambs 3½, calves 2½, hogs and pies 2, together</td>
<td>7,000,000</td>
</tr>
<tr>
<td>Poultry, game, and fih, ½ths; dairy, ½ths</td>
<td>7,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25,100,000</td>
</tr>
</tbody>
</table>

which divided amongst 818,129 inhabitants, is 30 ft. 5 lbs. or 245 lbs., which clothing upwards of 8l. 3l. each peron.

#### For England and Wales

<table>
<thead>
<tr>
<th>Description</th>
<th>Stone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000,000 bullocks, at 9 ft. each, is</td>
<td>90,000,000</td>
</tr>
<tr>
<td>Lambs 8, calves 8, swine, fih, poultry, game and dairy, 24; together</td>
<td>81,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>211,000,000</td>
</tr>
</tbody>
</table>

which, at 4½. 6d. a thone (offal included in the price, but not in the weight), amounts to 47,450,000; 487½ per annum; which being divided among 9,000,000 of inhabitants, is 23 ft. 3½ lbs. or 18½ lbs.; and being priced in the same manner, amounts to 5½. 5½. 5½ per head, the mean nearly to 3½ ft. 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 6,000,000. 5. 5. per annum, which is the total produce of the whole quantity of wool, and it will be seen that we have of block sheep 35,000,000. It is apprehended that they consist nearly of

<table>
<thead>
<tr>
<th>Description</th>
<th>Stone</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,000,000 breeding-ewes, which bring as many lambs. The former are killed off at an average of five</td>
<td>2,400,000</td>
</tr>
<tr>
<td>23,000,000 other sheep, which are killed off at an average of three years, or annually</td>
<td>7,600,000</td>
</tr>
<tr>
<td>35,000,000 Total number of sheep. Of which are killed annually</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Lambs slaughtered</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Lambs and sheep die carrion (principally from the rot) one in twenty-five of the last two numbers</td>
<td>500,000</td>
</tr>
<tr>
<td>Yearly increase and decrease</td>
<td>13,000,000</td>
</tr>
</tbody>
</table>

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-grounds, at 3l. is</td>
<td>115,000,000</td>
</tr>
<tr>
<td>10,000 of nurseries, at from 5l. to 10l. for 100. is at only 5l. is</td>
<td>500,000</td>
</tr>
<tr>
<td>50,000 of garden-ground cultivated by the spade, at from 5l. to 10l. is at only 5l. 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 10s.</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>
</tbody>
</table>

46,916,000 the whole quantity of land, the produce of which is

Which colts in labour, artificers, and horse-keep

Remains net increase in value on the produce of the land per annum

Of which, it is said, the landlords take

The state, in taxes and tithes

And the farmers are permitted to share the remaining

which is all they receive in return for interest of capital, skill, industry, and attention.

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 face 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 which 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 of division in some degree); yet the supply and consumption of their population may be figured, when estimated on the same principles as the above, to require as below.

Carry forward 27,274,500

The former having, it is supposed, a population of 1,805,088, will, for its supply and support, stand in need of about the produce of

The latter, as containing, it is believed, a population of about 5,500,000, will demand for their supply and consumption the produce of

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

As, however, the supply and consumption in these two 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 these 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'S Passage, in Geography, a channel of the South Pacific ocean, between Sirius island and Queen Charlotte's island, so named by Jean. Ball, who commanded the Supply shore-ship, in 1790.

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 lying 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 coifes.

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. Menéndez traces their origin to the ancient tournaments, in which the knights called their shields to be carried by servitors 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 lifts were opened. But for G. Mackenzie says, that the first origin and use of them are derived from the custom of leading such as are inviolate 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 chooses.

The supporters of the arms of the a lion, and an unicorn; some of the former kings have had a leopard, and an unicorn; others, griffons, 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 Urfini, bears; in allusion to their names.

In England, supporters are the prerogative, first, of those called nobles majors, 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 bestow this honour upon. 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 Crows.

The Germans permit none but princes and noblemen of rank to bear them; among the French, the use of them is more promiscuous.

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.

SUPPOSITORY. See MEDIUM.

SUPPOSITION, in Arithmetic. See Position.

SUPPOSITION, in Music. Rouelle says very truly, that this technical term has two distinct senses: the first is when many notes ascend or descend diatonically in one part to a single note in another. At such time, these diatonic notes cannot all be in harmony, nor belong to the same chord. Some are, therefore, disregarded in the harmony; and these are what go under the title of notes by supposition. (See Passing Notes, where the article is confined to melody, and chiefly drawn from Dr. Pepusch.) But in the second use of the word supposition, by the French in Rouelle's article, the word is applied to harmony; where he tells us, that chords are said to be by supposition, when the continued base or violoncello acts as a treble, and plays notes above or below the fundamental base. The dissonances in chords by supposition ought to be prepared by fyncope, or driving notes, and resolved in descending diatonically on a concord; and in this sense, chords by supposition may pass for pure suspensions. See Suspension.

There are other kinds of chords by supposition; all chords of the 7th.—We do not very well understand the combinations which Rouelle has given for chords by supposition, nor will English readers understand the French technical language in which he explains these chords.

What we understand to be chords by supposition, are chords played by anticipation to the first of two notes, instead of the second, or to a kind of appoggiatura.

Chords by supposition, therefore, in Rouelle, in the Supplement to the folio Encyclopédie, and in Dr. Pepusch's 7ths, prepared and resolved in the base, are nothing more than chords of the ² and ⁷, though so much parade and pains have been bestowed in explaining them. They are played to appoggiaturas in large notes of the baso continuo, or violoncello base, made a treble part, while the fundamental base is stationary.

SUPPOSITIOUS BIRTHS. See Bastards.

SUPPOSITORY, a preparation of salt, honey, &c. which is introduced into the rectum, in order to procure froth. Medicinal compositions are also thus applied, with a view of acting upon local diseasises of the bowels.

SUPPRESSION, formed from sup, and remo, I prefix 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 obstruccion or stoppage of the usual outlet.
SUP

We say, a suppersion of urine, of the menes, &c. See Ischuria, Urine, Menses, &c.

Suppression of Urine. There are commemorated in the Philosophical Transactions three cases of an actual and total suppression of urine, supposed to proceed from a stone lodged in the neck of the bladder; but in all which, upon 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 consequence 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 farther use of medicines. Philos. Trans. N° 253.

A suppersion of urine sometimes happens to women with child, by the womb falling down, and pressing on the urethra.

It is also occasioned by an inflammation of the bladder, a swelling of the membranous veins, hard fceces lodged in the rectum, a stone in the bladder, excrescences in the urinary passages, a palsy of the bladder, hysteric affections, &c., each of which cases requires a particular treatment. It may be observed, in general, that in all of these, mild and gentle applications are the safest; as strong diuretics, 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 process 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 held with reiterated flourings; 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 mole elevated part of the tumour appears soft and white, while the rest has its redness increased; and when, at the same time, the surgeon can feel the fluctuation 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 Abscess, &c.

With respect to the theory of suppuration, it may be observed, that the exposure of the internal surface 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 circumscribed cavities, without a wound, the air cannot be suspected as a cause; nor does the air, in emphysematous cases, 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 floughs 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 delusive of foundation. The discharge of pus from secreting surfaces, without any loos of substance; the stationary rate of many abscesses; the backwardness of matter to become putrid, while exposed 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 circumscribed cavities, the vellips alter their mode of action, so as to secrete pus. This 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 solids, or dissolution of parts, was first noticed by the celebrated Dr. William Hunter, in the year 1749 or 1750. The circumstance was remarked in the diminution of a subject, who died of empyema. M. Crevoy has also inferred, in the Memoirs of the French Academy of Surgery, a case, 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 proportion 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 solids, but from the fluids of the part. See Remarques sur les Plaies du Cerveau, tom. ii. p. 163, edit. in 12mo.

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 solids never suffer any dissolution, 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 so dissimilar from blood, and of which at least it must be considered as a new combination, seem to assume all the power of glandular secretion. Cooper's First Lines of Surgery, chap. 3d. 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, melilot, lily-roots, dyschylion, pellitory, figs, aromatic gums, meals, &c.

Supputation. See Computation.

Supra, in Music. See Epit and Hyper.

Supracostales, in Anatomy, the levatores costarum muscles. See Intercostal Muscles.

Supradecomposite, in Botany and Vegetable Physiology, is a term applied to a leaf, or a panicule, which is more than twice compound or subdivided. See Leaf, Inflorescence, and Panicule.

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, supra lapsum, antecedently to any knowledge of the fall of Adam, and independently of it, to save some, and damn 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.
SUP

salvation of others; and for that purpose decreed that Adam should necessarily fall, and by that fall bring hu-
man-kind, and all his offspring, into a state of everlasting con-
damnation.

There are also called antelapflari tie; and are opposed to
sublapflaries and infralapflaries.

According to the Supralapflarians, the object of predestina-
tion is homo creatus & lability; and, according to the
Sublapflarians and Infralapflarians, homo creatus & lapflus.

SUPRASCAPULAR, in Anatomy, a name applied to
some parts about the scapula, viz. to a notch in the
upper edge of the bone, and to a nerve and artery which go
through it.

SUPRASL, in Geography, a town of Lithuania; 21
miles S. of S.

SUPRASPINATUS, (sur-spinous, fus-spini-scapulo-
trochiterion,) in Anatomy, a muscle of an elongated
triangular figure, situated at the upper and back part of
the shoulder, where it fills the suprapsinal fossa, extending
from the base of the scapula to the great tubercle of the
humerus. Its outer or posterior surface is covered by a thin aponeu-
ronus, which is extended from the spine of the scapula to its
superior cornua; by the trapezius, from which it is separated
by copious cellular tissue; and externally by the deltoid,
the acromion, and the triangular ligament, interposed between
the acromion and the coracoid process. The anterior or inner
surface covers the dorsum of the scapula, having its
fibres attached to the posterior two-thirds, and separated
from the anterior third by the suprascapular nerve and
veffels. Beyond the scapula it covers the orbicular ligament
of the humerus, adhering to it very strongly. The superior
dge is attached to the upper margin of the scapula, and
projects a little beyond it. The inferior is fixed to the
upper flat surface of the spine; beyond which eminence it
is parallel to the superior margin of the infraspinatus. The
basis of the triangle described by the supraspinatus is at-
tached to the base of the scapula, from the commencement of
the spine to the superior angle. From that point the muscle
advances towards the shoulder-joint, becoming gradually
narrower: it then goes under the arch formed by the acro-
mon and clavicle, forms a little downwards over the head
of the humerus, and is attached, by its anterior extremity,
to the front of the great tubercle of that bone. This
attachment takes place by means of a tendon closely united
to that of the infraspinatus: it is first narrow and thick,
and then expands into an aponeurosis, which penetrates into
the muscle, receiving the fibrous fibres in all directions: some
of these come from the aponeurosis, which covers the
muscle. It afflicts the deltoid in elevating the humerus; but
cannot act with much effect, because its insertion is so near
the centre of motion.

SUPREMACY, in the English Polity, the superiority
or sovereignty of the king over the church, as well as
state, of England, of which he is established head. See
KING.

The king's supremacy was first established, or, as others
say, recovered, by king Henry VIII. in 1534, after break-
VIII. c. 21. 26 Hen. VIII. c. 1. 35 Hen. VIII. c. 3.
1 Ed. VI. c. 12. 1 Eliz. c. i. It is hence 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
an accesty qualification for all offices and emplacements,
both in church and state, from persons to be ordained, from
the members of both houses of parliament, &c. See Oath
and Coronation Oath.

This oath, as finally established by 1 W. c. 8. is as
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S U R

follows: "I, A. B. do swear, that I do from my heart
abjure, detest, and abjure, as impious and heretical, that
damnable doctrine and position, that princes excommuni-
cated or deposed by the pope, or any authority of the see
of Rome, may be deposed or murdered by their subjects,
or any other whatsoever. And I do declare, that no foreign
prince, person, prelate, state, or potentate, hath or ought
to have any jurisdiction, power, superiority, pre-eminence,
or authority, ecclesiastical or spiritual, within this realm.
So help me God." By Stat. 5 Eliz. c. 1. to refuse the
oath of supremacy will incur the pains of premunire; which
fee. By the 31 Geo. III. c. 32. no person shall be sum-
momed to take the oath of supremacy, or be prosecuted for
not obeying such summons; but Roman Catholics, in
order to enjoy the benefits of that act, and to take the oath
pre-
scribed by it. See Papists, Popery, and Toleration.

This right of supremacy conficts chiefly in the following
articles: 1. That the archbishops of either province cannot
summon the bishops and clergy to convocation, or enact any
canons, without the king's express consent, by 25 Hen.
VIII. c. 19. whereas, before that act, the convocation was often
called, and laws made by it for governing the church,
without any authority from the crown.

2. In that there lies now an appeal from the archbishop
to the king in chancery; and, on such an appeal, a com-
miffion, under the seal, is to be directed to certain persons,
of which commonly half are laymen, and half clergy-
men, which is called the Court of Delegates, (which fee,)
and which finally determines all ecclesiastical causes, by
25 Hen. VIII. c. 19. though sometimes a review is granted.
Before this statute, the appeal from the archbishop's court
lay to the pope only.

3. The king can grant commissions for visiting such
places as are exempt from the jurisdiction of bishops, or
archbishops; and appeals lie from thence to the king in
chancery: whereas before 25 Hen. VIII. the pope only
could visit them, and receive appeals from those courts.

4. Persons in holy orders are not, as formerly, exempt
from the king's temporal laws, any more than laymen.

5. The bishops and clergy do not swear, or pay any
obedience to the pope; but must take the oaths of alle-
giance and supremacy to the king.

SUPREME PEAR, a name given by the gardeners to
a small pear, called also by some the little stuff pear. It
is of a roundish shape, and is usually produced in clusters;
the stalk is short, and when it is ripe, the skin is yellow;
the juice is somewhat mucilag. If it be not suffered to hang
till too ripe, it is an excellent pear. It ripens in the
beginning of July, and continues but a few days. The
French call it le petit muflet.

SUR, or SOUR, in Geography, a town or rather village of
Syria, in the pachalic of Saide or of Acre; for the ancient
state of which, see Tyre. In this name, says Volney, we
recognize that of Tyre, which we receive from the Latins;
but if we recollect that the y was formerly pronounced eu,
and observe, that the Latins have substituted the 5 for the
6 of the Greek, and that the 5 had the sound of the English
sh in the word thank, we shaall be left surprized at the alter-
ation. This has not happened among the Orientals, who
have always called this place " Tioue" and " Sour."

Sour is situated on a peninsula, which projects from the
shore into the sea, in the form of a mallet with an oval head.
This is a flat rock, covered with a brown cultivable
earth, which forms a small plain of about right hundred
paces long, by four hundred broad. The littlus, which
joins this plain to the continent, is of pure sea-landy. This
difference of soil renders the ancient insular state of the
plain,
plain, before Alexander joined it to the shore by a mole, very manifest, since it is plain that the sea, by covering this mole with sand, has enlarged it by successive accumulations, and formed the present illium. The village of Sour is situated at the junction of this illium with the ancient island, of which it does not cover above one-third. The point to the north is occupied by a haven, which was a port evidently formed by art, but is at present so choked 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 flut the harbour. From these towers began a line of walls, which, after surrounding the haven, enclosed the whole illium; 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 Motoulas 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 more safety than at Saïde; they are not, however, free from danger, for they are exposed to the north-west winds, and the bottom injuries the cables. That part of the illium 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 south side is sandy, and more covered with rubbish. The whole village contains only fifty or sixty poor families, which live but indifferently on the produce of their little grounds, and a trifling fishery. The houles they occupy are no longer, as in the time of Strabo, edifices of three or four storeys high, but wretched huts, ready to crumble to pieces. Formerly they were defended for the land, but the Motoulas, 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: clofe to which, amid heaps of stones, lie two beautiful columns, with shafts of red granite, of a kind unknown in Syria. Djezzar, who has flripped 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 illium, 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 became troubled in September, and continues some days full of a reddish clay. This feaon 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 proceeded along the illium, towards the continent, we perceive, at equal distances, the ruins of arches, which lead their right line to an eminence, the only one in the plain. This hill is not factitious, 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 there but a houle in ruins, and the tomb of a fish or fanton, 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 arcade become more numerous, and are not so high; they terminate by a continued line, and, at the foot of the rock, form suddenly a right angle to the south, and proceed obliquely towards the sea: we may follow their direction for above an hour's walk at a horie's pace, till, at length, we distinctly perceive, by the channel on the arches, that this is no other than an aqueduct. This channel is three feet wide, by two and a half deep; and is formed of a 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-tun, 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 stone, 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 surprizing; for, instead of finding the water low, or no higher than the ground level, it reaches to the top; that is, the column which fills the well is fifteen feet in height. Besides this, the water is not calm, but bubbles up with violence, and rushes through channels contrived at the surface of the well. It is so 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 Roque afferts, that he found it at fix 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 reeds 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 illium, to the tower, whence the water was drawn. The circumjacent country is a plain of about two leagues wide, surrounded by a chain of considerably high mountains, which stretch from Kafmie 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 facks 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. 33° 13'. E. long. 35° 13'. Volney's Travels in Egypt and Syria, vol. ii. For the history of ancient Tyre, see Tyre.

SOUR. See TSOR.

SOUR, 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 lugur, but it is little esteemed.

Sura, in Anatomy, the calf of the leg.

Sura, in Geography, a town of Athletic Turkey, in the province of Driuirker, on the Euphrates; 55 miles S. of Rahabe.-Alfo, a town of the Arabian Irak, on the Euphrates; 150 miles N.N.W. of Balcara.-Alfo, a town of Sweden, in Vettmanland; 15 miles N. of Stroemholl.

-Alfo, a river of Norway, in the province of Drintsm. which runs into the North sea, opposite to Christianland.

-Alfo,
Among 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. Afura, or Alloor, is the name of a malevolent race, opposed to the Sura; the initial letter being private in the Sanscrit tongue, and Sura meaning good. It seems to be a generic term, comprising several species of benevolent genii; such as Gandharva, Kinnara, Dunhadi, Pupha-ruthi, Sina, Upfara, &c. who appear to be celestial choristers, dancers, mountain nymphs, flower-flowers, nereids, &c. Among the Afuras may be classed the Daityas, (offspring of Diti and Ka-tysa,) Rakhia, Yakhia, Pitri, Darsua, (offspring of Dauh,) &c.

The Suras, it is suggested, are flars of the northern hemisphere, and the Afuras of the southern. The Hindoo writings abound in allusions to their ilate of continued warfare, and it seems probable, so prone are the Hindoos to physical as well as moral perfonification, that such fables are of an astronornical nature, and relate to the rising and setting, and other phenomena, of flars in the two, or fupposed light and dark, hemispheres.

Sura appears alo to mean fermented liquors, or spirituous liquors, and Afura such as reject them. This has not hitherto been explained. The first book of the Ramayana contains the well-known and popular allegory of churning 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 Suradevi, goddes of wine. (See Suradevi.) Sura is likewise a name of Surya, the regent, or a perfonification of the sun. (See Surya.) Hence has arisen some apparent confusion in affixing to Sura the regency of both wine and wealth, and in regard to the latter, of intellectual wealth; for the Veda is reprefented 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 myths fay 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, Om, and Veda.

Surabhi, in Hindoo Mythological Romance, 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 conversation of the Hindoos. Her origin is of course equally miraculous with her deeds. She is fabled to have arisen from the sea, when charmed 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 "similarly beautiful," read "similarly bountiful." An influence of her bountiy may be seen in our article Jambangi. A Hindoo poet having occasion to mention the wealth or munificence of an individual of ancient days, is very likely to express it by saying, that "Indra had enfrouted him with Surabhi, the cow yielding all that the heart can desire," as we find said of the munificent prince Jamadagni. Indra, the regent of the firmament, is the sup posed possessor of the boon-granting cow, and is hence, probably, called lord of wealth. See Indra.

Among a pastoral people, whose latale 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 Brahmins and others to feed a cow before they take their own breakfast, offering ejaculations of a pious and benevolent tenor.

The Hindoos hope to obtain the favour of the boon-granting cow, by feeding kindreds 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 intances of affectionate tenderness for cows and calves, on the parts especially of individuals of the sects of Brahan and Bania. See Sects of Hindoos.

In marriage ceremonies, a cow, as representative of Surabhi, the granter of desires, the emblem of fruitful love, is one of the actors. The hospitable rites are concluded by letting loose a cow at the intercession of a guelt. A barber, who attends for that purpose, exclaims "The cow! the cow! upon which the guelt pronounces this text: " Relefe the cow from the fetters of Varuna. May the labudc my foe: may he destroy the enemies of both him (the host) and me. Dismifs the cow, that she may eat grass and drink water." When the cow has been released, the guelt thus addresses her: "I have earnestly entertained this prudent perfon, faying, kill not the innocent harmlcws cow, who is mother of Rudras, daughter of Vafus, fitter of Adityas, the fource of Umrita, or Ambrosia, &c." Mr. Colbroke, in his "Essay on the Religious Ceremonies of the Hindoos," A4. Ref. vol. vii. remarks on the above paffage, that "the guelt's intercession evidently imply a practice, now become obfolute, of faying a cow for the purpofes of hospitality."

A cow, the reader will perceive, is no unimportant mythological perfonage; nor is the bull; the latter we have spoken of in another place, as the vehicle of the Hindoo god Siva, and the fymbol of divine justice. (See Siva.) Thefe fuperflitious are not confined to India, though they probably originated there. Similar honours were paid to the fymbolical 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 adored a most prolific 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 lefts abhorrence of killing kine than many fea now feel on that point. Ancient books prefer the faying of kine, as well as other animals. It must be allowed, however, that the very ancient code of laws called the Infitutes of Menu, (fee Menu,) lays down very feveral penances for faying a cow, even without malice. These are in chap. xi. of that curious work, verfs 190 and following. The extreme utility of the cow and bullock in well-peopled and agricultural countries, will almost necfly give rise to a repugnance at faying them, which will, in no long time, grow to stronger prohibitive feelings, and at length be stamped with the fanction of holines. Here we fee, what we in many cafes fuppofe, that mythology and religion inculcate principles grounded originally on the conveniences and wants of mankind. Of this, the reverence paid to the ichneumon by the Egyptians is an example. (See Ichneumon.) And the sacrifces of the falcon, called by the English the Brahmany kite, in India, is another. See Superna.

Suraca, in Geography, a town of the island of Samos; 4 miles S.W. of Cora.

Suradevi, in Hindoo Mythology, is the name of the goddess of wine, or of strong drinks; but however often they may be sacrificed to, she is very rarely heard of, and her name rarely occurs in Hindoo writings. Her origin from
SUR

from the sea, when charmed by gods and demons to obtain certain precious articles, is noticed under our article Kur-

mavatara. See also Sura.

Sura'djie, in Geography, a town of Arabia, in the province of Yemen; 16 miles E.S.E. of Doran.

Sura'es, or Karwan Sureau, a name given in Peru to buildings constructed for the accommodation of travellers. They are more commodious than the "choutries" 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 muleteer to collect all the dirt which has been made, and on his leaving the furae, to set it on fire, so that the stables are kept tolerably clean.

Sura'jabad, in Geography, a town of Bengal; 16 miles S. of Dacca.

Sura'jeeunun, a town of Hindoostan, in the circuit of Ellichpoure; 12 miles W. of Ellichpoure.

Sura'jepper, a town of Hindostan, in Oude, on the Gogra; 17 miles S. of Gooracpour.—Alfo, a town in the circuit of Schurumpour; 25 miles S. of Merat.—Alfo, a town in Oude; 15 miles E. of Corah.—Alfo, a town of Oude, on the Ganj; 25 miles N.N.W. of Furreckabad.

Sura'jeputty, a town of Hindoostan, in Bahr; 15 miles W. of Durbungah.

Sura'jurràh, a town of Hindoostan, in Bahr; 15 miles S.W. of Monghir.

Sura'les Musculi, in Anatomy, the gastrocnemius and soleus, which make up the chief bulk of the calf.

Sura'm, in Geography, a town of the principality of Georgia, on the frontiers of Imirettia, anciently a city of Colchis, and called Surim by Pliny; 30 miles W.N.W. of Teflis.

Sura'mi, a town and fortress of Georgia, in the province of Carduel; 24 miles W.S.W. of Gori.

Sura'n, a town of Perfia, in the province of Khorasan; 35 miles N. of Maru.—Alfo, a river of Ruffia, which runs into the Viatka; 32 miles N.E. of Slohodjiko, in the government of Viatka.—Alfo, a town of Hungary, formerly strong, but now defenseless; 4 miles N.E. of Neuheulfe.

Sura'nuh, in Mythology, the wife of Surya, the Hindoo Phebus, a regent of the sun. She is fabled as the daughter of Twafhta, the engineer of the gods, who is found to correspond in many points with the Vulcan of the Greeks. See Twashta, and Surya.

Suras, in Geography, a town of Austrian Poland; 15 miles N. of Lublin.

Sura't, a city of Hindoostan, in the province of Guzerat, situated in a large and fertile plain on the left or south bank of a considerable river, named "Tappi," which fea. 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 outermost, 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 shore 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 thickness, and which, at the height of eight feet, is reduced to about half its thickness, 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 pikes. It is, as Stavrovius says, almost the only defence which the place poffeffes; the semi-circular bastions cut out from the walls, and planted with a few cannon, and the bulwarks, or fcones, 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 Naffary-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 are as 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 exported must be carried through this gate, in order that the customs may not be defrauded. Close to the inner walls are several high and narrow spires, round which are balconies, called by the Turks minarets, and serving for the purpose of calling the Mahometans to prayer. Although Surat has been long under the dominion of the Mahometan Moguls, it has no handsome mosque with turrets, such as often occurs among the Turks and Abirans. The space included between 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 kilns. Few good houses are found either in the inner towns or the suburbs; but small huts, made of bamboo and plastered with mud, often occur. In one division or ward, indeed, leading to the Delhi-gate, there are none but stone-buildings, which have a tolerably handsome appearance. The larger houses are flat-roofed, and have courts before them; but the houses of the common people are high-roofed. The squares of the city are spacious; but the streets are, in general, unpaved, narrow, and irregular, 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 in point of cleanliness by the native inhabitants, who throw every kind of filth into the middle of the road, and feldom or ever remove the accumulating dung-hills. Each street has its own gates, which are shut up in times of turbulence; and these, 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 Moguls, on the confines of Guzerat. 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 Durbur; 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 building, surrounded by a high wall. The lodges, or factories, of foreign nations, viz. of the Portuguese, French, English, and Dutch, are situated in the inner town; and each have what they call a wharf in the fuburb. Surat has two caravanseras, but it had formerly a greater number, which were liberally supported. Its mosques are scarcely adequate to be mentioned. Its bazars, or market-places, are numerous, and much frequented; and it has also a great number of retail-shops. The "Mehan," called the Caffle-gram, on account of the vicinity 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 paling 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, half-built, constructed of wood, and closed with mats of palm-leaves, in which private goods were formerly housed.

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 always brackish.
Surat.

brackish, if this inconvenience were not remedied by a number of deep wells, lined with brick, from which water is brought by oxen in leather 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, 2° farther to the S., it frost, in the month of May, at 93°.

The trade of Surat finds obstructions from the harbour, which ships cannot enter, because the Tappao is full of sandbanks. 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 Asia are impediments to all improvements for the general good.

General toleration and unmolested liberty are here granted to perverts 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 for the care of 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 here 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 laid 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, or 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 want of other manure. The cow and horse dung is either used for fuel, or for other purposes. The chief products of the fields are wheat, millet, or a grain serving the purpose of rice, and growing in bunches like maize; rice, also a shrub, yielding a fruit from which is expressed an oil that is used for lams, 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 forells 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 Gentoos, and under the shade of which they therefore build their pagodas or temples. Culinary vegetables are plentiful here. Beef is good and fat, and fo are also 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 houfes 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 50,000 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, and so blocked up by doors, as to afford a striking instance of the diftrust 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 a scarcely a tomb without lofty spires, and the meanest has a grave-stone with a sculptured epitaph. These burial-places are surrounded by a high wall, and cover, as Stavlorinus 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 various in the obstinacy of their local customs, 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 Hafien. 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 Mufulmans of Surat bring about them many fables of their own religion from the interior parts of the country. (See FAKIR.) The Hindus, 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 Baniats; and hence their skill and dexterity in matters of calculation and economy often raise them to places of considerabletrust, in the collection of the taxes and customs for the Mahometans. These Baniats, 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 Baniats, 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 dreds only a plain robe of white cotton. At Surat are numbers of Perfes, or Persians, who are skilful merchants, industrious artisans, and good servants. (See PERSERS.) In the same city are also Armenians, Georgians, and Jews, but not in considerable numbers. The Indian Catholics, commonly called Portugalues, from their speaking the Indian dialect of the Portugalue 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 sunset to sunset, and is divided, not into twenty-four hours, but into sixty garris. 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 garris is counted, and the man announces its lapse, by striking the number which it makes upon a plate of metal, that sounds like
like a clock. Each ‘garri’ consists of 24 of our minutes. In the houses 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 nabur (which see.) The silver rupee is the standard coin. (See Rupee.) The only copper coin is the pice (which see.) Almonds are also laid 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 60 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 alfy. 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 gen, and 8 telfoc, the gen being 24 telfoc: the standard of Surat is 1½ Dutch ell. Distances are reckoned by c Calendar (which see.) The carriages most common here, as well as in other parts of India, are the hackeries or kalkies, which are drawn by oxen, and run upon two wheels; the oxen being on particular occasions much ornamented. At Surat the citizens display their talfe for magnificence to a great degree in their palanquins, which are a fort of couches suspended from a bamboo, and borne by four men; one of these carriages, ornamented with silver, covered with rich fluffs, and suspended upon a handlome bamboo, properly bent, will cost above 200l. sterling.

Surat, and the great district of which it is the capital, belonged, for a long time, to the Great Mogul, who, to keep Isfahan a province the more effectually in obedience, put it under the government of two nabobs, independent of one another. The one resided 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 Nader’s expedition into Hindostan, the dasturb 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 raised 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, Irove to make her son-in-law nabob at once of the town and citadel. The content 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 houses and gardens, and, from time to time, endeavoured to surprize or drive away his opponents. During these hostile operations, which were not attended with great slaughter, the inhabitants were content with shuffling the gates nearall to the scene of action, and continued to go about their ordinary affairs without fear of being pilaged. Nay, they were lare 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 imprudently called in the Mahrattas; and they, without doing anything for any party, made the victors pay for their affianlment, although they had, apparently, favoured the vanquished. Since that time, the Mahrattas have enjoyed a third part of the amount of the customs of Surat; and one of their 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 nobles of the country then had recourse to those powerful traders. 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. Teg Beg Khan, protected by the English, was at last expelled from the city. But, in 1758, he returned, and his mother-in-law, the rich widow above-mentioned, made so good an use of her treasures, that the nabob, for whom he had been expelled, was obliged to yield 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 council 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 flattered 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 asserted, that those petty tyrants had suffered the fleet necessary for the protection of trade to fall into a state of decay, and 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 attested, and the proposals 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 discharges 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 sovereigns 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 fitlable to his dignity. The Indians are in part content with their new masters. The merchants are no longer in danger of the avaricious extortions of the nabobs, yet they complain of the selfish spirit of their masters. The English dare not fail without a pall from the admirals.

The great trade carried on at Surat renders this city the forehouse of the most precious productions of Hindostan. Hither is brought from the interior parts of the empire an immense quantity of goods, which the merchants carry in their ships to the Arabic gulf, the Perisan 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 yet in a 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. Their good regular clergy have done essential service to the public, by keeping a register of all events that have happened in Hindooistan, 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, 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 lends one of its members to the council of Bombay; 112 miles S. of Amedabad. N. lat. 21° 10' 30". E. long. 72° 50'.

SURAT, 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 Rullia, in the government of Polotfsk; 80 miles E. of Polotfsk. N. lat. 55° 18'. E. long. 25° 34'.

SURAZSK, a town of Rullia, in the government of Novgorod Sieverfsk; 72 miles N.N.W. of Novgorod Sieverfsk. N. lat. 54°. E. long. 23° 22'.

SURB GIJDER, a town of Turkish Armenia; 3 miles N.E. of Erzerum.

SURBACH, a town of France, which runs into the Rhine, 5 miles below Fort Vauban.

SURBATING, in Horfe, is a term used to signify when the sole 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, preës upon the soft parts beneath it. If a horse be furcubated by bad shoeing, the part that is affected may be known by the thinnes of the shoe, where it presses most; and therefore it ought to be pared deeply in that part, before another is put on: but if the shoe is not the fault, it may be known that he is furcubated 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 lopping 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 boiled together; but nothing will be more efficacious, in case it be troublesome, than first softening the sole with the application of unctuous 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 circuit of Bilfah; 15 miles S.E. of Bilfah.

SURCHARGE of the Forest, is when a commoner puts more beasts in the forest than he has a right to. See Forest.

SURCHARGE of Common, is a disturbance of common of pasture, by putting more cattle therein than the pasture and herbage will sustain, or the party had a right to do. This injury can only happen where the common is appendant or appurtenant, and of course limitable by law; or where, when in gross, it is expressly limited and certain; for where a man hath common in gross, sans nombre, or without stint, he cannot be a furcharger. In this case, indeed, there must be left sufficient for the lord's own befts. See Common.

The usual remedies for surcharging the common are by the lord's dilating the furplus number, or by his bringing an action of trespass, or by a special action on the land, in which any commoner may be plaintiff. The ancient and most effectual method of proceeding is by a writ of admeasurement of pasture.

SURCHARGE, Writ of secon,f de secunda jurisprudencia, is given by the statute of Welfm. 2. 13 Edw. I. c. 8. when, after the admeasurement of pasture hath ascertained the right, the fame defendant surcharges the common again; and thereby the sheriff is directed to inquire by a jury, whether the defendant has in fact again furcharged the common; and if he has, he shall then forfeit to the king the supernumerary cattle put in, and also shall pay damages to the plaintiff.

SURCINGLE, a girdle, with which the clergy of the church of England usually tie their cahocks. See Girdle.

SUSINGLE is also the grid which comes over the saddle, and binds it firmly to the horse.

SURCO, in Geography, a town of Peru, in the diocese of Lima.

SURCOAT, a coat of arms, to be worn over body-armor. See Coat of Arms.

The furcoat is properly a loose, thin taffeta coat, with arms embroidered or painted on it. Such as is worn by heralds, anciently also used by military men over their armours, to delineate themselves by.

SUR Cut in vita. In Law, a writ that lies for the heir of a woman, whose husband aliened her land in fee, and the neglected to bring the writ cut in vita for the recovery thereof, her heir may bring this writ against the tenant after her decease.

SURCULUS, in the Anatomy of Plants, a word used to express that part of the branching of the ribs of a leaf which is of the middle kind, between the great middle rib and the smallest reticular ramifications. The middle rib is, by the writers on these subjects, called petiolum. The first divisions that go off laterally from these are called rami, or branches; the next divisions of these, into more minute ones, are called furculi; and the final divisions of these into the reticular work, that spreads itself over the whole leaf, are called capitamenta.

Many, however, confound these two last divisions, and call all beyond the second division, or lateral branches of the middle rib, by this name of furculi. See Petiole and Ramus.

SURLCUNDY, in Geography, a town of Hindooftan, in Allahabad; 22 miles W. of Currah.

SURLD, in Arithmetic, denotes a number or quantity that is incommeasurable to unity; or that is inexpresable by any known way of notation, otherwise than by its radical sign or index.

This is otherwise called an irrational or incommeasurable number; and an imperfect power.

When any number or quantity hath its root proposed to be extracted, and yet it is not a true figure number of that kind; that is, if its square root be demanded, and it is not a true square, if its cube root be required, and itself be not a true cube, &c. then it is impossible to assign, either in whole numbers,
numbers, or in fractions, any exact root of such number proposed.

And 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 \( \sqrt[3]{16} \) 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 *furd 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, as \( x^2, x^3, x^4 \), &c. signify the square, cube, and fifth power of \( x \); so \( x^{\frac{1}{2}}, x^{\frac{1}{3}}, x^{\frac{1}{4}} \), signify the square root, cube root, &c. of \( x \).

The reason of which is plain enough; for since \( \sqrt{x} \) is a geometrical mean proportional between 1 and \( x \), so \( \frac{1}{2} \) is an arithmetical mean proportional between 0 and 1; and therefore, as \( \frac{1}{2} \) is the index of the square of \( x \), \( \frac{1}{3} \) will be the proper index of its square root, &c.

Observe also, that, for convenience, or brevity’s sake, quantities or numbers, which are not fards, are often expressed in the form of furd roots. Thus, \( \sqrt[3]{4}, \sqrt[3]{27}, \sqrt[4]{288} \), &c. signify \( 2, 3, 2 \), &c.

But though these furd roots (when truly such) are inexpressible in numbers, they are yet capable of arithmetical operations (such as addition, subtraction, multiplication, division, &c.) by which readily to perform which the algebraist ought not to be ignorant.

For the method of performing these operations, see the sequel of this article.

Surds are either *simple* or *compound*.

**Surds, Simple, are those which are expressed by one single term, as \( \sqrt{a} \).**

The fards \( \sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{2} \), &c. though they are themselves incomminserable 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 incomminserables are called some communicable: and when they have a common measure, as \( \sqrt{2} \) is the common measure of both, then their ratio is reduced to an expression in the leaf terms, by dividing them by their greatest common measure. This common measure is found as in commensurables quantities, only the root of the common measure is to be made their common divisor.

Thus, \( \sqrt{\frac{1}{3}} = \sqrt{\frac{3}{9}} = 2 \), and \( \sqrt{\frac{18}{4}} = \sqrt{\frac{9}{2}} \).

**Surds, Compound, are those formed by the addition or subtraction of simple fards:** as \( \sqrt{5} + \sqrt{2}, \sqrt{2} - \sqrt{2}, \frac{1}{\sqrt{2}} + \sqrt{2} \); which last is called an *univerfal root*, and signifies the cubic root of that number, which is the result of adding \( \sqrt{3} \) to the square root of 2.

1. To reduce rational Quantities to the Form of any furd Roots assigned.—Involve the rational quantity according to the index of the power of the fard, and then prefix before it the radical sign of the furd proposed. Thus, \( a = \frac{1}{\sqrt{a^2}} = \sqrt{\frac{1}{a^2}} \).

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, \( \frac{\sqrt{2}}{5} \) is reduced to \( \frac{\sqrt{3}}{25} \) and \( \frac{\sqrt{3}}{4} \) to \( \frac{\sqrt{125}}{4} \); thus also \( a \) reduced to the form of \( a^\frac{1}{3} \) is \( a^\frac{1}{3} \).

And roots with rational co-efficients may thus be reduced so as to be wholly affected by the radical sign. Thus, \( a \times b^\frac{1}{3} = a^\frac{1}{3} b^\frac{1}{3} \).

2. To reduce simple Surds, having different radical Signs (which are called heterogenous Surds), to others that may have one common radical Sign, or which are homogenous: or to reduce Roots of different Names into those of the same Name.—Invoke 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 fards 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, \( \sqrt[3]{a} \) or \( a^\frac{1}{3} \), and \( \sqrt[x]{a} \) or \( a^\frac{1}{x} \), will be \( \sqrt[3]{a^x} \) or \( a^\frac{1}{3} \) and \( \sqrt[x]{a^x} \) or \( a^\frac{1}{x} \).

Alfo \( \sqrt[3]{3} \) and \( \sqrt[2]{2} \) are reduced to other equal fards \( \sqrt{27} \) and \( \sqrt{4} \), having a common radical sign.

3. To reduce Surds to their most simple Expressions, or to the lowest Terms possible.—Divide the fard by the greatest power denoted by the index, which you can discover is contained in it, and will measure it without any remainder; and then prefix the root of that power before the quotient or furd to divided; this will produce a new furd of the same value with the former, but in more simple terms. Thus, \( \sqrt{16} a b c \), by dividing by \( 16 a a c \), and prefixing the root of 4, will be reduced to this, \( 4 \sqrt{b} c \) and \( \sqrt{12} \) will be depresed to \( 2 \sqrt{3} \).

Alfo \( \sqrt{c b} \), for \( c b \) will be brought down to \( b \sqrt{c} \).

To reduce \( a^\frac{1}{n} \) to its lowest term: suppose \( x \) the greatest power, that will divide \( a \) without a remainder; and let \( y = \frac{a}{x} \); then will \( a^\frac{1}{n} = x^\frac{1}{n} \times y^\frac{1}{n} \); for \( a = x^\frac{1}{n} \); therefore \( a^\frac{1}{n} = \left( \frac{x}{y} \right)^\frac{1}{n} = \frac{x^\frac{1}{n}}{y^\frac{1}{n}} = x^\frac{1}{n} - y^\frac{1}{n} \).

Alfo \( \sqrt{75} \) or \( 7^\frac{1}{3} = 5 \times 3^\frac{1}{3} \), or \( 5\sqrt[3]{3} \), and \( \sqrt{81} \), or \( 81^\frac{1}{3} = 27 \times 3^\frac{1}{3} \), or \( 27^\frac{1}{3} \times 3^\frac{1}{3} = 3 \sqrt{9} \), or \( 3 \sqrt{3} \).

This reduction is of great use, whenever it can be performed; but if no such square, cube, biquadrature, &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 be a square, cube, &c. or such a power as the radical sign denotes; and if any such can be found, let that be used in the same manner as above, to free the furd quantity in part from the radical sign. Thus if \( \sqrt{288} \) be proposed, among its divisors will be found the squares, \( 4, 9, 16, 36, \) and \( 444 \); by which, if \( 288 \) be divided, there will arise the quotients \( 72, 32, 18, 8, \) and \( 2 \); wherefore, instead of \( \sqrt{288}, \)
\[ \sqrt{288} \text{, you may put } 2 \sqrt{72} \text{, or } 3 \sqrt{32} \text{, or } 4 \sqrt{18} \text{, or } 6 \sqrt{8} \text{, or, laffy, } 12 \sqrt{2} \text{; and the same may be done in } \text{fprecies.} \]

By the two lat problems we may determine, whether any two roots are commenurable one to another; and alfo find their ratio. For after reduction into the lowest terms, and the fame name, if the powers are equal, the roots are commenurable, and their ratio is equal to that of the rational co-efficients. Thus, \( \sqrt{75} \) and \( \sqrt{27} \) reduced, will be \( 5 \sqrt{3} \) and \( 3 \sqrt{3} \), which are commenurable; and \( 5 \sqrt{3} : 3 \sqrt{3} :: 5 : 3 \).

4. To add and fubtrah Surds.—When they are reduced to their lowest terms, if they have the fame irrational part, add or fubtract their rational co-efficients, and prefix the fum or difference to the common irrational part. Thus,

\[ \sqrt{75} + \sqrt{48} = 5 \sqrt{3} + 4 \sqrt{3} = 9 \sqrt{3} \text{; and} \]

\[ \sqrt{a^2} x + \sqrt{b^2} x = a \sqrt{x} + b \sqrt{x} = a + b \times \sqrt{x}. \]

And \( \sqrt{150} + \sqrt{54} = 5 \sqrt{6} - 3 \sqrt{6} = 2 \sqrt{6} \). If they have not the fame irrational part, they can only be connected by the sign + or -.

Hence it appears, that the fum or difference of any two square roots is equal to the square root of the fum or difference of the fums of the powers, and twice the product of their roots.

E.g. \( \sqrt{75} + \sqrt{48} = \sqrt{75 + 48 + 2 \times 5 \sqrt{3} \times 4 \sqrt{3} = 2 \sqrt{243} = 9 \sqrt{3} \).

For if \( \sqrt{a} \) and \( \sqrt{e} \) be any given quantities, it is plain that \( a \sqrt{e} \pm \sqrt{e} = a \pm \sqrt{e} = a \pm 2 + a \sqrt{e} \pm \sqrt{e} \).

5. To multiply and divide Surds.—If they have the fame rational quantity, they are multiplied by adding their indices, and divided by fubtracting them. Thus, \( \sqrt{a} \times \sqrt{a} = a \sqrt{a} = a^2 \times \sqrt{a} \); and

\[ \sqrt{a} \times \sqrt{b} = \sqrt{a \times b} \text{.} \]

\[ \sqrt{2} \times \sqrt{2} = \sqrt{2^2} = \sqrt{2} \].

Also, \( \sqrt{a} \times \sqrt{a} = a \sqrt{a} = a^2 \sqrt{a} \); and

\[ \sqrt{a} \div \sqrt{b} = a \sqrt{a} \div b \sqrt{b} = a \div b \sqrt{a \div b} \text{.} \]

If they have different rational quantities, and the fame fign, multiply thefe rational quantities into one another, or divide them by one another, and fet the common radical fign over their product: thus, \( \sqrt{a} \times \sqrt{b} = \sqrt{a \times b} \text{, and} \]

\[ \sqrt{2} \times \sqrt{5} = \sqrt{10} \text{; also,} \]

\[ \sqrt{a^3} \div \sqrt{b^3} = \sqrt{a^3 \div b^3} \text{.} \]

If \( a \) and \( b \) are integers, \( \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \text{, the product will be} \ a - b \).

The investigation of that furd, which multiplied into the propofed furd, gives a rational radical, is made easy by three theorems, delivered by Mr. Macaulin, in his Algebra, p. 109, feq. to which we refer the curious. This operation is of use in reducing furd expressions to more simple forms. Thus: suppose a binomial furd divided by another, as \( 2 \sqrt{20} + 2 \sqrt{12} \text{ by } 2 \sqrt{5} - 2 \sqrt{3} \), the quotient might be expreffed by \( \frac{2 \sqrt{20} + 2 \sqrt{12}}{2 \sqrt{5} - 2 \sqrt{3}} \).

But this might be expreffed in a more ample form, by multiplying both numerator and denominator by that furd, which multiplied into the denominator, gives a rational produâö: thus, \( 2 \sqrt{20} + 2 \sqrt{12} = \sqrt{20} \div \sqrt{5} \div \sqrt{3} \times \sqrt{5} + \sqrt{3} \text{, and} \]

\[ \frac{2 \sqrt{20} + 2 \sqrt{12}}{2 \sqrt{5} - 2 \sqrt{3}} = \frac{16 + 2 \sqrt{60}}{8} = 2 \sqrt{15} \text{.} \]

To do this generally, see Macaulin, lib. cit. p. 113.

When the square root of a furd is required, it may be

\[ \sqrt{a} \text{, and proceed as before. Thus,} \]

\[ \sqrt{a} \times \sqrt{b} = \sqrt{a^2 \div b^2} \text{, and} \]

\[ \sqrt{2} \times \div \sqrt{4} = 2 \times \div 4 = 2 \times \div \text{.} \]

\[ 4 \div = \sqrt{2 \div 4} = \sqrt{8 \times 16} = \sqrt{128} \text{. Also,} \]

\[ \sqrt{a^2} \div \sqrt{b^2} = \frac{m^2}{n^2} \text{, and} \]

\[ \sqrt{a} \div \sqrt{b} = \sqrt{a \div b} \text{.} \]

\[ \sqrt{2} = \sqrt{5} \text{.} \]

\[ \sqrt{5} \div \sqrt{3} = \frac{16 + 2 \sqrt{60}}{8} = 8 + 2 \sqrt{15} \text{.} \]

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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, $\sqrt[5]{5} + \sqrt[17]{17}$ 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 $\sqrt[5]{5} + \sqrt[17]{17}$.

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 $1 + \sqrt{2} \times$

$1 + \sqrt{2} = 1 + 2\sqrt{2} + 2 = 3 + 2\sqrt{2}.$

For the method of performing this, the curious may consult Mr. Maclaurin's Algebra, p. 115, eqn. where also rules for trinomials, &c. may be found.

For extracting the higher roots of a binomial, whose two members being squared are commensurable numbers, we have a rule in Sir Isaac Newton's Arithmetica Universalis, p. 59, but without demonstration. This is supplied by Mr. Maclear, in his Algebra, p. 120, eqn. as also by Sir Graevenfide, in his Mathematica Universalis Element. p. 211, eqn.

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 Maclear. loc. cit. p. 127, eqn.

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. Maclear. loc. cit. p. 130.

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. Sanderson, inferred by way of Appendix to his Algebra, and to the Philosophical Transactions, No. 451; or to Dr. Martyn's Abridgment, vol. viii. p. 1, eqn. See also on the management of surds, Kerley's Algebra. Ward's Mathem. part ii. cap. 4. Jones's Synopsis. Palm. Math. part i. lect. 3. cap. 6. Sanderson's Algebra, vol. ii. Bonny-Mell's Algebra, &c. &c.

**Surd, Commonenurat.** See **Commensurable**.

**Surd, Heterogeneous.** See **Heterogeneous**.

**Surd, Homogeneous.** See **Homogeneous**.

**SURDAH,** in Geography, a town of Hindoostan, in Bengal; 15 miles S.W. of Nattore.—Allo, a town of Hindoostan, in the circuit of Rutumpour; 18 miles N.E. of Dundah.—Allo, a town of Bengal; 10 miles S.E. of Baileah.

**SURDE; or SURDY (Sorree).** See **Schech Suri**. This island, situated in the Red sea, nearly call of Nobilure (Faloor), appears at first sight like a two-matted welch. It is not far from Sheik Shaib, called by d'Anville Baileah, which is one of the largest islands in the gulf, inhabited.

**SURDESOLID.** See **Suredsolid**.

**SUREAU,** in Geography, a river of Louisiana, which runs into the Missour, N. lat. 38° 54'. W. long. 92° 42'.

**SUREN,** a river of Switzerland, which runs from the lake of Sempach into the Aar, 2 miles N.E. of Aarau.

**SURENHSIUS,** William, in Biography, a celebrated Hebrew scholar in the university of Amsterdam, well known for his edition of the Mishna, with notes and a Latin version, which he began to publish in 1698, and completed in 1705, in 3 vols. fol. It contains also the commentaries of the rabbins, Maimonides and Barstenoa.

**SURETY, in Law,** a bail that undertakes for another man in a criminal case, or action of trespass, &c. See **Fide-Juror**.

**Surety of the Peace,** an act by which a person in danger of hurt from another, is secured by a bond, or recognition acknowledged by the other to the king, and bail bound with him, for keeping the peace. See **Securitate Fidei**.

This security a justice of the peace may command, either as a minister, when commanded thereto by higher authority; or, as a judge, when doth it of his own power, derived from his commission.

It differs from **Surety of good abating,** in that whereas the peace is not broken without an affray, or such like: the **surety de bons guts** may be broken by the number of a man's company, or by his or their weapon, or harnece. See **Peace, and Good Abating.**

**SURF,** in Agriculture, a term sometimes, in draining, applied to a fough, which is the coodiut or bottom part of a drain, when formed with brick or itones. See **Spring-Draining.**

**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 in proportion to the height and violence of the surf. The surf begins to assume its form at some distance from the place where it breaks, gradually accumulating as it moves forward, till it gains a height, in common, of from 15 to 20 feet, when it overhangs and falls, like a cascade, nearly perpendicular, involving itself as it descends. The noice in some caves is so great, that, during the illiness of the ight, it may be heard many miles inland from the shore. 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. Marden, in his History of Sumatra, has made some ingenious observations on the caule of surfs in general, and particularly on the phenomena of surfs which occur on the coast of that island. When a wave is at its height, it defends by the force of gravity, and the moment acquired in defending impels the neighbouring particles, which, in their turn, rife and impel others, and thus form a succession of waves. This is the cafe 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 subduing wave, instead of preffing on a body of water, which might rife in equal quantity, preffes on the ground, whose reaction caufes it to routh on in the manner which we call a surf. Some have flated, that in forming a surf, the body of water has no actual progresive motion; but Mr. Marden
Marden denies this fact, and says, that the only real progression of the water is occasioned by the perpindicular 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 surf is not, like common waves, the immediate effect of the wind, is evident from this circumstance, that the highest and most 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 are experienced during the four-east monsoon, 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 fo 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 uniform and invariable action causes a long and constant swell, that 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. Marden's Hill, of Sumatra, p. 32, &c.

**SURFACE.** See SUPERFICES.

**Surface.** Connection of, in Ornamental Gardening, that front 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. London, in his work on forming, improving, and managing country residencies, 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 natural connection, in its several superficial parts. It is well and duly flated, that the most beautiful mound formally placed upon a level, or the most elegant sweep, amid abruptnesses and irregularities, will ever be discordant and disgusting. 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 abruptnesses and broken ground must neyer 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 interposed so as, flowing below and looking upwards upon them, they may seem to favour the general tendency to rise; and standing above, and looking down upon them, they may appear in union with the nature of the deformity. That a hollow without an outlet, or a circular mound without a continuation of swell, are alike unnatural and disagreeable.

It is suggested, that wood may render undulating surfaces more charming, by being planted on the eminences; that it may give expression and effect to tame formless hills, by judicious disposition upon their sides, so as to vary both their surface and line outline, and that it may even render an uninteresting situation intrinsical and attractive. That few trees falling down a declivity or precipice, increase the appearance of steepness; and a wood covering the base, 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, which on a small scale must be connected 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 every thing 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, is, it is said, no less important in smaller variations of surface. 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 flade and character immediately; and that they may conceal deformities in the distance, serve as a frame or fore-ground to distant shrubberies, or, if not perceived, 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 a proper connection of surface in ground where ornament, variety, and beauty, are to be produced, 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 forts of pleasure-grounds, but especially those of the more extensive kind.

**Surface, Planning and Modelling of,** that fort 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 forts, and descriptions of country residencies, and the buildings or 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. London, 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 contrive such useful improvements with ease and certainty. Without some such alliace, it is well known this fort of business is often not only badly mismanaged, but very tedious and troublesome.

It has been flated by the author of a late work on forming and improving country residencies, 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 prospect, 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 commi-
S\textsc{urface}.

Completing 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 ichnography, and bird's-eye views, of the present state of the whole should first of all be delineated, and geometrical sections taken, where water or similar works may be hinted to be laid. 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, shewing what may be the effect of the proposed improvements at a certain future period, supposing three or seven years, after they have been executed. This should be accompanied by perspectice views of the most interesting parts or parages 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-plans (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 propelling 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 elliminate 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, 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 ruled 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, as an improvement, which may be used without any 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 may be inTanktly 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 inserted without injuring the piece; and hence no estate will ever, it is said, require to be remodelled. The remarkable objects upon an estate, such as the manion-house, &c. can also, to give a clearer view of them, be modelled separately, upon a larger scale than the general plan. The unvieldings and bulk of such a model would at the first light 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: 1. t hat a proprietor will sce a correct imitation or miniature of his estate, in the clearest manner, and without the risk of being misled or deceived by a plan: 2dly, that every proposed alteration or improvement, of whatever kind, will be clearly understood, and may be so pointed out to workmen, as 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 designer 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 residencies. Thole 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: 3dly, that the effect of every alteration proposed may be clearly seen before it is executed; whether it be the effect that changing the line of fences, rows, &c. will have, in altering the contents of the adjoining enclosures (and this can be instantly 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 propelling 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 conlecting and forming such models have since the above, it is said, been made, so that ten thousand acres of surface may now be modelled on a sufficiently large scale, and the weight of the models of intended new places 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 propelling 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.

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 alarming 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 adverse to the real interest of a proprietor; as confuting much artificers or improvers may often have no little expense.
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 cases of these beds, and in kitchens, and other places. A writer in the first volume of the "Memoirs of the Caledonian Horticultural Society" directs, in this intention, the laying on the surface of such beds, fine drifted river or seaboard, to the depth or thickness of three inches. This kind of covering, it is said, pollutes many advantages. It will extinguish the flatter, or wood-louse, as the nature of the sand prevents the insect from concealing itself from the rays of the sun. In dunged hot-beds, it keeps down the lecan; and to fruit, it affords a bed as warm and as dry as tiles or slates. 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 neat 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, Perforations 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 anger, and that of examining and searching into it by the borser 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 Boiler, 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 flratum, 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 flate, to a greater depth than the greatest of thee, 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 subfinsates of the manure kinds, tend to furth the surface mouldy materials with qualities which the subfrata have not the means of acquiring.

The medium depth of the cultivated layers of the surface foil 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 it 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 cases 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 feed. These kinds of drains 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 suited 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 shaves 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 all other inferences 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 times hooked towards the points, and sometimes double rows of times. 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 cases. These answer extremely well on lands of the more strong flit kinds, when employed at proper seasons.

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 feed, as the surface is thereby well broken down and rendered fine for it, from which a great many advantages are derived to the feed 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 wetnesses 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 keeping 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 feet were
were the common depth in mull soils; 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-fix is much more considerable. The main or receiving drains are always, it is noticed, made a little lower than the others, having more water to convey, and farther to carry it in small inclusions. 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 trench must be sufficient to prevent the impregnation of the feet of cattle from affecting the position of the materials used in filling them.

It is laid, that in forming these sorts of drains in all the modern drainages in the eastern counties, the farmers have been very hitherto to cut them as narrow as possible, by which means a great saving is made in the materials used for filling them, such as bushes, poles, spray, or straw; but if bricks or flones 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 flones are only coupled at bottom, or thrown in promiscuously, or more than sixteen inches, if laid in form of a conduit. Whatever the depth of materials be, the mould that covers them to the surface should never be less than one foot thick, or rather more, in all tillage fields. In pasture-land, gravel, if it be at hand, especially if the foil be very tenacious, is preferable to the mould thrown out, which may be spread on any adjoining hollow.

The depth and width of about thirty 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 watered from surface water, or from its flagellation in a porous upper foil.

Digging and forming the Drains.—The best modes of having these sorts of work performed, both in cutting and filling, in order to perfectly enure the successes of the drains, are perhaps to employ the labourers by the day, and to engage none but such as are fully acquainted with the buñfines.

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, leaving gradually in breadth, so as to form a regular narrowing to the bottom; but by previous ploughing or making furrows, all the spades were drawn from the bottom 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 scap, which is pulled or drawn along the bottoms of the drains, in order to clear out the loose crumblin 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 Modes 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 defends from higher grounds, or such wetlands 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 sort of draining and that of the spring kind.

These kinds of drains are formed with different materials; such as, in some cases, though rarely, with bricks, pipes, and free-flones, but frequently with land-flones, wood, fad, peat, straw, and heaths 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 adaptation for the purpose, are used in these cases. Where such as 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 about 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 some flone 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 Subsoil Brick-Drain.

Pipes may sometimes be employed for drains in this sort of draining, but they are not commonly used in it. In the county of Essex and some others, however, pipes of clay, of about eighteen inches in length, with openings of three or four inches in width, are had recourse to, after being burnt, in forming drains for removing surface wetness; but they are more or less better calculated for the conveyance of the water of a small rill or spring, fo as to supply a house, or other similar purpose. See Spring-Drain.

In filling up drains, where small flones collected from the adjoining lands are used, as is mostly the case in this kind of draining, as a means of preparing a passage to the water, there is no material variation in the practice of any particular district from that of others, nor is much attention any where bellowed 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 straw, 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 interludes between the flones from being choked up with earth, sand, or gravel, is adopted, that is, placing a layer of long broom, bushes, &c. in the bottom of the drains before the flones are thrown in.

But another method of constructing drains of this fort which been collected from the land, is to select the largest and broadest of them, and to place them triangularwise in the bottom, leaving a small vacancy in the middle for the water to run through. When the flones best suited for the purpose are placed in the manner thus mentioned, small flones are laid over them to the usual depth, and over them again, straw, earth, &c.

It has been stated, that there are two methods of forming surface hollow drains with flones, which are materially different from each other. The first for this purpose, where free-flones or flones 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-flones only are used, and to connect these walls by a cover of flone on the top. The size 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-flones can be procured, they are laid above the cover of the free-flone to the depth of 10 or 15 inches; and a layer of straw, rushes, &c. or of turf, with the green side downwards, being placed over the whole, the earth is then replaced.
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The other kind of this sort of drain, which is constituted with free-forest, or those from quarries, seems extremely well adapted for the purpose of drainage, when the filterings from the tubs, 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 sides of the drain; on the top of the are laid horizontally other flat stones, by way of covers to them. A sort of conduit is thus formed for the water to pass in. This kind of drain is very useful in some cases of this sort of drainage, as it forms good passages for the water, and refills prefure well; but it is most frequently made use of in the draining of land, where the wetness 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 foil at the bottom of the drain being taken out with a kind of scoop, bent and formed for the purpose, the labourer forms the drain, is completed. Then willow, thorn, or any kind of brush-wood, as the boughs of trees, &c. is cut in 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 made to rest on the sides or shoulders which constituted the bottom of the larger drainage 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, may appear to some as a very superficial mode of draining; and when compared with drains made of stone, it may be for the interist of those who have surprising, how durable, and in many instances how effectual, they are. The writer alluded to above was informed in the county of Essex, that influences are there very common, where drains of this fort have been known to last upwards of 30 years. Much of their durability is understood to depend on using green new-cut wood, in place of that which had been allowed to remain 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 filterings of drains on any farm, it may be for the interest of those who have 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 Peter: the drains filled with wood, and covered as usual with straw or rushes, 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 laid 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 bathe 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 drain transversely of the old one, the benefit of the filterings through the rotten wood is secured, and the clogging or sapping up of old broken and damaged drains corrected and carried off. Moreover, as bathe form a much greater number of cavities than other stones or poles, they are left able to stop up, and encourage filtering more than larger and more solid bodies. A load of bathe, containing 120 faggots, will, it is thought, do about 350 rods; and a load of straw, containing 120 bottles, the same. The load of bathe is generally worth about 14s., and that of the straw 18d. per load. It is, therefore, calculated, that this expense may be about 12s. the acre, the ditches being a rod apart. And it is remarked, that Richard Petton, efq., of Blackmure, on 20 years' experience, prefers black thorns to every other material for filling drains of this sort.

There is also besides this, it is said, another method of filling drains with wood, which is by suspending the faggots or bathe upon crofs-billets, let on end in the bottom of the drain. This kind of drain has been successfully formed and practiced in Berwickshire, where it is laid 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 Caermarthens, in Wales, who says, that the completest 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. Willows, alder, fap, 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.

There is another method, which is said to be preferable to the last, as requiring less wood: it is to fix in at every foot distance, a thicket, in the manner of a hoop or semi-circular arch; and along these to lay the longest poles or branches longitudinally. This will form a secure vacancy below, and an arch capable of supporting any weight of earth necessary above.

Various methods have been devised of faving the expence of materials in the filling of drains of this sort. The sod or pipe-drains are, undoubtedly, it is laid, the least expence of any, and may be of considerable benefit on some foils; but their duration and safety in supporting heavy cattle or hores 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 would be 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 foot with a narrow draining spade, a shoulder is left on each side, upon which a sod or turf, day from grassland, is laid, the sward side downwards, and the mould thrown in over it. It is affected, 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 Geographical Essays, by a writer who has practiced the method largely.

An improved mode of cutting and forming drains of this
this fort, too, has been lately practised in the county of Chetter, as will be seen in speaking of turf-drains under that head.

In cases where the soil is of a very tenacious nature, and old fward-turf can be procured, it has been laid, that it is not uncommon in some districts, where neither stone, brick, nor wood, can be easily obtained, to use the surface sod or turf in the construction of these kinds of drains. This is the case in some parts of Yorkshire and Wales, and in the counties of Nottingham, Buckingham, Essex, &c. The drains having been formed in the manner described, when brush-wood is used, the fods are laid on the top of the narrow part of the drain, with the green side downwards, and being rammmed down as hard as possible, form a kind of re-verified arch over the open part of the drain. These drains are laid to last frequently 20 years, and upwards; but the period to which it can be suppos'd they will continue to prove effectual, must depend upon the nature of the soil, and the current of water that may pass through them. See Sod-Drain.

Sod or turf drains are pretty much in use in some of the northern counties of England, where land-tons are scarce. And a simple method to have materials in grass-lands is said to be practised in Buckinghamshire. When the line of a drain is marked out, a fod is cut in the form of a wedge, the upper or grass side being the narrow; which is done by flop the fpade in cutting or forming the fides. The fods are taken up, in lengths of one foot or eighteen inches, and carefully laid on one side of the drain. After this the drain is cut to the depth required, by ufing the draining fpades and fcoop, which con-figures to a very narrow bottom. The fods are then let in, with the grass side downwards, and priefled as far as they will go, fo as to form like key-tons between the fides of the drain. As they cannot go to the bottom, a cavity is left underneath, which serves as a water-courfe; and the fpace above is filled to the top with the earth that was thrown out. If the drain be three feet deep, there will be nearly two feet of earth above the wedge-fods, which is sufficient to secure them from any injury by the feet of cattle. This fort of drain is said to succeed admirably, and to last from 12 to 20 years: the expense of forming it is fated to be one penny the yard.

A very simple form of drain for carrying away the surface water on wet lands in sheep pastures, in some cafes, is this: a strong common plough is first made use of for turning up the furrows which are necessary in the hollow parts of the field or ground to be drained, where the water may be liable to stagnate, going completely through the middle of the whole; a man is then ready with a fpade to pare off the loft or mould, letting the inverted fod or grass side be left about three inches in thickncfs: having completed this part of the bufinafs, he is to turn the fod over, back again, into the furrow wherein it was railed, grass side upwards. In this way a drain, canal, or opening, will be formed and left in the bottom of the furrow, of about three or four inches in magnitude, which is sufficient to discharge a large quantity of water, if it should fubside into it, which may sometimes be readily the cafe.

In some situations near the sea, the filling of these forts of drains, after they are made, to the depth of about three feet, and two inches wide at the bottom, is done to the depth of two feet with thingle brought from the sea-floure, or fifted gravel, sometimes at the expense of about two fillings and fixpence the rod, but occasionally at a great deal more. A load of thirty-five bulks of this fort of materials will commonly be sufficient for eight rods. The drains are usually made about a rod and a half alfter, in this intention. It has likewise been observed, that peats are materials for forming drains, which few people would have thought of, but which are sometimes used in these as well as other cafes. Drains formed with these are believed to be peculiar to Lancashire, and to have been introduced there only within a short period.

Another simple mode of making pipe-drains has, it is said, been successfully attempted; but that it is better calculated for the purpose of an aqueduct, or conveyance for water, than for drying the soil. In this cafe, a drain is dug to the necessary depth, narrow at bottom, in which is laid a smooth tree or cylindrical piece of wood, ten or twelve feet long, fix inches in diameter at the one end, and five at the other, having a ring fastened in the thickest end. After brewing a little sand upon the upper fide of the tree, the clay, or toughfet part of the contents of the trench, is firft thrown in upon it, and then the remainder, which is trod firmly down. By means of the ring and rope through it, the tree is then drawn out to within a foot or two of the small or hinder end, and the fame operation repeated. A gentleman who has tried this experiment says, this clay-pipe has conducted a small rill of water a considerable way under ground for more than twenty years, without any sign of failing. See Pipe-Drain.

The latell and belt improvement in filling furface or hollow land drains with fraw, is that of twifling or wind- ing the ftraw into a rope. The common practice is to tread in the loose ftraw; but Mr. Bedwell has lately invented a method of winding it into a hard rope, as large as a man's arm, which he forces to the bottom of the drains, and finds it from experience to convey the water off the land more readily, and to have a much longer duration; at the fame time the quantity of ftrew confused is not increased, and the operation of filling accelerated. After the cattle have picked it over, he finds the ftrew tougher and in better order to wind, than when quite dry and fresh.

The substance or material which is called heath, or ling, has likewise been found a very ufeful article for the purpose of filling drains.

Open cuts or drains are not unfrequently found useful in this fort of draining, and are sometimes the only means that can be prove effectual, in the described or other wet situations, or where there is much surface water, they are often formed for the double purpose of carrying off the superfluous water, and of fencing the fields. In all such cafe, the size of the drain should depend on the situation of the land or farm. There is one general rule in regard to the dimensions of open cuts or drains, where they are intended for conveying much water, that ought always to be attended to, namely, to make them fipe one foot for every foot of depth.

For open cuts or drains, which are merely to take away the surface wetnefs of fields, one rule may be generally adopted, which is, that the width at the bottom should be one-third of that at the top, which gives a fufficient flope to the fides, and prevents their falling in; and the fall or declivity should be such, that the water may run off without stagnation, but not with too rapid a motion. See Spring-Draining.

In all cafes where the admission of surface water, or that which may be augmented in time of great rains, is unavoidable, the drain must necellarily be open, to prevent the risk of choking or filling up; which is always the confequence when fuch water is admitted into a covered drain.
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It may be noticed here, that sunk-fences, in some measure, come under the denomination of open drains; but the nature and construction of these sorts of fence-cuts or drains are so generally known, and must vary so much according to situation and other circumstances, that no particular description of them is necessary to be introduced in this place. See Surface Open-Drain.

All open cuts or drains are required to be secured out and cleaned, at least, once in the course of the year: for when this necessary business is neglected, they are apt to lose their good effects, and the operation or work becomes the more difficult afterwards.

It may be noticed also, that the filling of pits is another mode of forming drains for taking away and draining the surface wetness of land. Some fields are so extremely ill situated, in regard to outfall, or deficient for drainage, that it is not possible to free them from water, either by open or covered drains, so as to render them at all times fit for tilthage or pollurage. If, in a field so situated, the farmer can discover a subflatum of gravel, sand, or any other porous material, in any part of it, to which, by opening a drain, he can conduct the stagnated water, and if he will there dig a large pit, the evil may be removed, as the water will sink rapidly through the stratum of sand, gravel, or other open subflustrance. Should this answer the purpose, of which, in most cases, there is little reason to doubt, he has only to fill up both the pit and the drain with stones collected from the land; and the improvement will not only be effectual, but permanent. See Spring-Drainage, and Sunk-Pit Drain.

And a still farther mode of forming surface-drains is by the opening of water-furrows.

The neglect of this branch of the due cultivation and clearing of the fields, and allowing the water, often hazards a crop, even in leasos not uncommonly wet, and must therefore be considered not only an improper using, but one which, in nineteen instances out of twenty, is attended with very bad consequences. It is, indeed, a mode of making surface-drains which answers in the most beneficial manner in many sorts of tillage clayey arable lands, and which, in such sorts of soils, should constantly be formed at distances in proportion to their degrees of stightness or tenacity; being, in no instance, at any very great space from each other, but so near as effectually to take off the water from the ground, and prevent its being injurious to the crop by its stagnation. See Water-Furrow.

Methods of partly opening the Drains by the Plough.—In cases where ploughs are made use of in performing this sort of work, no one plough, so far as we know, has yet been invented which is capable of completely and effectually accompanying the business at once, though several have been contrived at different times for this purpose. In order to expedite the business of making drains, recourse is had to the plough. The method which was practised at first, was that of a plough, which was invented for cutting surface hollow drains about twenty-five years ago by Mr. James Young, of Clare, and which he has himself described in the "Annals of Agriculture," from a very ample practice, it is declared to be this: when he has marked the drains in a field (usually a rod asunder), he draws two furrows with a common foot plough, leaving a bank betwixt them about fifteen inches wide; then, with a strong double-breasted plough, made on purpose, he splits that bank, and leaves a clean furrow, fourteen or fifteen inches below the surface; but where the depth of soil requires it, for he likes to touch the clay by a second ploughing, he finks it to eighteen or twenty inches: it is then ready for the land-ditching spade, with which he digs, fifteen inches deep, a drain as narrow as possible. See Surface-Draining Plough.

But the method followed by some good farmers, who do not potter ploughs made on purpose for the work, is this. With their common ploughs drawn by four or five horses, and usually barrering about four or five inches deep, they turn a double furrow, throwing the earth on each side, and leaving a bank in the middle. This bank they raise by a second bout, in the same manner; then they go in the open furrow twice, with their common double-breasted plough, getting what depth they can. After this they shovel out all the loose mould and inequalities to the breadth of about a foot; and thus having gained a clear open furrow, the depth varying according to the soil and ploughs, but usually about eight or nine inches, they dig one spad with a draining-spade, sixteen inches deep, thus gaining in the whole twenty-four or twenty-five inches. But as this depth is seldom sufficient, when necessary they throw out another, or even two other spits, which makes the whole depth from thirty to forty inches.

Another method of opening surface-drains by the plough, which is practised by Allen Taylor, esq. in the parish of Winblith, in the county of Essex, is, it is said, one of the bold and complete sorts of land-ditching close heavy clayey wet soils that has yet been had recourse to. After first marking out the course of the drains, by drawing two furrows by the common foot-plough, about four or five inches in depth, leaving a bank, or solid unploughed slip of earth, between them, of about five or six inches in breadth; another plough, of great size and strength, is made use of, the beam of which is thought to be not less than five or six inches square; and, that its strength may be greater, it is somewhat shorter than the ordinary plough. The coulter is very flint, and sufficiently long to penetrate the solid soil seven or eight inches deep: the share is also proportionably strong and solid. The upper and hinder part of the breest has properly not a breadth, but a large solid piece of wood, shaped nearly as the breast itself, firmly and immovably fixed to it. With this addition, the upper hind extremity of the plough is upwards of thirty inches in breadth; and the bottom hinder part of the foot is not less than twelve. The plough, thus constructed and prepared, has four heavy powerful horses put to it. It goes on one side of the above-mentioned bank, forestalls down into the soil full seven inches, and a half below the surface of the unploughed land; makes its furrow at the bottom clean and clear twelve inches wide, and the additional breast, and consequent prodigious extent of the plough behind, throw the whole quantity of earth raised up, bank and all, on one side, upon the solid ground, several inches from the furrow it has made. It returns in the next marked-out drain, which it treats in exactly the same manner, and so on until it has completed the whole space intended to be drained.

When this has been done, a third plough is applied to the work. This is about double the height or depth of the former, and made exceedingly strong; but it is only half as wide at the bottom. It has, however, like the other, an additional breast, shaped and fixed in a manner as nearly similar as may be; but its extent, in width behind, is thought, from its appearance, is less by at least five or six inches. This is drawn by the same number of equally powerful horses, and goes along the furrow already made by the larger and more extensive plough, but in a contrary direction, and, of course, throws the earth on the opposite side. The left, or ground side of the plough, is left...
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Jet in about three inches from the left extremity of the former 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 breast, calls 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 six inches wide, leaving on each side a kind of shoulder or ledge, of three inches breadth.

The whole is ready now for the land-ditch spade, which has a suitable length and breadth of mouth part for the ditcher to make a cut with it of fifteen inches more in depth, and exactly in the middle of the half 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 haulin, which is the next operation, it is done without any mixture or portion of wood whatever, as Mr. Taylor supposes it generally does more harm than good, except only a very little at the edges of the crofs 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 different degrees of loofcrads and porosity of the soil, but also as there may be different degrees of declivity in the ground from ditch to ditch. In level forts of land generally a rod apart, and where there is a declivity above four yards sander, as in the former cases, the water mildly 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 Elex, which is by means of a cutting-wheel constructed of cafl-iron that has considerable weight, and is about four feet in diameter, the extreme circumference or cutting-edge of which has the thickness 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 resistance made by the ground may be more or less: which parts being thus forced 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 cutting summer by the heat. The fillures are then filled with twilled straw or hufhes, and covered lightly with some of the porous earth that may be most conveniently at hand. In this manner, upon grafs 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 fort of wheel is slatized to have cut the drains of twelve acres in one day; 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 or of the strength of draught which is re
dquired to draw it. Another more simple fort of wheel con
trivance has also been made use of in Middletex, by the writer of the account of the agriculture of that di
crét, 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 pressing and forcing down the
dward without destroying it. See Wheel-Draining.

Expenes of forming and filling the Drains.—The expense of the several kinds of themselves will of course vary with the nature of the foil, depth, price of labour, &c. and their circumstances are so 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, in some measure, on the quality of the foil, as certain species or kinds of land have the power of preserving wood or other perishable materials much longer than others. Stones last till accidental causes impede the flowing of the water, and may last for ever. Wood perishes in certain periods, but it does not follow 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 fluff are rotten and gone. Drains of this fort that have been filled with hufhes and straw, both which were rotten, have been observed to run well forty years after making. And on this subject, Mr. Young, of Claré, observes, that he has never been able to ascertain the duration of the fluffle with any degree of certainty; neither has he ever drained a field a second time; but a drain will sometimes be cropped by cutting the land in the wet, or 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 flubdce remaining in them, but full of looie porous earth, at once run freely, or, according to his workmen's phrase, 6ked freth. During the wet weather, about the middle of April, he examined a field of six acres, which he land-drain'd 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 tracts have been drained, or have been meant to be drained, it is laid, 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 fo important a point, and judiciously mark the directions of their drains obliquely. They are also careful to give them just the fall which is sufficient to carry off the water in a gentle but not a rapid current, by which means they are less apt to choke, 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 numbers of which are found in the western counties of England, it has, it is said, been a common practice, and not an improper one, 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 sfander, 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 drop short, or discontinue their length on one side of the field, as soon as the ditch operates in laying it dry. Where the slopes of a field vary, and fall in different directions, the farmer should attend to such variations,
tions, and direct his drains so as to cross obliquely the upper tide 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 fall; and a failure in that case affects to much a larger space of ground, by impeding 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 the same outlet. Caves will, however, occur where, 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 Essex, 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 fame number of drains as would be required upon a foil of equal clovenefs 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 hang 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 chose the most convenient season for the buffels. Many excellent farmers will not do it at any other time than summer, from being then able to execute the work in a cleaner and neater manner, and free from that kneading and plathering which takes place in winter, and which they think tends to prevent the flowing of the water from these 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 loams 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 never land-drains, 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 laid down level, as he has a plough on a very simple construction, with which, and fix horses, 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 dugged 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 furrow 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 division between 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 sections, 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 grails-lands, which lie too flat and swampy to shoot off readily their surface waters, and which are free from lohes, the mole-plough drains will perhaps be found of general benefit; but most especially, Mr. Marshall conceives, for mild 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 appear, 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 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-Drains.**

**Surface Open Drain,** such a drain as is not closo 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 furrows, or discharging channels of the higher lands, and the more flagrant fervers, or water-fences, of low countries. This fort 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 foil, 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 superficial moisture properly from the subsoil, cannot be left open with any degree of propriety. When water ilues, the subtratum is naturally loose, and liable to shoot into open trenches, which are likewise exposed to the tide of cattle; so that even in grails-lands they are ineligible, and still more impracticable, it is laid, 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 crowding them. It has been noticed by the writer of the corrected Report on 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 cafes, 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 expence of cleaning and reinforcing them out every year be not inconceivable, there may be some recompence 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 underad the benefits 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. Elkington and others made the discovery of a method with which they were wholly unacquainted. The best French writer on agriculture, De Servés, who wrote in 1668 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 pallages 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. Buffes, as has been seen, are generally used, but fallow or willow is probably much better. The Board of Agriculture has, however, been informed by Richard Preston, esq., that land drained according to the prentice practice of surface-draining, it not more than forty years standing in his neighbourhood in Essex, this, it is thought, deferves inquiry, for it is generally huppoled to have been used there long before such a period of time.

The different methods of managing springs that proceed from water at any considerable depth in the earth, or which break out from the variation of certain strata in hills, which demand deep cutting and the use of the auger to work their course, have already been considered in speaking of Spring-Draining; which see. But surface or hollow-draining is chiefly used for correcting that wetness of foil which results from rain, and which, from the flatness of the surface, or its retentive quality, stagnates, to the injury of both foil and crops. This is the most general nature of the evil which this fort of draining is intended to remedy, but by no means exclusively of that caused by land springs, whose feet is apparently not below their depth. The wetness proceeding from such is, in some cafes, removed by these forts of drains, and this kind of drainage, when the drains are deep enough cut, and properly directed; but in many other cafes, from ignorance in the drainer, great sums of money are often thrown away, for want of attending properly to the nature of the evil, and of distinguishing betwixt surface water only and the oozing of land-springs.

It may be noticed, that in soils that are so very tenacious as to retain water on the surface till evaporation carries it off, such as are found in some parts of Suffolk, Surrey, and in many other counties, this method of draining has been tried, and found almost entirely to fail. The cause of this can easily be accounted for. Very stiff clay will hold water like a dike, (the expression of the farmers in these counties, who have attempted to drain such foil,) and consequently the small portion of water which each drain will carry off, is only what falls immediately above it, or what it can receive at top, when the ground on each side has a deficient towards it. The water being all on the surface, cannot find its way into them. If they are on a declivity, the water will run over them, as it does over any other part of the field; and if they are in a hollow, it will stagnate even above them. This is, therefore, a more expensive foil to drain, requiring a greater number of trenches, and these very closely together, than any other foil whatever. Open trenches, with the ridges and water-furrows properly formed and directed, is the only method whereby its drainage can be effectually accomplished. It is necessary to lay it up in ridges properly placed, and to cut small open drains across the ridges, where requisite, communicating with each other, and with the furrows; and thus all the water-furrows operate as drains. The water, as it falls upon the ridge, immediately makes its way into the furrows, and runs along them, while there is a defcent; and, if it is stopped in any of them, by the ground rising, is conveyed by the drains across the ridges into some other furrow, where there is a defcent, along which it makes its way into some ditch, or water-course, at the extremity of the field.

It is obvious, it is thought, that laying up such land in ridges, and cutting drains in proper places, may be of great use, but will not effectually remove the wetness; as the foil, from its nature, will always retain too great a proportion of moisture. It is necessary, therefore, it is said, to change the nature of such foil by frequent culture, and the application of manures, which will lessen the power of retaining water in it, in a high degree.

In Essex, and in the county of Suffolk, where it has been found advantageous, the foil is a wet poachy loam, more or less mixed on the surface with vegetable mould; under that, in some places, a raw hungry loam, and in others a clay marle. On these foils the effort is very great; for the upper stratum, where the moisture is chiefly lodged, being in some degree porous, the water is easily extracted 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 foils, he certainly means foils of this description or quality. That able drainer says, that he knows from experience, that in "clayey foils 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 all of a thin, black, moorish quality, resting upon a retentive till bottom, which in the winter seasons, when pulverized by falling during wet times, afforded not any fort of retinace to the feet of the plougher, but which instantly plumped down to the subsoil; and which, even when in pasture, and the surface firm by gravity fward, was extremely subject to poach at the same season; and in which, upon the second or third year of paturage, the
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 Marbichel, in his parks at Sunny-side, in Newland parish, in Scotland. It is stated by the writer of the Agricultural Report of the County of Peebles, that in an hour or two after the heaviest rain, 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 fort 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 Ploughing, 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 may, in most cases, be accomplished with very little expence. The upper soil being composed of a porous stratum of two, three, or four feet in thickness, and having under this a strong retentive body of clay, the rain-water falling on the surface easily subdues, till it meets the clay; and there being obstructed from farther descent, the whole open part of the field floods so full of water, as 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 so much on the surface. In this kind of drainage there is no need for the auger, there being no real spring or subterraneous 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 defect from both sides, one drain cut through the porous to the clay soil, in the hollow part of the land, will effectively 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 ipade. 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 case, may either be open, if it can serve as a division of the ground or field at the same time; or covered, 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 cases, 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 fuller equally from wetnesses, that consist of a soil exactly opposite to the former in its nature, namely, a clay surface, having a porous substratum. The drainage of such ground, where the wetness is full of a more injurious nature, and where the impervious stratum that upholds 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 see); 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 calamity. Such ground is more difficult to drain, and requires a greater number of cuts than any other soil whatever; as they must be so 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 drain. The first thing, in all such cases, 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 fuits 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 fo 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. Loofe gravel, if it be at hand, is better than the stiff clay that came out of the drain, as it more easily admits the water to be absorbed and passes 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 turf 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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equit, 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 calily 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 outflow of the water; and thus much depends on the proper ploughing of such ground, by attention to which, many drains, otherwise necessary, might be saved. The mode of draining these soils, which is here 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 Exfex 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 declivity 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 drained by means of one of its ditches, 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 intervening on Land of the moor 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 different means of this fort; and some highly interesting improvements, accomplished by this mode of draining, in land of the above fort 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 wetnesses, recovering, and improving land, which for ages had not only been useless, but dangerous, in consequence of confined and pent-up waters in it. At Trewarthenick, the seat of Francis Gregor, esq., a moor, of previously no value, it is said, lying upon the side of the river Fal, and conflating of thirty acres, will be converted into the finest meadow 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 steeemed for tin, which is searching for granules of it that lie in horizontal strata, from six to 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 hence called steeeming. The old land of the stream-works was left in the above devastated condition. By this steeeming 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 flate, fedges, rushes, furze, and flinted bruff-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 drainage and other management was, after clearing away the surface-obstructing matters, draining, and preserving 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 thistles of potatoes, turnips, &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 wound back in such a manner, that the upper surface of the river-water was permitted to flow over the land. The deposit made in this way constituted, it is said, of the lightest particles; the heavier ones, particularly the gravel, sinking 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 same way, proper draining of this surface kind having first been well performed.

The plan of drainage given below is that which has been practiced 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 spring-tides, it is impossible to effect a drainage by the ordinary modes, from the want of levels; and, of course, such parcels of land, from being constantly covered with water, become unprofitable to the proprietor, and offensive to the public, by producing disease. Several marshes, and some small lakes in the above county, fall under this description, and have been looked upon as irremediable, on account of the sea, at spring-tides, being several feet higher than this land; so that no levels, by the common modes of draining, can be procured to carry away the internal and surface waters. Purchasing an esfate near the above town in 1790, where a piece of land of about thirty-six acres was continually 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 channel 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; so 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-six acres: it exposes its fourth side, of six 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 passes, 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, to the surface of the ground in the marsh, being a distance of one hundred and seventy-four yards, it was found that six 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 land 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 pipe
pines were secured by large rocks or boulders, 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 sand was about twenty-four feet above the pipe, so that the difficulty of getting to a sufficient depth in this place became very great, as the sand was apt to run on the workmen, and required the opening on the surface to be forty feet. As the marsh was approached, the depth of sand became gradually less, so that the pipe was introduced into a referror about six 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 infiltration 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 so close as effectually to exclude the sea-water, which, at high spring, is about nine or ten feet above the pipe. There is also another valley in the hill pipe, near the referror, to afford the total exclusion of the sea, in case of any accident happening to the other valve. The pipe which projects a few feet into the referror, 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 fluttering; some little difficulty likewise arose from the confined air in the pipe, at the approach of the tides, but this was removed by introducing an ree small pipe, of about an inch and a half diameter, through the cover of the pipe nearest the referror, so as to carry away the air confined between the two valves, at the approach of the sea, which prevented the discharging of the marsh water till the return of the tides, during which time the water accumulates in the referror 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 salt-water; but the writer would recommend circular pipes of elm, which, from their shape, are not so liable to be injured as the square ones.

In regard to the referror, 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 six 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 six 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 peristom-feet. And as soon as the drainage, in this case, was finished, a strong embankment of turf or loam was made around the marsh, so as to prevent the river, surrounded by its two sides, from overflowing the land, and through which river the sea flowed at springs-tides. The danger arising from the approach of the sea was also prevented by a draw-water, placed in a narrow part of the river, which always shuts 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 land; but the culmets of the foal, from its being covered with the sea for ages, prevented any crops from vegetating for the first three years; after which it was repeatedly covered with fresh water, which so accelerated the soil, by diffusing 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 flat 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 facility and improvement. And in different moor and marshy tracts which are not so greatly overflowed by sea-water, something of this plan might often be adopted and practiced with great propriety and benefit, in removing the wetness which is so injurious by stagnating and reiting 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 clay constituent materials, the wetness is drawn off to only a very small extent, or distance, 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 cases, 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 that, in very retentive soils of this nature, where the drains in this sort 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 space between them. They should never have more declivity given them than what is just necessary to enable a very gentle run or pilgrimage to the water. In the draining of clayey 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 grafs, 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; for 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.
SURFACE.

wide and deep, square, and filled up promiscuously with quarried stones to within nine inches of the surface. The quantity of stones required in this way was so great, that the quarrying and distant 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.

Thee, though not the exact forms of clayey soils 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 grass lands.

In draining the close, retentive, red, tough, clay soils in different places in the county of Effex, 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 shown under the head surface-drain, to the depth of twenty inches from the surface, and are left one inch in width at the bottom, which part is in the higher portion of it filled with straw alone. Thee leading to the outfalls are usually made about eight inches deeper than the lateral ones, and have elm-wood vied 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 an acre, but without the effect in any way encouraging so important a practice. 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-furrowing; but though these operations are performed in the best manner, the land is still left saturated 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 forts, the practice of surface hollow-draining has effected considerable improvements in the lands of the same district.

In all soils of this clayey sort, when the lands are in the tillage flat, 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 affected, 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 forts 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 inclusions, furrows are not properly directed, nor properly deepened, and the ridges are too flat; by which the water stagnates in the hollows, 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 soils, 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 deemed, for land of a very retentive surface, an excellent mode of draining, for 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 most absurdly; and from being perhaps a custom in that part of the country, no discrimination has been made; but their beauty is 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-throughing, or, as it is usually called, furrowing land, as practised in the car of Gowrie, in Perthshire, is described in the following manner by George Paterson, esq. of Cattle Huntly, in that county. As clay is perfectly impervious to water, surface-draining is the only means by which that species or fort of improvement can be accomplished; and all over the car of Gowrie this operation is said to be extremely simple. There are certain large common drains, which pass through the district in different directions, sufficiently capacious 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 to empty their contents into the river Tay. There are also ditches which surround every farm, or pass through them, as their situation may require, but 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 from a foot to a very yard of depth. If the fields be of an uniform level surface, the common furrows between the ridges, provided they be sufficiently deepened at their extremities, will serve to lay the grounds dry; but as it seldom happens that any field is to completely free of inequalities, the last 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 a foot, 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 require
Surface.

quire 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 spouts, and to keep them perfectly clear, is a very essential part of every earl-farmer's attention.

It may be observed, that on some steep-palettes, the carrying off water may be effected in the simple manner of forming drains that has been already noticed in speaking of Surface-Drainage; which fece.

It may be flated, 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 lutulus ager tractetur—nam quae limosa verfatur arva toto anno defuntum poeie tracarli, nec sunt habilia fementi, aut oxationi aut flatiovi." Col. lib. ii. cap. iv.

Surface-Draining Level, that fort of implement of this kind which is used in draining land. There are several kinds of levels employed in this fort 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 cases, in both forts of draining. See Level.

Surface-Draining Mill, that fort 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 to eight, the common draining-mill of the marsh-land districts 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 cases where the depth of the water is still more considerable, and the covering materials of it of loose 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 marsh 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, any fort 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 soils. 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 sufficient to answer the intention in all the varieties of soil on which they may be required. A plough of this fort, 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 fluff clay with the force or power of eight horses. It has of course long ago been wholly laid aside, but it might probably be altered and improved, as to be made a good tool for the purpose in some cases. It may be observed, that the mode of operation in this drainage-plough is nearly the same as that with the common plough. But it would seem, that as the angle of the brealt 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 fluff, it requires a great force to draw it, and cannot be held down properly by the handles. By the angle of the brealt part being therefore lessened to about thirty-three degrees, it is not improbable but that it would, in a great measure, remove this difficulty. In marshy, bogy, and mony soils, it is laid to answer the intention extremely well, and to make a clean trench, working very well. From its requiring very great strength of draught, it can, however, only be employed in particular cases 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 fort 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 Suffolk. Afterwards another plough of this fort, for the same purpose, was invented by Mr. Arbuthnot, of Mitcham, in Surrey, which is described and represented in Young's "Eastern Tour." And more lately different tracts, for forming drains of this fort, have been made with various contrived tools of the mole-plough kind, which by forcing a pointed circular iron or steel 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 foil it has loosened, to a proper depth below 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 laid, by experience. Different improved implements of this fort 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 Practice 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 effective 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 fort of difficulty in making one to open and prepare the ground for the narrow drain-spade to make one spit at the bottom. The repeated ploughings or shovellings which are necessary with common tools are expensive, and might, probably, it is suppos'd, 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, was 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 employ.

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 fort, too, made use of in Leicestershire, with advantage in different cases and forts of land.

Surface-Draining Furrow-Plough, a plough of this kind, 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 flagmates 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
diftribitus, is faid to be a very useful implement. It is con-
structed with two mould-boards, which can be regulated and
set off to different distances, so as to make wider or narrower
water-turrows, as the nature and circumstances of the lands
may be. It is also contrived so as to work to greater or
less depths, as may be necessary. By these different means,
water-turrows of very different sizes are capable of being
formed by the fame plough, which is a matter of much util-
ity and advantage in different cafes, and which favours a great
deal of expence in many instances.

**Surface Draining Gutter Plough** is a plough of the
drainage kind, made use of for forming gutter-drains in
grafs-lands. A plough of this nature has been lately re-
commended by the Duke of Bridgewater, and which is faid
to have been found useful in forming gutter-drains on grafs-
lands, where the foils are of a retentive nature. The power
of six horses is, however, required in drawing it in foils that
have not been drained before; but in opening the old gut-
ters, four horses are found sufficient for effecting the pur-
pose. This great power of draught in all ploughs of this
kind, forms a great objection againft them, and greatly
prevents their utility in different instances of this fort of
drainage.

**Surface Land Fall Plough**, a particular fort of plough
made use of in some parts of Essex, it is faid, with ad-
vantage, where the nature of the under-ground is a great
menefare, 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 cafes, it is fuggesfted,
from the want of proper hollow surface-drains, is all liable
to retain a considerable quantity of water, which not un-
fequently perifhes the feed which has been fown; and by the
chill which it produces, even in the moft favourable feafons,
greatly retards and prevents the powers of vegetation. See
**Water Furrowing**.

The plough is conftituted in a fort of box-like form, open
in the front, but clofed on the fides, and made fo as to
havfe off levels, and reduce the inequalities of the land of
the ridges, having handles behind for regulating it by, and
hooks with chains and fwingle-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 faid, in a dry time,
do fifty rods a day with it. A repre{entation of it may be
beem in the fecond volume of the Efsex Corrected Report on
Agulture.

**Surface Draining Mole Plough**, a fort of plough made
ufe of for the draining of grafs-lands, where it is a material
object not to have the furface injured; yet to have the moif-
ture removed at particular wet feafons, as in parks and plea-
fure-grounds, &c. It is a fort of draining-plough that has
been faid to anfwer well with fix or eight horses. The firft
plough of this kind was probably invented by Mr. Adam
Scott; but a great variety of implements of this fort have
since been contrived, though none probably that completely
anfwers the purpofe in every intention. They have, how-
ever, been fo far improved, as to be wrought with much
less power or strength of team, and fometimes by means of
human labour, without the treathing of teams at all. The
mole or bread parts of them have been fo altered, as to flide
through the foil with much greater facility than was the
cafe at firft, as has been seen in speaking of the improved

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It is a plough too which has been ufed on the arable peaty
lands, in some parts of Lancashire, with great succex.

**Surface Draining Pump**, that fort of pump of this kind
which is contrived for the purpofe of raising and discharging
the water which fermentation in large quantities on lands in fonme
situations, where there is none or very little drainage level.
These pumps are mostly of a very fimple nature, and con-
trived fo as to lift the water over the banks by which it may be
furnrounded. The writer of the late work on "Land-
ed Propert" is of opinion, that by means of powerful pumps
of this fort, many of the cold flat lands which lie at the feet of
hills, in almoft evei district of the kingdom, might be
drained and confiderably improved in different ways. See
Surface Drain and Surface Draining.

**Surfeit**, an indifpofition caufed by excess in eating or
drinking, that is, by over-charging the flomach; and
ufually attended with eruptions, and fometimes with a fever.

**Surfeit**, among Animals, a particular fort of complaint
which is incident to horses and other cattle belonging to
farms, and which arises from various causes; but is com-
monly the effect of fome affiffion not attended to, or ill
cured, and frequently from the want of food and manage-
ment. It alfo proceeds from over-feding, or not allowing
immoderate feeding; but efpecially upon unwhofome food; from cold
and hard riding, &c. whereby the animals forfake their
meat, and are infected with hard dullwells, which, if they
happen to fall upon the joints, will, in process of time, oc-
ca{fon lamens, and many other diforders. Animals are faid
be to be forfeited, when their coats flare, and look rufy and
dirty, though proper means have not been wanting to keep
them clean. The skin if full of fcares and lumps, that lie
thick and mealy among the hair, and are conflantly fupplied
with a fresh infccution of the fame, for want of due tran-
flation. Some have hurdles of various fizes, like peas or
tares; others have dry fixed fcafs all over their limbs and
bodies; fih others a moiture attended with heat and inflam-
mation; the humour being fo sharp, and violently itching,
that the animals rub fo increafingly, as to make themfelvcs
ran. Some have no eruption at all, but an unwhofome
look, and are dull, fluggifh, and lazy. Some appear only
lean and hide-bound, others have flyng pains and lamens,
resembling a rheumatic; fo that, in the furfeits of animals,
we have almoft all the different appearances of fevency and
other chronic diftempers.

In all furfeits of animals, care fhould be taken to have them
well managed, both with refe{p to their food and other
matters, frequent changes being highly necel{ary and ufeful.

**Surfeit Water**, is a water diftilled from poppies, and
other herbs, proper to cure indifpofitions.

**Surfundkar**, in Geography, a town of Aftafic
Turkey, in Aladuia; 25 miles S. of Marafch.

**Surgab**, a town of Cadahar, on the Kameh; 42
miles S.E. of Cabul.

**Surgeres**, 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 1477, and the canton 11,293 inhabitants, on
a territory of 261½ kilometres, in 18 communes.

**Surge**, in Ship-Building, the tapered part in front of
the whelpes, between the shocks of a capftan, upon which,
when
but marvellous feats he might accomplish, were they to have the advantage of a great head, and of ample time.

But it is not to be expected that such a talent can be the result of any amount of study, nor can it be attained without the greatest perseverance.

To surgery, as a science, it is a matter of great importance to be acquainted with the nature of the disease, and the methods of treatment, which can be applied to it.

It is also to be observed that surgery is a branch of medicine, and that the surgeon must be acquainted with the whole science of medicine, before he can be considered as a surgeon.

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Socrates, 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. Socrates drew up the history of acute diseases in so masterly a style, that twenty palt centuries have hardly found occasion to add any thing to the performance. But surgery was far from attaining the same degree of perfection. The religious veneration for the stylium of the dead, and the impossibility of dissecting the human body, formed an insuperable obstacle to the study of anatomy. An imperfect acquaintance with the structure of animals, reputed to bear the greatest resemblance to man, could only furnish venturesome conjectures, or false inferences. These circumscribed notions sufficed for the study of acute diseases. In these cafes, the attentive observation of strongly marked symptoms, and the idea of the operation of a fatal 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 surgery, deprived of the affinitie of anatomy, was too long kept back in an infant stage. Whatever profiles 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 medici, de fracturis, de capitis vulneribus, de articulis vel luxatis, de incircibus, de dilulis,) 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 pollute no work written by any of the successors of Hippocrates until the period of Celsus, which leaves a bare interval of almost four centuries. In this space lived Erasistratus, 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 Antonius, Tiberius, and Caligula. He appears never to have practised the healing art, on which however he has written with much precision, elegance, and perspicuity. His work is the more precious, inasmuch as it is the only one which gives us information with regard to the progress of surgery in the long intervale 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 elegant, that he has generally been regarded quite as the Cicero of medical writers, and long enjoyed high reputation in the schools. His surgery was entirely that of the Greeks, notwithstanding he wrote at Rome; for, in this capital of the world, physic was then professed only by persons 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 Asia Minor, and came to Rome in the reign of the emperor Marcus Aurelius. He practised surgery and physic there about the year 165 of the Christian era. (Galeni Opera Omnia, 1521, edit. 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 physic into dietetical, chirurgical, and pharmaceutical, no such distinction was followed in practice. As Galen had been a surgeon at Pergamus, he continued the fame 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 systems and dazzling speculations of philosophical sects, he afterwards neglected surgery, which strictly rejects them. His writings prove, however, that he did not abandon it entirely. His commentaries on the treatise of Hippocrates, "De Officina Medici," and his essays on bandages, and the manner of applying them, shew that he was well versed even 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 15, 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 Oribabas, Eutius of Amida, a physician who lived towards the close of the fifth century, Alexander of Tralles, and Paulus Aegineta, so called from the place of his birth. This last collected into one work, still jully 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 be wished to let the Arabs have a share in the honours of antiquity. Paulus practised at Rome and Alexandria. Afterwards the rise of surgery followed that of all the sciences, and from the capture of Alexandria by the Saracens under Amrou, viceroys of Egypt, in 641, until the end of the tenth century, nothing prevailed but the dark clouds of ignorance and barbarism.

Matters of a great part of the Roman empire, the Arabsian dug up the Greek manuscripts, which were buried under the ruins of the libraries, translated them, appropriated to themselves the doctrines which they contained, made them poorer with additions, and transmitted to poerity only enormous compilations. In a word, such are the treatises of Rhazes, Hali Abbas, Aviceanna, Averroes, and Alhacces, the most celebrated of the Arabian authors. Inventors of a prodigious number of instruments and machines, they appear to have calculated the efficacy of surgery by the richness of its applications, and to have been more anxious to inspire 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 fate of medicine was not more fortunate. In vain the school of Salernum, founded about the middle of the seventh century, made some attempts to revive its splendour. Medical science being feated on the fame benches, where the doctrine of Aristotle, accommodated to religious opinions, was the subject of endless controversies, it imbibed, as it were by contagion, the argumentative and sophistical mania, and became enveloped in the dark hypotheses of scholastic absurdity. Richerand, Nofographic Chirurgiale, tom. i.

The universal ignorance (continues this author) the horror of blood; the dogma of a religion, which hired it in torrents for ufelefs quarrels; an exclusive rehil for the fubflely of the fchools, and fueculative theories; are circumfances which further explain the profound darknefles which followed fuch empty labours. About the middle of the twelfth century (1163), the council of Tours prohibited the ecclefiaftics, 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 almofit all entirely unlettered and deftitute of education. The
SURGERY.

The priests, however, still retained that portion of the art which abounded in the effusion of blood. Roger, Rolandus, Bruno, Guilelmus 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 1353, in the pontificate of Urban V., whose physician he was, continued to be for a long time the only classical book in our schools. It may be observed, that as he imitated in every respect the other Arabians, and like them thought that it did not become an ecclesiastic to deviate from the austerity of his profession, he has panned over in silence the diseases of women.

Antonius Benivienus, 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 Abdritis Renum Caufûs, Florent. 1507, 4to.) A new era now began. The moderns, that, by treating fervidly in the footsteps of their predecessors, they should never succeed in equaling them. The labours of Vefalius gave birth to anatomy. Illuminated by this science, surgery, the reformation of which had been already prepared by the works of some Italian physicians, put on a different appearance in the hands of Ambrofio Paré, the first and most eminent of the French surgeons.

Obeying the dictates of his genius, Paré made authority yield to observation, or sought to reconcile them, when envy, basely intent on perverting him, represented his discoveries as a crime. Although he was the reformer, if not the inventor, of the art of tying the blood-vessels, 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 distinguished improvement deserved.

Surgeon of king Henry II., Francis II., Charles IX., and Henry III., of France, he practised his profession in various places, followed the French armies into Italy, and acquired such eminence, that his mere presence in a besieged town, was enough to reanimate 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 (Mém. 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 savoir aucun (fays Brantome) finon maître Ambrofio Paré, fon premier chirurgien, et le premier de la chrétienne: et l'envoya quérir et venir le lair dans sa chambre et garderobe, lui commandant de n'en bongy; et dîant qu'il n'étaoit raisonnable qu'un qui pouvait servir à tout un petit monde; feul ami mauîcace."

Ambrofio 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 justly celebrated for having composed the first statutes of the College of Surgeons at Paris, in the reign of St. L., wis, 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'Ambrofio Paré, Contellor et premier Chirurgien du Roi, divises en 28 livres, in folio, edit. 4. Paris 1585.

His writings, so remarkable for the variety and number of facts in them, are eminently distinguished from all those of his time, insomuch as the ancients are not looked up to in them with superstitious 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 surgeons the same place that Hippocrates occupied amongst physicians. Nay, they add, that perhaps there are none, either of the ancients or moderns, who are worthy of being compared with him. Richerand Nofographie Chirurg, tom. 1.

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 barbers by a most disgraceful allocation.

Pigrai, the successor of Ambrofio Paré, was far from being an adequate substitute for him. A spiritless copy of his matter, he abridged his Surgery in a Latin work; where the unaffected graces of the original, the fincerity, and the ineffable charm, in separable from all productions of genius, entirely disappeared. He received, however, equal praise from his contemporaries; doubting, because he filled a high situation. But, as Richerand remarks, his name, which is to-day almost forgotten, proves sufficiently that dignities do not constitute glory.

Reuillet and Guilmeneau distinguished themselves in the art of midwifery; while Covillard, Cabrol, and Habicot, enriched surgery with a great number of curious observations. See Obf. Chir. plines de Remarques curieuses, Lyon, 1659, 8vo.; Alphabet Anatomique, Geneve, 1662, 4to.; and Semaine Anatomique Qüelion Chir., Sur la Bronchotome, Paris, 1660, 8vo.

In the next or 17th century, the same impulsive produced additional improvements. Then appeared in Italy Cexar Magatus, who simplified the treatment of wounds, (De Rara Vulnerum Medicatione, lib. ii. Venet. 1616, fol.); Fabricius ab AQuapendente, even less praifeworthy as a surgeon than as a physiologist (Opera Chir. Paris, 1615, fol.); and Marcus Aurelius Severinus, that reformer of active surgery (De Elliciae Medicinâ, lib. iii. Francfort, 1613, folio; De Recondita Absceffim Natura, lib. vii. Neapol, 1624, 4to.); and Trimenis Chirurgia, &c. (Francfort, 1653, 4to.) Amongst the English surgeons flourished Wilkeman, 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 classified among the principal improvers of this science. (See Exercitatio Anatomica de Motu Cordis et Sanguinis in Animâbus, Francoforti, 1655, 4to.) In Germany, Fabricius Hildanus (Obf. et Curatum Centuria 6, 2 vols, 4to. 1641.) This Fabricius was far superior to the other. Scolceitus, so well known for his work, entitled, "Armamentum Chirurgicum, Ulmæ, 1653, fol." Fürrmann and Salingen, who had the fault of being too partial to the use of numerous complicated instruments. See Curze Obf. Chir. Lipzi, 1710, 4to. Manuale Obf. 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 merit equal celebrity for his Obf. Anatomico-
Chirurgicarum Centuria, Amsterdam, 1691, in 4to. carried with him to the grave the secret of his admirable injections. (See also his Thèfur. Anat. X. 4to. Adversaria Anatomicorum Medicæ-Chirurgicorum, Decad. 3. 4to. Amsterdam.) Roehuysen 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 acconcheur Mauriceau (Traité des Maladies des Femmes Grottes, Paris, 1668, 4vo.), Dionis (Cours d'Opérations de Chirurgie, Paris, 1707, 8vo.), Saviard (Nouveau Recueil d'Obst. Chir. Paris, 1702, 12mo.), and Belli (Chirurgien d'Hôtel, Paris, 1659, 8vo.), were the only French surgeons of note, who could be contrasted with so many 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 society. 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 fatal return to absurd prejudices, exploded opinions, and practice, condemned by experience, would be too certain a proof of it.

Chronology teaches only the history of dates. In the flux 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 feeble rays always precede brillant lights, and it approaches perfection in a very gradual way. In the last century, however, amongst the distinguised 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, whose glory has been shared by the Academy of Surgery; and, secondly, the celebrated Default.

It is not with surgery, as with physique, slightly so called; the epochs of the latter are distinguished by hypotheses; while those of surgery are marked by discoveries. The eminent men in this latest branch of the profession have not, like the most renowned physicians, created facts, built systems, deestroyed those of their predecessors, and constructed a new edifice, which, in its turn, has been demolished by others. 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 futilities, 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 invabriable laws of its principles, shall we oppose the numerous revolutions of phystic? The Christian religion, which abounds in fects, has not more in physic. "Naturfestes, solidities, humoristes, vitalites, animistes, semi-animistes, mechanicists, chimistes; le plus grand nombre des médecins honore Hippocrate d'un culte presque spherullieux; ceux-ci marchent sous les bannières de Stahh: ceux-la s'appuient du grand nom de Boërhave: tels autres invoquent, Sydenham, Hoffmann, Stoll, abfolument comme les théologiens combattent pour Luther, Zuingle, Calvin, ou Janien."


The elegance of 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 blending the study of anatomy with his amusements when a boy; and ardently 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 fur 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 eminen 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 associates. 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 Marefchal, La Peyronie, and La Martiniere, affured him of the royal favour, Quefnay, 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 Mémoires et Prix de l'Académie Royale de Chirurgie to 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 Opérations qui leur conviennent: Ouvrage posthume," a production that will always stand 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 "Mémoires 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, Ganenguet, De la Faye, Louis, Verrier, Poubert, Hevin, Pibrac, Pâbre, Le Cat, Bordemave, Sabatier, Puxos, Lever, 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 Vésicule, 1 vol. 12mo.
2. Opérations
Surgery.

1. Opérations de Chirurgie, 2 vols. 12mo.
3. Traité des Plans d’Armes à feu, 1 vol. 12mo.
4. Connaissances de Chirurgie, 1 vol. 12mo.

Garrigue wrote:
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 compiled:
Traité des Accouchemens, Paris, 1759, 4to.

Levet wrote:
2. Art des Accouchemens, démontrée par les Principes de Physique, Paris, 1761, 8vo.

To the foregoing list of eminent French surgeons, must be added the names of La Motte, Maître-Jean, Goulard, Daviel, Ravaton, Mejean, Poutou, David, and Frère Cofne.

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:
Œuvres de Chirurgie, Liège, 1763, 2 vols. 12mo.

Ravaton compiled:
Le Chirurgien d’Armée.

Poutou:
1. Mélanges de Chirurgie, 1 vol. 8vo.
2. Œuvres polthumes, 3 vols. 8vo.

David:
Observations fur la Nécrôse, Paris, 1782, 8vo.

While surgery was thus advancing in France, other nations did not neglect it. At this period flourished in England, Cheffelden, Douglas, the two Mons, Sharpe, Cowper, Alanon, Percival Pott, Hawkins, Smelle, 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 treatt, entitled, “Lithotomia Douglasiana;” Sharpe’s Treatise of the Operations, and his Critical Enquiry into the Present State of Surgery; Mons’s Works, by his Son; Alanon’s Treatise on Amputation; Pott’s Chirurgical Works; Smelle’s Midwifery; and John Hunter on the Blood, Inflammation, &c.; his Treatise on the Venerial Difeafe; Animal Economy; and all the papers written by himself and his brother; are productions, which reflect the highest credit on the whole of surgery in England.

At the period when the preceding distinguished men upheld the character of their profession in Great Britain, Molinelli, Bertrand, and Molécati, 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; Reederer (Elements Artis Obfletriciae, Goett. 1752; Obs. de Partu Laborante, Decad. ii. 1755); Stein; Bélanger; Acrel; Califen (Principia Systetati Chirurgiae, Holdein, 2 vols. 8vo.); Brambulla; Theden (Progrés ultérieurs de la Chirurgie); and Richter, Traité des Hernes, 2 vols. 8vo.; Bibliothéque de Chirurgie; Anfamglgr. der Wundartzney-kund, 7 vols.; and Obst. Chirurgiatricum Fafe.

On the continent, the Academy of Surgery at Paris was long considered quite as the solar light of this branch of science. The French revolution, which, by a fatal abuse, involved in the same prohibition useful as well as improper societies, did not spare even this beneficial estabishment. Although the academy was deprived of the talents of M. Louis, who died a short time before its suppression, it yet had, at this period, several members worthy of continuing its labours and supporting its reputation. Sabatier, Default, Chopart, Lafuini, 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 Voies urinaires, 2 vols. 8vo.

Percy:
Pirotchtnie Chirurgicale, &c.

Baudeloque:
Traité des Accouchemens, 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 politerity: 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 he delivered Boyer, Dubois, L’Heritier, Mansoury, Lallemant, 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 courtes of lectures upon the materia medica, internal clinical medicine, and morbid anatomy, announced this valut 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 indispensible the study and even the practice of surgery are to him, who would wish to be a distinguished and successful physician. Nofogri. Chir. tom. i. p. 25.

Perhaps nothing contributed so favorably 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 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 discontinuance of a society, in which emulation and talents were so long united for the benefit of mankind. The various dissertations, 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 institution 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 overthrown by the agitation of the French revolution, has had only a very inferior substitute in the Ecole de Sainte.

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, without hesitation, assign such importance to the establishment of an institution in the metropolis, on the same grand, liberal, and encouraged plan, as the late Royal Academy of Surgery 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 defer the utmost encouragement the profession can bestow; but in a surgical 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 Ecole de Médecine, than a manifest falling off occurred. It is right that physicians 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, ext eris paribus, prove 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 rea son, which now prevail both in the doctrines and treatment of the complaint.

Strictures in the urethra, an equally common and distressing 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, Scarpa, Lawrence, &c.

The treatment of injuries of the head has been materially improved by Queinay, Le Drone, Pott, Hill, Abernethy, &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 productive of considerable relief, and sometimes of a perfect cure.

The mode of treating lumbar affections 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 injection, as described by Sir James Earle, may also be enumerated among the recent improvements.

The increasing aversion to the employment of the garget in lithotomy, and the many distinguished advocates for the use of better instruments in this operation, may be hailed as propitious omens of beneficial changes in this part of practice.

In the treatment of unsutured fractures, the simple and ingenious practice proposed by Dr. Physic of Philadelphia, merits particular notice; not only on account of the several successful trials which have been made of it in this country and France (see Medico-Chir. Trans. vols. vi. and vii., 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 ineffable treatise of Dr. Jones on hemorrhage, has now produced quite a revolution in all the principles by which the surgeon is guided in the employment of the ligature for the lopping of bleeding, and the cure of aneurisms. Instead of thick clumsy cords, small firm filks, or threads, are now generally used; and so far is the practitioner from being fearful of tying arteries too tightly, left the ligature cut through them, that it is now a particular object with him to apply the silk, or thread, with a certain degree of force, in order that the inner coat of the vessel may be divided. If this 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 hemorrhage is more likely to occur. But in order to convey 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 Hæmorrhagia, to give a tolerably full account of the results of all his interesting experiments.

Befides 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 suspect, that much benefit may also arise from cutting off both portions of the ligature close to the knot, after amputations, the removal of the breast, &c. No one has inquired 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 particle of extraneous substance in the flesh, as the little bit of silk compoing 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 almost nothing; the danger of convulsive affections will be lessened in proportion as a serious caufe 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 hitherto his experience 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 several of our military surgeons; and although they have probably not employed exactly such ligatures as this mode absolutely requires, the greater part of them have met with hardly any incursions of future trouble from the bits of ligature 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 silk composing the extraneous fibrilane left in the wound, when such ligatures as Mr. Lawrence particularly recommends are employed.

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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.

Amongst 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 farago of irritating plasters and platters, and a cumbersome fmalie 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 issue of the discharge. Over the adhesive plasters, let the surgeon be content with placing a single pledge of fperms acerate, and some linen wet with cold water, which will often avert hurtful degrees of pain and inflammation, by keeping the parts cool.

Wares, 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 Withering also collected their most valuable knowledge principally in 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 superseded, 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. Boncher.

(See Mem. de l'Acad. de Chir. tom. ii. 4to.) It was, however, more particularly described and even practised by Mr. C. White, of Manchester. (See his Cales in Surgery.) Lately, it has been repeated with success by Mr. Morell, in the York hospital. See Medico-Chir. Trans. vol. vii.

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 (we believe) with success. This proceeding has also been adopted by Mr. Brownrigge, flank-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 the only means affording a chance of life; but we deem the chance to 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. Scarpa's book on Anureism, and Hodgden'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 discauses 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 professed quacks and quacks of the most lucrative and agreeable branches of practice. However, the able writings of Daniel, Wenzel, and Ware, begin now to be familiarly 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 inserted in this Cyclopedia, 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 fize, as long as its circumference preserves its transparency; but as soon as the capsule and lens are penetrated, even with the finest 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 confidence 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, pollefs various degrees of vision. Some see external objects indistinctly; others can discern only bright colours, or vivid lights. If the blindfolds 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 Pel-lier's elevator; controlling the little patients by force; dilating the pupil with the belladonna; and employing
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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 precluded itself, his main plan was to form an opening in the middle of it.

When Mr. Saunders practiced his posterior operation, for a capsule containing an opaque lens, he introduced the needle, in the common way, through the sclerotic. He then gently depressed its handle, so as to direct its point towards the capsule, through the thin edge of the lens; and, pulling 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, left he should dilate 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 loosen the texture of the lens. Small fociuli he allowed to fall into the anterior chamber; but he endeavored to avoid forcing large fragments thither.

When the posterior operation was done, and the capsule 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 first detached; and then the same manœuvre were adopted, as in the anterior operation or capsular cases. The capsule was often so yielding, that a backward or deprefling 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 prococles, or vitreous humour, and was left apt to excite inflammation.

The success of this gentleman's practice may be conceived, when it is known, that of sixty patients, he restored fifty-two to sight 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 ages of eighteen months and four years.

Among the arguments mentioned in favour of operating early, two in particular merit attention. First; we are told, that in cases in which the patient has no perception of external objects, the muscles acquire so involute a habit of rolling the eye, that for a very long time after the pupil has been cleared by an operation, no voluntary effort can control this irregular motion, nor direct the eye to objects with sufficient precision for the purpose of distinct and useful vision. Secondly; the retina, when not exercised for a long while, is apt to lose a degree of its sensibility. Treatise on some practical Points relating to the Diseases of the Eye, by the late J. C. Saunders, 1811, edited by Dr. Farre.

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 specific for nearly all cafes of gangrene; and in these and many other infirmities it was prescribed without any discrimination, and in doses beyond all moderation. But the false idea that this medicine has any specific effect in checking mortification, no longer blinds the eyes even of the ordinary practitioner. He neither believes this doctrine, nor the still more absurd opinion,
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 diarrhea. I believe it to be, in mortification, a medicine completely inert and inefficacious." Lectures on Inflammation, p. 564.

The removal of this deeply-rooted prejudice concerning the virtues of bark in stopping 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 utmost consequence. Every surgeon is aware, that when a limb is seared 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. Pott, only been sanctioned when the mortification has manifestly ceased to spread, and a line of separation has formed between the dead and living parts. All other instances, 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, Mr. Larrey. How different his doctrines and practice are from those usually taught in the schools, the following extract from his writings will sufficiently prove.

"Writers on gangrene, or phæclusus 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 humid 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 any thing 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 seared 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 phæclusus, 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 else where unimjured, 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 seared with mortification, the operation must be done on the thigh, and no time should be lost. The same practice is applicable to the upper extremities. We must be careful not to mistake a limb affected with lipor for one that is actually phæclated. In the first case, warmth, motion, and liveness will be 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 laid 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 ceased to spread.'

"I have been a witness of the death of several individuals, from too vigorous an adherence to the contrary precept; and at length grievously impelled with this lofs, 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 est enim auxilium auxilium, quia nihil auxilium.'

"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 from the whole limb into a phæclated 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 18th regiment, whose fore-arm and afterwards arm phæclated, in
consequence of a gun-shot wound in the articulation 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-join. 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 sloughing, and saved the patient's life, who, at the conclusion of the siege of Alexandria, 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 soldier belonging to the 36th regiment of the line, the leg having 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 sloughs were detached; the wound assumed a clearer appearance; and cicatization was completed on the 52d 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 Jena and Auerstitz, several of my colleagues, surgeons of the first claf, undertook, in confluence of my advice, and the examples of successes which I had recited to them, the amputation of limbs equally sloughed, although the mortification was not limited, rather than abandon the patients to a death which appeared inevitable. In general, these practitioners experienced the same successes 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 sloughing may yet be in a spreading state. We must be content, however, with having stated the particulars already explained; and the reader will find more of the subject in 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. Potis 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 Pot attributes 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 constitution has been changed between the era of Mr. Pot and that of M. Larrey? The last gentleman's facts are too well authenticated 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 he had the pleasure to see his patient recover in the most favourable manner. See Medico-Chir. Tranf. vol. vi. p. 184.

"The ille effect of the preceding cases," says this gentleman, "clearly proves, that that humud kind of gangrene which occurs in a healthy subject from severe local injury, which is rapidly affects, or rather injures, a whole limb, and reaches the trunk in a few hours, must constitute one of these exceptions to the maxim of not amputating till the mortification has actually stopped. It may, indeed," says Mr. Lawrence, "be stated generally, that the operation, even if its result should be deemed hazardous, offers the only chance of life; and that without it, the patient's fate is certain. I would not be understood as meaning to recommend the practice in all instances of mortification from local injury. I can conceive that a gangrene may arise, in an unfound constitution, from a comparatively slight accident, so 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 very severe injury, in a subject otherwise healthy." Lawrence in Medico-Chir. Tranf. p. 188.

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 maller glazier, a strong man, about 40 years of age, flipped down a ladder with his feet foremost. When he had defended some yards, the end of a spear-shaped iron railing came into violent contact with the right arm, at the bend of 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 vein. The patient was conveyed home, and treated on the antiphlogistic regimen. In the course of thirty hours, however, the limb became gangrenous, being affected with conflabular edema, livid discoloration, and a large phlyctena on the forearm. The patient's countenance was beginning to put on a cadaverous appearance; his pulse was small and rapid, not less than 125, and irregular; and he was covered with profuse perspirations. He was also affected with a remarkable degree of fluor, which made him feem 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 coincided 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 fluor appeared to leave him at 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 cafe 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 allude to and even flatter the belief of the French and other continental surgeons. We therefore propose to conclude this article with a few remarks, explaining some particulars which we 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 milk 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 adduced in favour of the efficacy of a treatment first proposed by the celebrated Valfaiva, 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 vast aneurisms of the aorta, so large as to project through the aborced part of the ribs and sternum, may sometimes in a very moderate time be reduced and cured by Valfaiva's method. This chiefly consists in bleeding the patient largely and repeatedly; in allowing only the milk, vegetable 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 the strictest 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, having been bled several times a day. Besides aortic aneurisms, M. Pelletan effected the cure of a subclavian aneurism by pursuing Valfaiva's treatment. See Clinique Chirurgicale, par J. P. Pelletan, to. i. Mem. fur les Aneurismes internes, Paris, 1816.

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 pressure of the swelling itself on the vessel. It is sometimes produced by the skillful 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 cut 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 sloughing. We have seen an inguinal aneurism, under Mr. Albert, get well by the tumour mortifying, and the inflammation extending to the artery. Whenever the sloughing and inflammation are only superficial, and confined to the skin and fascia, 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 maintain much expectation of it, or to justify a surgeon in withholding his assistance.

Setting out of the quission Valfaiva'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, particularly if the aneurism be small, and the whole of its contents can be made to recede. However, though it is generally proper to try pressure 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 instances recorded of aneurisms being cured by a long perseverance in pressure, 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 Scarpa, 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 uncertainty of removing the factorius muscle too much from its position, or of turning it back for the purpose of exposing the artery and tying it. The bell operators, even professed anatomists, are frequently embarrassed by having the factorius immediately in their way, after they cut through the skin. Also, as the artery is more superficial higher up, and likely to be in a morbid state, there is every consideration in favour of this part of Scarpa's practice.

Mr. Abernathy 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 he has tied the external iliac artery, and established the fact, that the incoagulations, 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 person, 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. Alsey 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 anafo-mosing vessels. The cases might almost warrant the conclusion, that the limb is in no more danger of mortifying on
The surgeon always, until very lately, to deem it indispensably necessary, in operating for aneurisms of the brachial artery, to tie the vessel, both above and below the swelling. They thought that one ligature above would not be sufficient, by reason of the freedom with which the blood would get into the face, through the incoagulations between the collateral and recurrent arteries. Scarpa, however, has explained, that one ligature above the tumour is quite enough. An incision is to be made along the inner edge of the biceps muscle, the sheath of the artery opened, and the vessel, after being separated from the median nerve and vein, tied with due firmness.

When the aneurism of the brachial artery is diffused, and attended with violent pain and inflammation, Scarpa advises the old operation of opening the tumour, taking out the coagulated blood, and tying the artery with two ligatures, one above, the other below, the opening in the vessel.

The propriety of this practice seems to us very questionable.

The insufficiency of the anaestomosing vessels for the transfusion of the blood, when a large arterial trunk is tied, appears now to have been exemplified in every situation where the performance of such an operation is at all practicable. Not only may the external iliac artery be tied, without the circulation in the lower extremity being cut off, the subclavian artery at the point, where it first emerges from the chest may also be tied, and yet the arm receive an adequate supply of blood. Were it not for these well-established facts, patients with wounds and aneurisms of the axillary artery must be left to their fate.

In January, 1795, Default was called to a man, whose axillary artery had been wounded with a small sword. The external opening made by the weapon being small, the patient did not immediately bleed to death; but a large false aneurism arose, attended with occasional hemorrhages. Feverish symptoms came on, and the pain in the part was very great. On the fourth day, the fore-arm became cold and of a yellowish hue, and the suffering was so great as to threaten to induce convulsions. Treth bleeding took place; the swelling grew larger, red, and tense; and an obfure pulsation was perceptible.

Default caufed the axillary artery to be compreaffed againft the firft rib, on the outside of the frerno-cliedo-mafoideus, from above the clavicle. He then made an incifion fix inches long, from the external third of the clavicle in the direction downwards and outwards. Two large branches of the thoracic artery, divided by this cut, were immediately tied. By a fcond incifion, Default divided the two lower thirds of the pedicles major, the bifouary being guided on a firector. A vast quantity of blood now gushed out. Default infantly put his fingers on the artery, and with the aid of a kind of needle, to which the reader’s attention will preferly be requfed, he paflad a ligature at once under the veffel and axillary plexus of nerves. By means of this firft ligature, the hemorrhage was flopped for a time, and the artery drawn a little out, fo as to be more visible. The veffel was then separated from the nerves, and ligatures (on each fide of the opening in it) applied, with the aid of the particular needle ufed by Default, for conveying ligatures under veffels deeply lodged, and termed by the French la ligature à refort.

There are all the elfential circumstances which need here be mentioned, in regard to the mode of operating. The extravafated blood was washed away, and the wound dried, though unfortunately not without being crammed with lint, instead of having its edges brought together. The firft 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 sticking-plaster, according to the most approved principles. At the same time, it must be confelled, that diffufed false aneurism are the moft dangerous of all thofe which admit of operations, particularly when the arteries interfeed are of large fize. The interposition of an enormous quantity of blood into the cellular texture, proves both an impediment to the free circulation in the limb, and a frequent caufe of gangrenous symptoms, in addition to the obftruction to the paffage of the blood through the main artery, occafioned by the ligature.

It appears that Mr. Keate has also tied the axillary artery by cutting below the clavicle. The ligature, however, which was paffed with a needle, did not include the veffel by itself, as is most defirable. This operation proved entirely successful. See Med. Rev. and Mag. for 1801.

M. Pelletan, in 1786, had under his care a man, in the Hopituf du College de Chirurgie at Paris, who was affufed with an axillary aneurism, which had exifted 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 confiderable fpase was perceptible between the tumour and clavicle. The clear manner in which the artery could be felt under this bone, when the shoulder was elevated, and the eafe with which preffure on the veffel sufficed for flopping the pulsation of the swelling, feem to have induced Pelletan to think of operating. He was further encouraged by confidering, that the branches given off by the subclavian artery were numerous, as well as their communications with the branches arifing 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 pafling a director 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 expofed the axillary artery, fo as to have been able to apply a ligature to it. Unfortunately, fome other furgeons, called into confultation, objected to the project of dividing the pectoral muscle; and Pelletan was foiled, after making in vain a deep and hazardousフト with the needle, in the hope of being able to include the artery. The patient was afterwards feized with inflammation and pain in his chift, and died on the twentieth day from the operation. Clinique Chir. par J. P. Pelletan, tomo. ii. p. 49.

In a periodical work, we find brief mention made of another cafe, in which the subclavian was tied on account of an axillary aneurism. The mode of operating is not flated; the objeét is faid to have been easily accomplished; but the
the patient died on the fourth day, with symptoms of op- 

On the whole, perhaps, the method adopted by Defaulc 
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 pec- 
toral muscles. The auxiliary vein lies before the artery, and 
as a wound of it would probably be fatal, the utmost 
caution must be observed in the dilflection. 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 ascertained to be 
fixed, either the main and any adjacent nerve should be care- 
fully 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 ibrenum, 
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 inwards towards the ibrenum, the only place 
where the subclavian artery can be taken up, is just where 
it emerges from the chelf, from behind the anterior scalenus 
muscle, and the object can only be effected by cutting above 
the clavicle. On a dead subject, having no large aneur- 
smal fungation, such an operation is much easier than on a 
living person, whose clavicle is pulsed up by a vail tumour, 
so as to increase the distance between the artery and the 
round in the skin. The most interesting example of this 
operation lately occurred in St. Bartholomew's hospital. 
Mr. Ramden made a transfere 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 ilerno-cleido-maltooideus muscle. This incision di- 
vided 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 ilerno-cleido-maltooideus muscle, 
to the extent of two inches. The shoulder was now 
lowered, and the edge of the anterior scalenus muscle ex- 
pelled. The artery was then distinctly felt, presenting it- 
sself from between the scaleni, and it was detached with the 
finger-nail, in order that the ligature might be palled round 
it. Here some considerable difficulty arose, as Mr. Ram- 
den 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 duclile 
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 dilflection, 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 
dimination of its temperature, though the subclavian artery 
is tied immediately it comes out of the chelf. Secondly, it 
proved, that an artery so near the heart as the subclavian, 
must be rendered impervious by the ligature, or, on dilflec- 
tion, this vessel, where the cord was applied, was nearly 
divided through, while the two ends were found confolu-

dated 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 chosen to submit to the 
operation before the tumour began to throb, and before 
his health was materially impaired; and that the operation 
itself was shortened and facilitated by the afliance of the 
needles represented in Mr. Ramden's publication.

These instruments undoubtedly rememble, in principle, 
Default's signale a refolt, which confined of a silver sheath, 
one end of which was straight, and the other curved in a 
semi-circular way. This sheath encloped an elastic wire, 
one end of which projected a little beyond the bent end of 
the sheath, and had a transfere 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 pushed through it, till the transfere eye had ascended 
sufficiently to let the surgeon take hold of the ligature. 
This being difengaged from the instrumiv, the latter was 
withdrawn. The needle invented by Mr. Watts appears 
to us rather an improvement on Default's, inasmuch as it 
ismade to let loose the eye and ligature together, as soon 
as they are conveyed far enough round the artery; a con- 
trivance likely to save some little trouble.

Aneurismal needles, made on the foregoing principles, must 
certainly afford great afliance 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. Aikley Cooper 
in one attempt which was made some time since in Guy's 

Nothing is more possible than to mistake one of the cer- 
vical nerves for the subclavian artery, in consequence of the 
pullation of this vessel being communicated to all the adja-
cent parts. We have seen a mistake of this kind actually 
made by very skilful surgeons.

Pelletan practiced 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 ilerno-cleido-mal- 
toideus muscle, so as to bring into view the scaleni muscles. 
The anterior portion of these muscles being divided, a ligu-
ature was conveyed without difficulty under the subclavian 
artery, with the aid of an aneurismal needle, mounted on a 
handle, laid by the French to have been invented by Def- 
champs. (Clincine Chir. tom. ii. p. 86.) With the ex- 
ception of cutting the anterior scalenus, which seems un-
ecessary, Mr. Abernethy has demonstrated in his lectures 
a similar operation these many years past.

That the carotid artery might become obliterated, with- 
out 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 ca-
rotid obliterated from its bifurcation, as far as the subcla-
vian 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 con- 
sequences on the brain. In one instance, indeed, where Mr. 
Abernethy was obliged to take up the carotid artery, the 
head became gorged with blood, 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
Perhaps, therefore, it might be more correct to refer to the affection of the brain to these causes, than to the ligature on the carotid artery. We may make such inference with tolerable certainty, since it has now been repeatedly proved, that tying this vessel, even in the most hasty manner, occasions no dangerous consequences on the brain. Heubenreit mentions a case, which he had met with, where the external carotid was wounded in the extirpation of a tumour; and the patient would quickly have fallen a victim to the haemorrhage, had not the surgeon instantly tied the trunk of the artery. The operation succeeded, and the patient lived many years afterwards. (See his transl. of B. Bell's Surgery, vol. v.) Mr. B. Travers, surgeon to St. Thomas's hospital, tied the carotid artery in a woman, who laboured under an aneurism by anatomosis in the left orbit, causing a protrusion of the eye from its socket, and attended with disfiguring head-aches. No alteration in the functions of the brain ensued; no haemorrhage arose on the separation of the ligatures; and the consequence was a cure of the tumour in the orbit, the violent pain in the head, and the exophthalmia. See Medico-Chirurgical Transactions, vol. ii.

Another highly interesting example, in which an aneurism by anatomosis in the orbit was effectually cured by tying the carotid artery, is recorded by Mr. Dalrymple, surgeon at Norwich. This gentleman performed the operation on the 12th of November, 1812. The patient was a female, aged 44. The protrusion of the eye was relieved in proportion as the swelling diminished. The violent headaches also subsided; but the eye-sight was irrecoverably lost. See Medico-Chirurgical Trans. vol. vi. p. 111.

The most interesting example, in which the carotid was tied for the cure of an aneurism of this vessel, occurred in Gaty's hospital. The tumour was two inches and a half in diameter, was situated on the left side of the neck, and was accompanied with a severe pain on the same side of the head. The swelling in some degree affected the speech and respiration, and the patient was troubled with occasional sicknels, griddines, and loss of sight. The aneurism was just below the angle of the jaw. Mr. A. Cooper, in the operation, began an incision opposite the middle of the thyroid cartilage, carrying the wound from the base of the tumour to within an inch of the clavicle, on the inner side of the mastoid process. On raising the margin of this muscle, the omohyoid was seen crossing the fifth of the vessels, and the vessel was detached from it. Mr. A. Cooper next separated the mastoid from the omohyoid muscle, and the jugular vein became apparent. The vein being drawn aside, the par vagum was seen, lying between that vessel and the carotid artery, a little on the outside of the latter. This nerve was easily avoided. A blunt iron probe, then forced to convey a double ligature under the artery, and the lower ligature was immediately tied. Mr. A. Cooper then detached the artery from the surrounding parts, to the extent of an inch above the lower ligature, and then tightened the upper one. A needle and thread were then passed through the artery above the lower ligature, and below the upper one. The intervening part of the vessel was then divided. Lastly, the wound was closed with adhesive plaster. Suffice it to state in this work, that the patient instantly felt the violent pain in his head removed, and such complaint never returned; that the tumour immediately lost its strong pulsation, but yet had an obscure throbbing; that the swelling gradually subsided; and that the patient at length got quite well, and returned to his occupation as a porter. Medico-Chir. Trans. vol. i. p. 222—233.

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 preflure 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 unpropitious 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. 329.

In order to get at the carotid artery, Mr. Abernethy has recommended making an incision on that side of it next the trachea, where no important parts can be injured, and then to pass a finger under the vessel. The par vagum must be carefully excluded from the ligature; for tyng it would be a fatal blunder. See Fiirl Lines of the Practice of Surgery, by Samuel Cooper, edit. 3.

We could mention many other examples in which the carotid artery has been successfully tied; but the safety and propriety of the operation are now so generally known and acknowledged, that more facts of the same kind appear superfluous. Indeed, so little are surgeons now afraid of the ill effects upon the brain, that the carotid artery has lately been tied merely for the purpose of enabling the operator to take away a large tumour, including the whole of the parotid gland, from the side of the neck, without risk of hemorrhage. This mode of proceeding was adopted by Mr. Goodlad, surgeon at Barry, in Lancashire. See Medico-Chir. Trans. vol. vii. p. 112.

We shall conclude with some interesting particulars, relative to another new operation 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. Jeffrey, 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 practicability of putting a ligature round the internal iliac artery, informs us, that one of the first surgeons in London had a patient with gluteal aneurism. The tumour was large, allowed to burst, and the person bled to death.

I freely trust, that the following case may be the means of preventing such an occurrence in future.

M. Mills, a negro-woman from the Barbary country, in Africa, was imported as a slave into the West Indies in the year 1799. She was purchased for the estate Enfield Green; now the property of the heirs of P. Ferral, esq. I saw her first in the beginning of December, 1812. She had a tumour on the left hip, over the sciatic notch. It was nearly as large as a child's head, and pulsating very strongly. She could afford no cause for the diseaee. It had commenced about nine months before, with flight pain in the part, and had gradually increased to its present size. She
Sur

She was now much reduced, in great misery, and ready to submit to any operation."  See Medico-Chir. Trans. vol. v. p. 422, &c.

"With a few other particulars, Mr. Stevens notices, that he had tied the internal iliac on the dead body, and that he believed it might be done with safety on the living.

The following is some account of this operation, as practiced on the above negro-woman.

"On the 27th of December, 1812," says Mr. Stevens, "I tied the artery in the presence of Dr. Lang, Dr. Van Brackle, Mr. Neithropp, and Mr. Ford, the manager of the estate.

"An incision, about five inches in length, was made on the left side, in the lower and lateral part of the abdomen, parallel with the epigastric artery, and nearly half an inch on the outer side of it. The skin, the superficial fascia, and the three thin abdominal muscles, were successively divided; the peritoneum was separated from its loose connection with the iliacus internus and psoas magnus; it was then turned almost directly inwards, in a direction, from the anterior superior spurious process of the ilium, to the division of the common iliac artery. In the cavity, which I had now made, I felt for the internal iliac, infiltrated the point of my fore-finger behind it, and then pressed the artery between my finger and thumb. Dr. Lang now felt the aneurism behind; the pulsation had entirely ceased, and the tumour was disappearing. I examined the vessel in the pelvis; it was healthy, and free from its neighbouring connections. I then pulled a ligature behind the artery, and tied it about half an inch from its origin. The tumour disappeared almost immediately after the operation, and the wound healed kindly. About the end of the third week the ligature came away, and in six weeks the woman was perfectly well."

This is the first example in which the internal iliac has been tied. The operation was not attended with much difficulty nor pain, and not an ounce of blood was lost.

Mr. Stevens had no difficulty in avoiding the ureter, which, when the peritoneum was turned inwards, followed it. Had it remained over the artery, Mr. Stevens says that he could easily have turned it aside with his finger. See a particular history of this case in Medico-Chir. Trans. vol. v. p. 422, &c.

SURGOJA, in Geography, a circar of Hindoostan, in the country of Allahabad, situated W. of Bahar.—Also, a town and capital of this cirar, in the country of Orissa; 380 miles S.S.W. of Patna. N. lat. 23° 0'. E. long. 83° 31'.

SURGOOL, a town of Hindoostan, in Vizapour; 20 miles S.E. of Merritch.

SURGURRA, a town of Hindoostan, in the cirar of Sumbulpour; 7 miles N.W. of Sumbulpour.

SURGUT, a town of Russia, in the government of Tobolfs, on the Oby, built in the year 1593; surrounded with palisades; at which place the Oltians who live in this country pay tribute. The adjacent country abounds with tables; black, white, and red foxes, and fine grey furs; and has plenty of excellent fish, but produces no corn. The inhabitants of this town have the nick-name of Griwiche, because most of them are observed to squat; 284 miles N.N.E. of Tobolfs. N. lat. 61° 22'. E. long. 72° 14'.

SURIGY, a town of France, in the department of the Nièvre; 3 miles N. of Clamecy.

SURIAGO. See SULIAGO.

SURJAEPOUR, a town in Hindoostan, in Oude; 24 miles S.W. of Gorapour.

SURIANA, in Botany, named in honour of Joseph Vol. XXXIV.

Donat Surian, a celebrated physician and botanist at Marseilles, who accompanied Plunier in his travels to America.


Gen. Ch. Col. Perianth inferior, permanent, of five, lanceolate, pointed leaves. Cor. Petals five, obovate, spreading, the length of the calyx. Stam. Filaments ten, sometimes only five, thread-shaped, shorter than the corolla; anthers simple. Fil. Germens five, superior, roundish; filyles solitary, thread-shaped, erect, as long as the filaments, springing from the sides, not the tips, of the germens, rigman obtuse. Peric. none. Seeds five, roundish.


1. S. martina. Maritime Suriana. Linn. Sp. Pl. 624. Plum. t. 40. (Arbor americana, falcis folio, frondes bermudianlis; Pluk Alm. 44. t. 241. f. 5.)—Native of the coast in South America and the West Indies.—Root perennial. Stem shrubby, five or six feet high. Branches erect, subdivided, round, rough, glaucous, downy. Leaves on short stalks, clustered at the summits of the branches, wedge-shaped, obtuse, thickish, downy, or somewhat villous, pale green. Flowers small, yellow, generally from three to five, at a terminal, axillary flake, which is shorter than the leaves.

SURIGUR, in Geography, a town of Hindoostan, in Bahar; 28 miles W.N.W. of Rotafurg.

SURINAM, a province of 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 Maravina or Maroni, on the S. by a country of Indians, and part of French Guiana, and on the W. by the river Coretyn; about 150 miles from E. to W., and 65 from N. to S. The principal rivers that belong to this settlement are the Surinam, the Coretyn, the Equino or Equiquo, which at its mouth receives the Demerara, Berbice or Berbiz, giving name to a colony, the capital of which is Amsterdam, the Commewina, and the Maroni. The banks of creeks or rivulets that discharge themselves into some of these rivers are inhabited by Europeans, and cultivated with sugar, cocoa, coffee, cotton, and indigo plantations, which present a very delightful prospect to the water-paflengers. Captain Stedman says, that the province of Surinam has from fix to eight hundred plantations of this kind, which produce annually to the value of more than a million flirling. He computes the number of slaves at 75,000, the annual supply being 2500. The heats in this colony are tempered by breezes 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 appearances of fertility may be ascertained, 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 uncultivated parts are covered with immense forests, rocks, and mountains; some of the latter enriched with a great variety of mineral substances; and the whole country is interfaced by very deep marshes or swamps, and by extensive heaths or savannahs. The stream along the coast flows continually towards the N.W., and the
the whole there is rendered almost inaccessible, from its being covered with dangerous banks, quick sands, seedy banks, and a large quantity of brush-wood, which are closely interwoven as to be impenetrable. That part of Terra Firma which is called Guiana, or the Wild Coast, and in which lies the colony of Surinam, is laid by home to have been first found out by the jolly celebrated Christopher Columbus, in the year 1498, when he was lost among the chains of islands; though others contend, that it was not discovered till the year 1504, by Vaaco Unes, a Spaniard. In 1579, it was visited by Sir Walter Raleigh, under Queen Elizabeth, who also sailed the river Orunoko 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 a maracte, which the Spaniards call madre de oro. In the year 1634, a Capt. Marshall, and about sixty English, were discovered in Surinam, employed in planting tobacco, according to the relation of David Piteale de Vries, a Dutchman, who converted them with the intent. 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 1665, this colony being vacant, Francis lord Willoughby of Parham, by king Charles II.'s permission, sent thither one vessel, 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 Clarendon, 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 sugar plantations, and erected a strong fortress of hewn stone for their defence. It is proper, however, to remark, that some suppose these improvements were effected by the Portuguese, though at what period is uncertain; while the French strenuously dispute the point, and insist that they were the work of Monsieur Ponvert de Bercytagy, when France had possession of that country. However this may be, the fortress 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 Brazils by the Portuguese, took the colony of Surinam from the English, in 1667, under the command of a captain Abraham Crivon, who was dispatched for that purpose with three ships of war and 500 marines. The English commander, William Biam, left the settlement of Surinam by surprise, when above 600 of the best 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 fortress the name of Zelandia, 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, and in July following the peace was concluded at Breda; but most luckily for the new possessors of Surinam, it was concluded unknown to the English commodore, Sir John Harman, who, in October of the same year, having first taken Cayenne from the French, entered the river with a strong fleet of ten ships of war, two bomb-ketches, &c. and took the colony from the Dutch, killing on this occasion above fifty of their men, and destroying nine pieces of cannon in fort Zelandia. The new inhabitants were now in their turn laid under contribution, and the Dutch garrison were transported to the island of Barbadoes. At the discovery in Surinam that the peace had been concluded between the contending powers, before commodore Harman retook the colony from the Dutch, formidable tumult and disorder took place among the inhabitants, who knew not whom they ought to acknowledge as their lawful sovereign. At length, by an order of king Charles, the settlement was ceded to the Dutch in 1669, when 1200 of the old inhabitants, English and Negroes together, left it, and went to settle on the island of Jamaica. At the close of the succeeding war, it was agreed by the treaty of Westminster, that Surinam should be the property of the Dutch for ever, in exchange for the province of New York, which accordingly took place in the year 1674. In 1799, Surinam was taken by the British. The principal animals of prey are tigers; apes are abundant, as likewise parrots, scorpions, a great variety of insects, and serpents of an amazing size. The rivers abound with alligators, and in the Surinam is found that wonderful fish the electrical eel. Paramaribo is the chief town. N. lat. $4^\circ$45' to $6^\circ$. W. long. $53^\circ$40' to $56^\circ$25'.

Surinam, a river of South America, which rises in a ridge of mountains in the country of Guiana, and after a winding course of about 150 miles, from S. to N., falls into the Atlantic ocean, in N. lat. $6^\circ$25'. W. long. $55^\circ$40'. It has sand-banks at its mouth, over which there are about three fathoms of water in high tides; but above these banks the water is much deeper, and the river navigable for large vessels, above ninety miles up the country. At the capital this river is about a mile in breadth.

Suringia, a sea-port of Japan, in the island of Ni-phon, and capital of a province of the same name; 170 miles E. of Meecho.

Surita, Jeroms, in Biography, a learned Spaniard, was born of a noble family at Saragossa, in 1513, and became secretary to the inquisition, a circumstance which is lamented by Thurnau. His principal work was a "History of Arragon to the Death of Ferdinand the Catholic," in 7 vols. fol. He also wrote valuable notes upon the Itinerary of Antoninus, and upon Cesar and Claudius. He died at Saragossa in 1560.

Surkaw, in Geography, a town of Pomerelia, on the Rodius; 9 miles S.S.W. of Dantzick.

Surkees, a town of Hindoostan, in Guzerat; 7 miles W.S.W. of Amedabad.

Surkuuk, a town of Alatic Turkey, in Natalio; 8 miles N. of Caffamena.

Surma, a town of Perfa, in the province of Ferfif-ten; 32 miles N. of Schiras.—Also, a town of Perfa, in Chufistan; 50 miles S.E. of Jezkeld.

Surnmounted, in Heraldry, is when one figure is laid over another. As the pile surmounted of a chevron.

Surnullet, in Ichthyology, a name used both by the French and English, for the rutilus major, a fish of the cucus kind, and in the Linnean system the rutilus cirrus geminis, &c. in many things resembling the mullus barbatous, or rubber, but differing from it, in that it is twice as big, being often caught...
caught of twelve or fourteen inches in length. Its fins also are yellowish, and have a ruff 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 every where esteemed a very delicate fish. 

Kay.

Mr. Pennant calls this species of mullus the striped mullet, but he expresses a doubt whether this is not a variety, as Grunovius apprehends, of the red mullet, or mullus barbarus. 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. 17. See Hor. Sat. lib. ii. echi. 2. 37. and Juvenal, sat. iv. See MULLUS.

SURNAME, or SURNAMES, a name added to the proper or baptismal name, to denominate the person of such a family. They were the Romans who 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 cognomina, and gentilicia nomina; and the latter praenomina. See Name.

When the former came to be used among the French and English, they were called surnames, or fromae, 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 Cofam, &c.; in the Greek language, as Δαυιδσ; Ieouas, the son of Davidus; Davidus, the son of Eupalmus, &c.,

So also the ancient Saxon, Ceone, Ceowlad, Ceowald Cuthing; that is, Ceonne, son of Ceowald, son of Cuth; and in the same sense, the Welsh use ap for mad, son; as ap Owen, Owen ap Harry, Harry ap Rhyd; and the Irish, Mac, as Donald Mac Neil, 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, Auen-Pace, Auen-Zaar, &c.; q. d. son of Pace, son of Zoor, &c. As, if Pace had a son at his circumcision called Haly, he would be called Auen-Pace, concealing Haly; but his son, however he were named, would be called Auen-Haly, &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; that of Africanius, by Scipio; of Torquatus, by Manlius.

These three different kinds of surnames had also their different names, viz. nomen, cognomen, and agnomen: but these last were so insignificant, being, in effect, a kind of sobriquets, 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 Spanheim, De Prefett, and Ufii Numism. Diff. 10.

In these, too, they have been imitated by later times: thus, in our English History, we find that Edgar was called the Pæganæ, Ethelred the Unready; Edmund, Ironside; Harold, Harold, William, the Bastard; Henry I. Beaumark; 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 Tudor, that from Henry VII. to king James I.; or that of Steward, or Stuart, from king James I. to king George I.; or that of Vokes should be esteemed the surname of the late family of French kings; or Bourbon of the preface; or Oldenburg of the kings of Denmark; or Hapsburg of the emperors.

Du Cézene obserues, that surnames were unknown in France before the year 1587, 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 Richarden, or Rogeren; but from that time they were settled, some way, by act of parliament.

The oldest surnames are those we find in Domeday Book, most of them taken from places, with the addition of de: as Godofridus de Manneville, Walterus de Vernon, Robert de Oyly, &c. Others from their fathers, with filius, as Guilelmus filius Osbern; others from their offices, as Eudo Dapifer, Guilelmus Camerarius, Gislebertus Cecus, &c. But the inferior people are noted, simply, by their Christian names; without any surnames at all.

In Sweden, till the year 1514, nobody ever took surnames; and the common people there have none to this day, nor have even the native Irish, Poles, and Bohemians, &c.—It is very late that the Welsh have had any; and thence 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 Owen ap Rice, they now say Owen Price; or ap Howl, 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 possessions, or their births; such as Mortimer, Warren, Albigny, Piercy, Devereux, Tankerville, Neville, Tracy, Monforni, &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 son: though many were named from their trade, as Smith, Carpenter, Taylor, Weaver, Fuller, &c.; others from their offices, as Porter, Shepherd, Carter, Cook, Butler, &c.; others from their complications, as Fairfay; i. e. fair hair; Blunt or Blond, i. e. flaxen or yellow; others from birds, as Wren, Finch, &c.; others from beasts, as Lamb, Horse, Hors, &c.; others from the winds; others from faults, &c.

SURO, in Ichthyology, a name given by some to a fish of the
the cactus kind, much resembling the mackarel in taste and in shape, and more usually known by the name of the _trachurus_.

Suroorpouth, in Geography, a town of Hindoo-land, in Oude; 40 miles S.E. of Fyzabad.

Suroy, a town of Hindoo-land, in Orissa; 20 miles S.S.W. of Balisore.

Surrowna, a town of Bengal; 23 miles S. of Ghidore.

Suroy, or Soone, 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'.

Surplie, 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 gard prebired by act of parliament, in the second year of king Edward VI., is exempted; and this requires that in the faying or finging of matins and even song, baptizing and burying, the minifter in parish churches and chapels shall fwear a surplice. And in all cathedral churches and colleges, the archdeacon, dean, provosts, masters, prebendaries, and fellows, being graduates, may use in the choir, besides their surplies, such hoods as pertain to their severall 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-fleeved, with a vestment or cope.

Surplusage, in Common Law, signifies a superfluity or addition of more than is needful; which sometimes is the cause that a writ abates. 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 disbursement than the charge of the accountent amounteth to.

Surplusage of Intestate's Effects. See Intestate.

Surprise, 72, in War, is to fall on an enemy unexpectedly, in marching through narrow and difficult places, as in the passage of rivers, woods, inclosures, &c. There are various ways of surprising an enemy or place. See Stratagem.

Surrebutter, 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 Ambroise 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 merge or be determined by mutual agreement of the parties. Of surrenderers there are three kinds; a surrenderer properly taken at common law; a surrenderer 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 lessee to the lessor prove a sufficient sufficient to surrender his estate back again. Surrender in law, is that wrought by operation of the law, and which is not actual. As if a man have a lease of a farm for life, or years; and during the term he accepts a new lease; this act, it, 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 purposes as are expressed in the surrender; as to the use and benefit 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 feoffment, 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 an 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. ii.

Surrender of Letters Patent and Offices. 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 of 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 and 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 Subreptitious.

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 on the north is 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; its greatest width from north to south being about 26 miles, and its utmost length from east to west about 38. The best modern authorities compute its contents at 811 square miles, or 510,000 acres.

Historical Events.—The earliest inhabitants of this county were the Segontiaci, originally a people of Belgium, who settled at first in the western part of Hampshire, whence they were obliged to retire, on the arrival of another colony of the same name. After some time, however, such 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-Saxxna-ricce; and on the division of England into shires, this district, from its southern situation, was called Suthen, since modulated to Surrey. On the Danish invasion, and the Norman conquest, the landed property of this county, like most others, was divided and given
given to the followers of the victorious monarchs. In later times, the history of Surrey is trivial. During the civil wars, it adhered closely to the parliament, and petitioned them 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 Saxon who bore that distinction, was slain in battle with the Danes in 873.

**General Aspects, Soil, and Climate.** — The soil of this county is greatly varied, the different species lying intermixed in small patches. They, 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 land-stone, 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 summit 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, confining chiefly of flinty 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 strong 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 the climate is warmer in the south, than in the north of the county, and that of the Thames. From this circumstance the climate may be, upon the whole, regarded dry; but the southern district is damp, through the nature of the soil, and the flatness of the surface. From these causes, the low parts near the Thames may be also considered as damp; but the atmosphere of the chalk hils, whichcompose the county from east to west, is dry, keen, and bracing. On the wide and exposed heaths, near Bagshot, Alderhot, and Hindhead, a similar climate also prevails.

**Mineralogy.** — Iron-ore is found in considerable quantities in the south-western part of the county, about Haselmore, Dunsfold, and Cranley; and in the south-eastern 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 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 flint, of a peculiar quality, are worked near Godalming, 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 resist the heat of a common fire, and is thence called fire-flint. In consequence of this property, it is much in demand for fire-places in the metropolis, and its neighbourhood. These flints are procured of various sizes, from 10 inches thicknesses to 72 superficial feet. Chalk, brick-earth, sand, and coal, are likewise found in this county. The sand is in great request for hour glases; 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 rises in the parishes of Godstow and Horne, and, passing through the parishes of Lingfield, quits Surrey, and enters Kent. The river Loddon skirts Surrey on its western 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 wholesale 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.

**Towns, 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 300 to 500; 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 only extend for seven, or fourteen. 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 weft of Surrey, near Bagshot, Esher, &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 making, 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 frit is often grown on soil hard, 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 especially on the chalk hills. Turnips are here raised in large crops: they are always known; strong objections prevail against drilling. When sold to be drawn off the field, thirty to thirty-five guineas are commonly given by cow-farmers; but when packed for market, they may be reckoned worth 40l. per acre.

The crops which are only partially cultivated in Surrey, are those of cabbages, potatoes, lucern, and grasses, of which latter it has a much smaller proportion than most other counties in England. Carrots, clover, falfinow, and hops, are extensively cultivated; and a greater quantity of land is employed in raising physical herbs, than in any other shire in Britain. Thistle which are chiefly reared, are peppermint, lavender, camomile, aniseed, 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 Holdernes, 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 diffused. 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 heathlands 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 Windor forest were gradually extended, by the enclosure 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 uncleas'd; and of heaths, which might be planted with every species of succulents, there are no less than 48,180 acres. The whole amount of waste lands in the county of Surrey is computed at 73,940 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 clays of the Weald, on the fands, and in the low tract near the Thames, they are very indifferent. The Surrey iron rail-way 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 railway 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 railway.

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 Silets, 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 expense 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 boroughs and market-towns, and 140 parishes: all of them in the diocese of Winchester, with the exception of nine parishes, which are peculiar of the see of Canterbury. According to the population report of 1811, the number of houses in the whole county was 55,484, and that of the inhabitants 323,851. Surrey is represented in parliament by fourteen members: two for the county, and two for each of the boroughs of Southwark, Guildford, Reigate, Haslemere, Blechingley, and Gatton.

Antiquities.—The situation of this county being contiguous to the capital of the Roman settlements in Britain, it is by no means surprising 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 eastward of, the present turnpike-road. It proceeded across Mitcham Down to Dorking, and passing along a ridge of hill to Farnham, left Surrey, and entered Hampshire. The Stanef-reet or Stone-reet Caueway branched out from the Ermine-street at Dorking, and passing southward through Ockley, continued onwards into Sussex. Remains of Roman encampments are to be seen on Holmbury-hill, in the parish of Ockley, about two miles to the west of the Stanef-reet; and on Bottle-hill, in the parish of Warlingham, near another military way, which also bore the denomination of Stanef-reet, and passed through the eastern 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 Caesar seems to have encamped previous to his crossing the Thames at Coway Stakes, so named from the contrivance of the Britons to obstruct his passage over that river. At Walton on the Hill, also, great quantities of Roman bricks and other relics have been discovered within an enclosure of earth-work; and on Blackheath are the remains of a Roman temple, surrounded with embankments. Various other military antiquities exist in Surrey on Luthhill, War-Coppice-hill, and on a common in the parish of Effingham. —History and Antiquities of the County of Surrey, by the late Rev. Owen Manning, and continued to the present time by William Bray, Esq.; 3 vols. folio, 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.

SURROGATE, SURROGATUS, a person substituted or appointed in room of another; most commonly of a bishop, or bishop's chancellor. By 26 Geo. II. c. 33, no surrogate deputed by any ecclesiastical judge, who hath power to grant licences of marriage, shall grant any such before he hath taken an oath before the said judge, faithfully to execute his office according to law, to the belief of his knowledge; and hath given security by his bond in the sum of
SUR

100. to the bishop of the diocese, for the due execution of his office. See Marriage.

SURRECTION. See SurrECTION.

SURDOOL, in Geography, a town of Bengal; 25 miles S.E. of Nagore. N. lat. 23° 40'. E. long. 87° 46'.

SURROOPUR, a circur of Bengal, bounded on the N. by Rungpur; on the E. by Rungpur and Goragot; on the S. by Goragot and Dinagopur; and on the W. by Dinagopur; about 15 miles long, and 12 broad. The chief town appears to be Shamungo.

SUROWNAH, a town of Hindooftan, in Allahabad; 12 miles S.E. of Jionpour.

SURROWRY, a town of Hindooftan, in Dowlatabad; 22 miles S. of Renapour.

SURY, a county of America, in the Salisbury district of North Carolina; bounded E. by Stokes, and W. by Wilkes; containing 10,466 inhabitants, of whom 1456 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 vail rock prevents 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. an 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.

SURY, 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 6855 inhabitants, of whom 3440 are slaves.

SURY, a county of the island of Jamaica, containing seven parishes, two towns, and eight villages. The towns are Kingstown and Port-Royal, which are respectively the chief town of the county.

SURY, a town of Hancock county, in the district of Maine, on the W. bank of Union river at its mouth; containing 360 inhabitants.—Also, a township of New Hampshire, Cheshire county, containing 564 inhabitants; lying E. of Walpole, and incorporated in 1760.

SURYA, a town of Hindooftan, in Oude; 33 miles S.W. of Lucknow.

SUREH, a town of Hindooftan, in Oude; 30 miles N.N.W. of Kairabad.

SUREE, a town of Switzerland, in the canton of Lucerne, on the lake of Sempach; 15 miles N.W. of Lucerne, N. lat. 47° 5'. E. long. 7° 57'.

SUREFFE, a town of Africa, in the kingdom of Tunis, usually called "Surfassa"; 8 miles W. of El Meden.

SUREHE, a town of Persia, in the province of Khoraflan; 30 miles W. of Sebivar.

SURKOI, a town of Ruffia, in the government of Archangel; 140 miles E.S.E. of Archangel.

SURSOLID, or SURDESSOLID, 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 1, 2, 3, 4, 5, produces 2, 4, 8, 16, 32, which is the square, or second power of 2; and multiplied by 2, produces 8, the third power, or cube, and solid number of two; 8, again, multiplied by 2, produces 16, the fourth power, or quadrato-quadratum of 2; and 16 multiplied once more by 2, produces 32, the fifth power or surfolid, or surfosolid number of 2.

SURSOLID Problem, is that which cannot be resolved, but by curves of a higher kind than the conic sections.

Thus, $x^2$, to describe a regular decagon, or figure of eleven sides in a circle, it is required to describe an inscribe triangle on a right line given, whose angles at the base shall be quintuple to that at the vertex; which may easily be done by the intersection of a quadratrix, or any other curve of the second gender, as they are by some called, but not by any lower curve.

SURSOOTY, in Geography, a fortress of Hindooftan, on the borders of Cashmire, 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'.—Also, a river of Gujerat, which runs into the Indian Indus, 40 miles S.W. of Junagar.

—Also, a river of Hindooftan, which rises in the northern parts of the country of Delhi, and joins the Czagger, 105 miles N.W. of Delhi. This is one of the seven sacred rivers of the Hindoos.

SURSUNDEE, a town of Hindooftan, in Bahar; 34 miles E.S.E. of Bahar.

SURS, a town of Hindooftan, in Bahar; 8 miles N.E. of Chuprah.

SURSWUTTY, a river of Hindooftan, which runs into the Puddar; 26 miles W. of Pattun.

SURTAINVILLE, a town of France, in the department of the Channel; 13 miles W. of Vallogne.

SURUBDY, a town of Hindooftan, in Bahar; 21 miles N.N.E. of Durbungh.

SURUDBYPOUR, a town of Hindooftan, in Bahar; 20 miles W. of Durbungh. N. lat. 26° 5'. 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 appraise 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, or 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 form 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 implements; the modes of enclosing fence-gates; the arable land, gardens, and crops; the grazing, grass-lands, crops, and manure; the gardens and orchards; the woods and plantations; the water; the improvements; the live-stock; the rural economy; the political economy, as connected with affecting agriculture; the obstructions to improvement, including
SURVEYING

including 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.

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 area 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 cafes: viz. 1. The measuring of the several lines and angles. 2. Protracting or laying the same 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 indispensable of which is the chain, commonly called Gunter's chain, which is 22 yards in length, and is divided into 100 links, each link being 22 inches, or 7.02 inches. 10 of these square chains, or 100,000 square links, is one acre; that is 625 square links are 1 perch.

250,000 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.

Before 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-flags, with small flags, for setting up at the several angles, &c. and a rod, divided into links, for measuring the offsets and bendings in the hinges or boundaries of the fields. These are sufficient for measuring an estate of considerable extent, but it frequently saves a deal of labour to be furnished with proper instruments for measuring angles, the most usual and the belt adapted for this purpose, are the circumferentor, theodolite, and sextant, for a description of which see the several articles. The surveyor's staffs, or crofs staffs, is likewise very convenient for raising perpendiculars. See Cross-Staff.

The methods of measuring or surveying single fields with the Chain, Cross, Plain Table, &c. will be found explained under thefe 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 Degree.

Referring to Plate VII. Surveying, fig. 6, let C, D, E, F, G, H, &c. represent any remarkable objects in a county, as towers, steeple, mills, &c. the respective positions of which are to be determined.

First, an elevated situation is to be chosen, as a tower, a steeple, &c. from which the greater number of those objects can be seen; after which, it will be necessary to repair 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 delineate the distances nearly at which we judge them to be, that they may not be confounded with other objects which may have some 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: care should also be taken to render the instrument perfectly horizontal, according to the indications of the spirit-levels 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 ray 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. are to be measured; the distances of these 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 supposed 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 these two objects can be conveniently seen. Then considering C D as a 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 A C D, the difference
SURVEYING.

difference between the two angles C A B, D A B, and the sides C A and A D, which are given by the preceding calculation.

Let I be another object, which has not been taken either from the extremities of the base A B, or from those of C D. Here it is obvious that the side C L of the 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 I C L, 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 manner, for if we suppose that the point m, within the principal triangle C L D, is to be taken, it is evident, that by observing from C and D, the angles m C D and m D C, we shall have the triangle C m D, in which the side C D is known and the two observed angles.

This example has been limited to a small number of objects, in order to simplify both the explanation and figure, as without this contraction of the design, they would both have been necessarily embarrased and confused. What has been said, however, will doubtless be sufficient to show the manner 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 objects 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 practitioner, 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 be particular with getting his angles 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 be considered as doubtful. It is likewise essential not to employ, 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 assign the same 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 C I L, and that, on account of the situation of this point being considered as doubtful, we wished to verify it from the station D, where we are placed in the course of the observations; if the two points I and D be conceived to be joined by the line I D, and the angle C I D to be measured, we shall have the triangle C I D, in which, besides this angle, there will be known the side C D, as previously determined, and the angle C I D, equal to the two angles L C D and I C L, which have also been observed. The triangle C I D may, therefore, be resolved.

and it will thus be seen whether the new calculation gives the same length for C I, as had been previously assigned to it. Another and a most important method of ascertaining the accuracy of the entire operation is by means of what is called a base of verification, of which some singular influences may be found under the article Degree, above referred to.

4. Another observation, which should never be forgot by a young practitioner, is, that he should never leave a station before having resolved all the triangles that can be calculated at that place; as, by delaying the work till another time, errors may be discovered that would render it necessary to return to a place, from which the instruments and other apparatus have been removed to a considerable distance.

5. Whenever it can be done, the base should be taken in the direction of two fixed and very visible objects; as, by this means, it will be more easy to follow it exactly in measuring, than if the two signals could only be seen with difficulty, or which the wind or other causes might derange. And in order to insure accuracy in this measurement, a sufficient number of persons should be employed, and divided into several companies, independent of each other, who, after measuring the base separately, communicate generally the results of their respective operations. If each company has found the same length, the measurement is undoubtedly correct; and it may even be still considered so, if the difference of the several measurements be but trifling, and a mean of the whole be taken. But if the difference be considerable, the base must be remeasured.

The measurement of a base, in large trigonometrical surveys, is one of the most delicate and important operations in the whole; as any error in this must necessarily affect the accuracy of all the subsequent computations; and, accordingly, the greatest possible care is always taken in this fundamental operation. On this subject the following works may be advantageously consulted: *Vie Bouguer, "La Figure de la Terre;" Boltovich, "Voyage Astronomique et Geographique;" Cassini, "Meridienne de l'Observatoire de Paris;" Delambre, "Mémoire d'un Arc du Meridienne;" "An Account of the Measurement of a Base on Hounslow Heath," by general Roy; and "An Account of the Trigonometrical Survey of England and Wales," by colonel Mudge. See also Decazes.

In all that has been said at present, the land has been supposed perfectly horizontal, and no impediments are taken into the account, which in any way impede the operation of measuring, &c. But various cases arise in practice, in which obstacles of this kind occur, and must be surmounted.

We propose, therefore, in concluding this article, to give a few miscellaneous problems connected with this subject.

**Problem I.**

The length of a line measured on a declivity being given, and the angle of its declension, to find the horizontal length.

Let A B (fig. 7.) be the inclined line which has been measured, and A F a staff of the same length as the instrument, which has been used for taking the angle of declension E D F; it is required to determine the horizontal length or base A C.

In the first place, since F A = D B, and these lines being also parallel, it follows that F D and A B are also parallel and equal, and consequently the angle E D F. = the angle A B C; therefore, as

\[ \frac{A B}{\cos B A C} \]

It should be observed, however, that instruments are frequently
frequently used for this purpose, which give the reduced length of the sloping line from observation; but where great accuracy is required, the above is by far the most to be depended upon.

**PROV. II.**

Suppose it were required to determine the triangle $ABC$ (fig. 8.), the side $AB$ and the angle $ABC$ 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 $ABD$; 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 $EAB$, $EAC$, these angles, and the side $AB$, which is known, will furnish sufficient data for computing the lines $BE$, $BC$, and then resolving 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.

**PROV. 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 $ACB$, $BCD$, 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 that 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 $ACB$, $BCD$, 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 $ACD$, which is similar to the triangle $ACD$; therefore, the sides $CA$ and $CA$ may be computed: and as two angles and the side $CD$ are also known in the triangle $CDB$, the sides $CB$ and $CD$ may likewise be computed. And, lastly, in the triangle $ABC$, the two sides $CA$ and $DB$, and the contained angle $ABC$ are known, from which $AB$ will be found; and we shall then have the true distances by means of the following proportions, viz.

$$a : b \colon \colon \begin{cases} a \cdot d : C D \\ a \cdot c : A C \\ a \cdot d : A D \\ b \cdot c : B C \\ b \cdot d : B D \end{cases}$$

the lines whose dimensions were required.

**PROV. 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 the parts of the triangle $ABC$ 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 $BAD$, $DyC$, and $BCD$, respectively; then in the triangles $ABD$, $BCD$, 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 $x = 180^\circ - n - y = 180^\circ - n - (180^\circ - B - x) = x + B - n$; therefore, also,

$$\sin z = \sin x \cdot \cos (B - n) + \cos x \cdot \sin (B - n)$$

$$= \frac{AB \cdot \sin (m + n)}{BC \cdot \sin m} \times \sin x$$

By dividing this last equation by the $\sin x$, we obtain

$$\frac{AB \cdot \sin (m + n)}{BC \cdot \sin m} \cdot \frac{\sin (B - n)}{\cos (B - n)} - \cot (B - n)$$

or, for the sake of greater convenience in the calculation,

$$\cot x = \cot (B - n) \left\{ \frac{\sin C \cdot \sin (m + n)}{\sin BAC \cdot \sin m \cdot \cos (B - n)} - 1 \right\}$$

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 equation from which it is obtained holds good in all cases, as appears 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 one of the angles $A$, $B$, or $C$, may be obtuse, yet the segment of one of the acute angles is to be fought, in order to avoid any embarrassment and uncertainty respecting the species of the angle $x$; and we have always our choice in 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 $A$ must then be supposes at $y$, and the angle $x$ changes into $B + y)$, and we should have

$$\cot x = \cot \left\{ \frac{1 - AB \cdot \sin (m + n)}{BC \cdot \sin m \cdot \cos (B - n)} \right\}$$

$$\cot x = \frac{AC \cdot \cot n - AB \cdot \cot m}{BC}$$

4. When
4. When \( B = n \), the problem is indeterminate, as in this case, cot. \((B = n)\) is infinite, and the point D may have an indefinite 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.

Contribution.—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 \( \text{fin. m.} \), as taken from the tables.

In this manner,

\[
\frac{AC}{2 \ \text{fin. n.}}
\]

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 \( PRE \) and \( ARE \). Then, in order to reduce the angle \( ARP \) to \( AEP \); we find in the triangles \( APR, APE \), the common side \( AP \), and

\[
\frac{AP}{2} = AR^2 + PR^2 - 2AR \times PR, \quad \text{cot.} \ ARP = A^2 + PE^2 - 2AE \times PE, \quad \text{cot.} \ AEP;
\]

from which last equation, we obtain

\[
\text{cot.} \ AEP = \frac{AR \times PR - \text{cot.} \ ARP - \text{cot.} \ PRE}{AE \times PE};
\]

and this gives

\[
\text{cot.} \ AEP = \frac{\text{cot.} \ ARP - \text{fin.} \ \text{RAE} - \text{fin.} \ \text{RPE}}{\text{cot.} \ \text{RAE} \times \text{cot.} \ \text{RPE}};
\]

or, to simplify the computation,

\[
\text{cot.} \ AEP = \tan \ \frac{\text{RAE}.}{\text{PRE}} \times \left\{ \frac{\text{cot.} \ ARP}{\text{fin.} \ \text{RAE} \times \text{fin.} \ \text{RPE} - 1} \right\}.
\]

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:

\[
\text{\textit{viz.}}
\]

"The cosine of the reduced angle is equal to the cosine of the observed angle, minus the rectangle of the lines of the angles of elevation; the remainder being divided by the rectangle of the cosines of the same angles."

The angle \( ARP \) being thus reduced to \( AEP \), 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 formule of reduction, that given by Delambre may be employed, which is more convenient for the purposes of computation: \textit{viz.}

\[
\text{fin.} \ \frac{1}{2} \ AEP = \frac{\text{fin.} \ \frac{1}{2} (\text{ARP} + \text{RAE} - \text{PRE}) \times \text{cot.} \ \text{RAE} \times \text{cot.} \ \text{RPE}}{\text{fin.} \ \frac{1}{2} (\text{ARP} + \text{PRE} - \text{RAE})}.
\]

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 farther information on this subject, the reader is referred to the "Trigonometrical Survey of England and Wales," by Col. Mudge; "Bande du Système Métrique Décentral," by Delambre; "Exposition des Opérations faites en Lapponie," by Swanse; to the treatises on "Topography and Geodesia," by Puilfaut; and to the "Mémoire Topographique," lately translated into English by M. Ma
torte.

**SURVEYING CROFT.** 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.

Such are the surveyor-general of the king's manors; surveyor of the king's exchange, mentioned in flat. 9 Hen. V. flat. 2, c. 4; surveyor-general of the works; surveyor-general of his majesty's woods and parks; surveyor-general of the crown-lands, &c.

**SURVEYOR OF THE HIGHWAYS.** See Highway.

**SURVEYON, MARINE.** See Marine Surveyor.

**SURVEYOR OF THE MELTING.** An officer of the mint, whose business is to see the bullion cast out; and that it be not altered after the delivery of it to the meler.

**SURVEYORS OF THE NAVY.** Are two officers who sit at the navy-board, being invited with the charge of building and repairing his majesty's ships at the different 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 boat-wrights 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.** Is an officers whose charge is to survey all the king's ordnance, stores, and provisions of war, in the custody of the store-keeper 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 of 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, surveyors, surveyors-general, resident in London, and also of the riding officers; land-surveyors; surveyors of paper, keys, baggage, land-carriage officers, buildings, coast-watchers, king's warehouse, East India warehouse and navigation, belonging to the customs; general surveyors; general surveyors of distillery; surveyors of glas 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 stamps; surveyors of the hawker's and pedlar's 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 feoffed of a joint-estate in inheritance, for their own lives, or *per ante vie*, or are jointly poled by any chattel interred, the entire tenancy upon the decease of any of them remains to the survivors, 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 life estate. This right of survivorship is called by our ancient authors the *jus accrescendi*, because the right upon the death of one joint-tenant, accumulates and increases to the survivors; or, as they themselves express it, *part illa communis accrescit superplanus*, de persona in personam ujque ad ultimum superfricken. And this *jus accrescendi* 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 feoffed 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 trade, shall always be considered as common and not as joint property; and there shall be no survivorship therein. Blackstone, Commentaries, book ii.

SURVIVORSHIP. Payments which are not to be made till some future period, are termed *reversions*, to distinguish them from payments which are to be made immediately.

Reversions 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 Reversions.) Of the latter sort are those which depend on any contingency; as, particularly, the survivorship of any lives beyond other lives. Thee forms the most intricate and difficult part of the doctrine of revocations 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 Exercises*; Dr. Price on Reversionary Payments; and Mr. Morgan on Annuities and Affurances on Lives and Survivorships.

The whole likewise of the third volume of Mr. Dodson's Mathematical Repository relates to this subject; but Mr. Dodson's investigations being founded on M. De Moivre's hypothesis, of an equal decrement of life through all its stages, 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. Mafores, curator baron of the exchequer, (in two volumes, entituled the "Principles of the Doctrine of Life-Annuities," *) have discarded the valuation of lives grounded upon it; and the former, in particular, in order to set aside all occasion for using them, has substituted 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 strict conformity to the best observations. These tables, added to other new tables of the same kind in Mr. Baron Maffe's work just mention, 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-Annuities.

It should be observed, that in all computations of contingent revocations 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 revocations of the above-mentioned defension, but also as they have 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, deduced from observations of the proportions of the living to the numbers that have died at all ages for twenty-one years, from 1755 to 1776, in the kingdom of Sweden.

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Living</td>
<td>Decr.</td>
</tr>
<tr>
<td>Born alive</td>
<td>10,000</td>
<td>2300</td>
</tr>
<tr>
<td>1 year</td>
<td>7400</td>
<td>500</td>
</tr>
<tr>
<td>2</td>
<td>7200</td>
<td>337</td>
</tr>
<tr>
<td>3</td>
<td>6861</td>
<td>410</td>
</tr>
<tr>
<td>4</td>
<td>6623</td>
<td>590</td>
</tr>
<tr>
<td>5</td>
<td>6473</td>
<td>145</td>
</tr>
<tr>
<td>6</td>
<td>6348</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>6243</td>
<td>90</td>
</tr>
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<td>8</td>
<td>6155</td>
<td>75</td>
</tr>
<tr>
<td>9</td>
<td>6078</td>
<td>65</td>
</tr>
<tr>
<td>10</td>
<td>6013</td>
<td>55</td>
</tr>
<tr>
<td>11</td>
<td>5955</td>
<td>45</td>
</tr>
<tr>
<td>12</td>
<td>5913</td>
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</tr>
<tr>
<td>13</td>
<td>5886</td>
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<td>14</td>
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<td>15</td>
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<td>16</td>
<td>5749</td>
<td>39</td>
</tr>
<tr>
<td>17</td>
<td>5712</td>
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</tr>
<tr>
<td>18</td>
<td>5671</td>
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<td>5627</td>
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<td>5583</td>
<td>50</td>
</tr>
<tr>
<td>21</td>
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<td>50</td>
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<td>60</td>
</tr>
<tr>
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<td>4808</td>
<td>60</td>
</tr>
<tr>
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<td>4748</td>
<td>60</td>
</tr>
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<td>4688</td>
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<td>4508</td>
<td>60</td>
</tr>
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<td>40</td>
<td>4448</td>
<td>65</td>
</tr>
<tr>
<td>41</td>
<td>4389</td>
<td>65</td>
</tr>
<tr>
<td>42</td>
<td>4331</td>
<td>80</td>
</tr>
</tbody>
</table>
## SURVIVORSHIP

### Table II.

<table>
<thead>
<tr>
<th>Age</th>
<th>Living</th>
<th>Living</th>
<th>Expec.</th>
<th>Living</th>
<th>Living</th>
<th>Living</th>
<th>Expec.</th>
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<td>12972</td>
<td>9507</td>
<td>22.75</td>
<td>12972</td>
<td>9507</td>
<td>22.75</td>
<td></td>
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</table>

Shewing the probabilities of the duration of human life among males and females, taken collectively, deduced from the preceding table.
### SURVIVORSHIP.

#### 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 1.

<table>
<thead>
<tr>
<th>Ages</th>
<th>MALES 4 per Ct</th>
<th>MALES 5 per Ct</th>
<th>FEMALES 4 per Ct</th>
<th>FEMALES 5 per Ct</th>
<th>Lives in general</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.355</td>
<td>14.778</td>
<td>17.719</td>
<td>15.034</td>
<td>17.537</td>
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<tr>
<td></td>
<td>17.935</td>
<td>15.279</td>
<td>18.344</td>
<td>15.371</td>
<td>18.554</td>
</tr>
<tr>
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<td>18.528</td>
<td>15.624</td>
<td>18.780</td>
<td>15.951</td>
<td>18.930</td>
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<tr>
<td></td>
<td>19.600</td>
<td>15.970</td>
<td>20.041</td>
<td>16.268</td>
<td>18.820</td>
</tr>
<tr>
<td></td>
<td>18.491</td>
<td>15.866</td>
<td>18.852</td>
<td>16.229</td>
<td>18.721</td>
</tr>
<tr>
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<td>18.105</td>
<td>15.624</td>
<td>18.568</td>
<td>15.960</td>
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<td>17.958</td>
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<td>15.404</td>
<td>18.290</td>
<td>15.761</td>
<td>18.046</td>
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<tr>
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<td>18.151</td>
<td>15.662</td>
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<td>15.245</td>
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<tr>
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<td>15.014</td>
<td>13.337</td>
<td>15.629</td>
<td>13.866</td>
<td>15.521</td>
</tr>
</tbody>
</table>

**Continued on the next page...**
SURVIVORSHIP.

Table IV.

Showing 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.

Interest 4 per cent.

Differences of age of, 6, 12, and 18 years.

<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>
</tr>
</thead>
<tbody>
<tr>
<td>60-99</td>
<td>14.626</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table continues with similar entries for different age groups and annuity values.*
SURVIVORSHIP.
Table V.
Shewing the value* of two

joint lives, according to the probabilities

Tab.

(in

II.) of the duration of

human

life

among

males and females collectively.
Interell

4 per

cent.

Differences of age 24, 30, 36, and 42 years.

Ages.

Values,

Ages.

Values.

Ages.

Values.

1-25
2-26
3-24-28
5-29
6-30
7-3
8-32
9-33

12.832

'-3' 12.196

'-37 u.465

13.409
»3>778
14.003

2-32 12.730
3-33 13.066

2-38 11.913
3-39 12.164
4-40 12.284

4-34 13.264

4°37

5-35
6-36
7-37
8-38
'3-944
'3-855
9-39
IO ~34 '3-74' 10-40
1-35 13.604 11-41
12-36 13.428 12-42
•3-37 i3- 2 34 '3-43
14-38 '3- 02 3 14-44
"5-39 12.798 15-45
16-40 12.570 16-46
r

'4°33
14 006

•3-277
13.242
13.170
'3-°59
12.913
1

-743

12.563
'2-379
12. 196
11.997
11.787
11.562
7-47 11.328
18-48 1 1.076

1

17-41 l2 -35 l
18-42 12.146
•9-43 11.951 19-49 10 819
20-44 11. 751 20-50 10.567
21-45 11.550 21-51 10.332
22-46 "•335 22-52 10.092
2 3-47 1 1107 2 3~53
9.852
24-48 10.862 24-54 9.602
25-49 10.612 2 5~55 9-347
26-50 10.364 26-56 9.080
27-51 10.130 2 7-57 8.807
28-52 9.894 28-58 8-534
2 9-53
9.659 29-59 8.250
3°-54 9-4'3 30-60 7.967
3'~55 9.167 31-61 7.702
32-56 8.912 32-62 7.446
33-57 8 651 33-63 7.196
34-58 8.389 34-64 6.942
35-59 8. 114 35-65 6.679
36-60 7-833 36-66 6.402

5-4' 12.242
6-42 12.185
7-43 12. 1 12
8-44 12.004

9-45 n.865
10-46 1 1.694
11-47 "•493
12-48 11.259
'3-49 II. on
14-50 10.759
5-5i 10.514
16-52 I10.264
'7-53 10.018
18-54 9.761
'9-55 9.500
20-56 9.228
21-57 8953
22-58 8.675
23-59 8.385
24-60 8.097
25-61 7.823
26-62 7-557
27-63 7.297
28-64 7.032
29-65 6.761
30-66 6.481
31-67 6.197
32-68 5-9*7
33-69 5.642
34-7° 5-364
35-7' 5-°93
36-72 4.840

Ages.

Values.

Values.

Ages.

Values.

1

What

confequence is chiefly the multitude of focieties, eltablifhed in this and foreign countries, for providing annuities for widows.
The general rule for calculating from thefe tables the value of fuch annuities is the
this of

following.

—

Rule.
Find in Table III. the value of a female life at
the age of the wife.
From this value fubtraft the value in

Table IV. of the

joint continuance of two lives, at the
ages of the hufband and wife.
The remainder will be the
value in a Jingle prefent payment of an annuity for the life of
the wife, (hould fhe be left a widow.
And this lad value,
divided by the value of the joint lives increafed by unity,
will be the value of the fame annuity in annual payments
during the joint lives, and to commence immediately.

9

•

10.946 38-62 7.296 38-68 5.828 38-74 4-4°5
II. 168 39-63 7-033 39-69 5-543 39-75 4.195
1 1.260
40-64 6763 40-70 5- 2 54 40-76 3.975.
"•183 41-65 6.492 41-71 4977 41 77 3.762
1 1.064
42-66 6.225 42-72 4-73° 42-78 3-539
10.915 43-67 5-957 43-73 4-507 43-79 3-295
'o-743 44-68 5.689 44-74 4.322 44 80 3.052
9-5' 10.560 45-69 5.426 45-75 4.128 45-81 2.854
10-52 10.357 46-70 5- '53 46-76 3-9 2 ' 46-82 2.684
tl S3 10.140 47-71 4.884 47-77 3-715 47-83 2.533
12-54 9.898 48-72 4633 48-78 3-489 48-84 2.396
'3-55 9.644 49-73 4-398 49-79 3- 2 3 8 49-85 2. 2 27
2. 171
14-56 9-37' 50-74 4.205 50-80 2.990
50-86J
'5-57 9.087 5 '-75 4.008 51-81 2.792 51-87' 2.050
16-58 8.709 52-76 3-803 52-82 2.623 52-88I 1. 901
'7-59 8.503 53-77 3.605 53-83 2-475 53-89 1.68
18-60 8.208 54-78 3-389 54-84 2-344 54-90 1.366
19-61
7.928 55-79 3-i5° 55-85 2.232 55-9' '-078
20-62 7.658 56-80 2.909 56-86 2.130 56-92 0.810
21-63 7396 57-8
2.710 57-87 2.010 57-93 0.655
22-64 7.127 58-82 2-539 58-88 1.864 58-94 0.546
23-65 6.851 59-83 2-385 59-89 1.646 59-95 0.464
24-66 6.566 60-84 2.248 60-90 ••333
25-67 6.275 61-85 2 -'35 61-91 1.050
26-68 5.986 62-86 2.037 62-92 0.789
27-69 5.702 63-87 1.926 63-93 0.639
28-70 5-4'5 64-88 1.790 64-94 o-533
29-71 5-I36 65-89 1.585 65-95 0.456
30-72 4.881 66-90 1.290
31-73 4.646 67-91 1. 017
32-74 4-453 68-92 0.764
33-75 4.251 69-93 0.617
34-76 4.040 70-94 0.514
35-77 3-833 71-95 0.41
36-78 3.605

fiderable confequence in the doftrine of life-annuities.

made

Values.

2-44
3-45
4-46
5-47
6-48
7-49
8-50

The preceding tables furnifh the means of determining
the exnft differences between the values of annuities, as they
are made to depend on the furvivorfhip of any male or
female lives ; which hitherto has been a defideratum of conhas

\ ;es.

—Let

Example.
hufband 30.

The

\

[i

Value*..

37-79 3-352
38-80 3.098
39-81 2.889
40-82 2.710
41-83 2-553

42-84
43-85
44-86
45-87
46-88
47-89
48-90
49-91
50-92
5'-93
52-94
53-95

2.418
2.305
2.203
2.083
'•933
1.708
'•385
1.090

0.818
0.662
0.551
0.468

the age of the wife be 24, and of the
value in Table III. (reckoning intereft

4 per cent.) of a female life aged 24, is 17.252. The
value in Table IV. of two joint lives aged 24 and 30, is
13.455, which, fubtrafted from 17.252, leaves 3.797, the
at

payment, of an annuity of 1/. for
of the wife after the hufband ; that is, for the life
of the widow.
The annuity, therefore, being fuppofed
20/., its value, in a Jingle payment, is 20 multiplied by
And this lad value divided by
3.797, that is, 75.94/.
value, in a Jingle prefent

the

life

14.455, (that is, by the value of the joint lives increafed by
unity,) gives 5.25, the value in annual payments beginning
immediately, and to be continued during the joint lives, of
an annuity of 20/. to a wife aged 24 for her life, after her

hufband aged 30.
In order to give as full directions as poffible in this important cafe, we mall here infert the following table, taken
from the Treatife on Reverfionary Payments, vol. ii.
p. 431. 7th edit.

Tablb


SURVIVORSHIP.

**Table VI.**

[Content of Table VI with adjusted numbers and values]

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 1l. Interest ' per cent.**

**Vol. XXXIV.**

In most of the societies for providing annuities for widows, the right to the annuity is made to depend on the continuance of the husband's life for a given term. In this case, the value of the annuity is to be obtained by the following rule.

**Rule.**—Find the value of the annuity for two lives greater by the given term of years than the given lives. Discount this value for the given term, (that is, multiply it by the value of 1l. due at the end of the given term.) 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 29, after her husband aged 26; 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 just 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 26, shall continue four years, is 3.245. The probability, therefore, that the two lives shall both continue four years, is $\frac{3.245}{2}$, multiplied by $\frac{3.245}{2}$. The product is 3.245, which, multiplied by 3.245, gives 3.017, the answer in a **single payment.** And 3.017, divided by 15.144, (the value increased by unity of two joint lives aged 20 and 26, by Tab. IV,) gives .199, 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 supposed 2ol. (to be enjoyed for life by a wife aged 20, after her husband aged 26; provided he lives four years,) the value is, in a **single present payment, 60.341;** and, in **annual payments, 3.991.**

**Problems in the Doctrine of reverzontary 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 expectancy 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 expectancy be a male aged 24, who is to enjoy 2ol. per annum for his life, after a female aged 30. The value of his life, reckoning interest at 4 per cent., is 16.742. The value of the joint lives is (by Tab. IV.) 13.455; which, subtracted from 16.742, leaves 3.287, the number of years' purchase to be given for the annuity, which being 2ol., its value is 65.741, in a **single payment.** And 65.741, divided by 14.455, (that is, by the value of the joint lives increased by unity,) gives 4.57, 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 expectancy been a female aged 24, and the possessor a male aged 30, the former value would have been 75.941, and the latter 5.257. 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 upon the survivorship of a given life beyond another.
SURVIVORSHIP.

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 in this case.

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 24, the former of which is the expectant. Let the yearly value (or net rent) of the estate be 25l., and the rate of interest 4 per cent. The value of two equal joint lives, aged 40, is (by Tab. IV.) 12.657; the perpetuity is 25; the difference is 12.083; the half of which is 6.017; the expectation of the youngest life is (by Tab. II.) 35.27; and of the oldest life, 31.21. Therefore, as 35.27 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 24, provided he survives a person aged 24. And 106.48, divided by 14.455, (the value of the joint lives increased by unity), gives 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 youngest of 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 11, 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 ann. 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, 1.1 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. quell. 10.

This rule, first given by Mr. Simpson, in his Select Exercises, 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 P, 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 β denote the number of persons living in the table at the age of F; b, the number at the age of B; and ε, the number at the age of P; and let r be ½, increased by its interest for a year; then will the exact value of the sum S, payable on the contingency of B the elder surviving A the younger, be equal to

\[ \frac{S \times \beta \cdot r \cdot F - A \cdot P - A \cdot F + r - 1}{\beta \cdot A \cdot B} \]

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 sum or legacy payable on the same condition.

Solution.—Find the difference between the value of the 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 16.006; 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 a 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 third problem; and the equivalent annuity by the rule in the fourth problem.

Table.
### SURVIVORSHIP.

**Table VII.**

Shewing the value of 100, depending on the contingency of one life surviving another, according to the Northampton Table of Observations, (see Tab. III. under Life-Annuitie,) reckoning interest at 3 per cent.

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<td>2.105</td>
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The
SURVIVORSHIP.

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 1792, when Mr. Simpson's was the only rule in existence. In the middle ages 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.

Explanation.—The annual premium in this table is supposed to be payable during the joint continuance of the lives of the principal and expectant; 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 annuitant during his survivorship, should such an annuity be preferred to a gross sum payable on survivorship. Thus the payment of either 24. 58s. 13/4d. 11s. 10d. in hand, or 2.569l. (2l. 11s. 5d.) annually, during the joint lives of a wife aged 25, and a husband aged 35, the first payment to be made immediately, will, according to this table, entitle the wife, should the husband, either to 100l., payable to her when he becomes a widow, or to an annuity payable during her life, after becoming a widow, of 6.406l. (6l. 9s. 4d.) If she is 35 (or of the same age with her husband,) a single payment of 31.472l., or an annual payment of 2.474l., will, by the table, entitle her either to 100l. payable on survivorship, or to an annuity for her life of 7.466l., 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 survive A.

Answer.—Find the value of an annuity on the longest of two equal lives (see Life-annuities), whole 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, so is the said 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 30, and that of B 60 years. Let the given estate be 40l. per ann. and interest at 4 per cent. The value of the longest of two lives, whole common age is 60, is, according to col. 3. Tab. III. and by the rule under Life-annuities, 11.474l., which, taken from 25, the perpetuity, leaves 13.526 for the remainder: therefore it will be, as 31.21, the expectation of A by Tab. II., 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 30, the value required would have been 5.433, multiplied into 40, or 217.42; because the value of the longest of the two lives A and B (by col. 3. 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 ann. depending on the contingency above-mentioned, will be

$$2b \cdot r - 1,$$

when B is the oldest of the two lives. If B is the youngest, the value is found as directed above, by subtracting this from the value of the reversion after the longest of the two lives of A and B.

The value of a given sum S may be obtained by multiplying the above expression into

$$S \cdot r - 1.$$ 

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 A, 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 he 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 time; 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 to the third quotient.

[N. B. When the age of A is under 60, and the term so 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 value in a single present payment.

Example.—Let the Table of Observations be Mr. Simpson's for London. (See Tab. I. under Expectation.) Let the rate of interest be 3 per cent.; A, seven years of age; B, 30; 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 5.2. The number of the living at 7 is 430, which, divided by 5.2, and 100l. divided by the quotient, gives 1210l. 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, 11.296, which, divided by 9.4 (twice the complement
SURVIVORSHIP.

complement of the life of B), gives .12, which, added to 9.5, gives 9.62; and this again multiplied by 1.21, the referred quotient, gives 11.64, the present value in one payment of 100l 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 23.6 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 years of age, may be found in the method explained under Life Annuities, to be nearly 9 years' purchase; and 11.64#, divided by this value, with unity added, or by 10, gives 1.16, the foregoing value in annual payments during the joint lives for 14 years, the first payment to be made immediately, and the last payment at the end of 14 years, should the joint lives not fail.

Subjoined.—It deferves 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 30, 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 himself live at the time of the minor's death, that should happen before he is 21. In these circumstances, he wants to borrow 1000l on his expectation. What revenue out of the estate depending on such a survivorship, is a proper equivalent for this sum now advanced, interest being reckoned at 5 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 11.64, now advanced, the proper equivalent in such circumstances, is, 100l to be paid in case the survivorship should take place; or as much of the estate as 100l will buy at 3 per cent, supposing the first rent to be received immediately, that is, 2912 per annum. By the rule of proportion, therefore, for 1000l, the proper equivalent will be 8991l in money, or 253 per annum out of the estate.

PROB. VII.

"100l 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 100l 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, reckoning 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 1l 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 last quotient, added to the second referred quotient, will be the answer to 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 259, which, divided by 6.38, gives 35.8; and 100l (the given sum) divided by 35.8, gives 2.79, the first quotient to be referred.

The value of an annuity for 19 years, on a life at 30 years of age, 10.3; which, subtracted from 13.134, 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 100l payable at the death of B, on the contingency of his surviving A, aged 30, and both 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 100l 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 39; of A, 40; the term 47 years; and every thing else as in the last example. The complement of A's life is 39.2. The value of 100l to be received at the death of B, if he survives A within 39 years, may be found by the preceding rule to be 16.15; 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 100l, give 145.83; which divided by 47.2 (the complement of the life of B), and 16.15, added to the quotient, make 19.25l; 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; so, after finding the value of a sum, it is necessary to multiply that value by the said amount, in order to find it the value of an equivalent annuity.

In the first example, therefore, the value of an estate of 4l per annum, would be 8.32l; 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 to 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, being
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 Affurances, 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 £1. 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, 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-Annuitities, will be $A + B + C - A B - A C - B C + A B C - B + C = A + A B C - A C - A B$.

Example.—Let the ages of A, B, and C, respectively be 24, 36, 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 16,997; by Tab. IV. and Prob. IV. LIFE-Annuitities, $A B C$ 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 2,706.4, or 2l. 14s. nearly.

Prob. IX.

To find the value of an annuity of £1. 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 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 the same as in the preceding problem, the value in this case will be 16,997 - 9,372 = 7,625l., or 7l. 13s. 6d.

Prob. X.

To find the value of an annuity of £1. during the longevity 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-Annuitess), 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 the same as in the two preceding problems, the value will be 16,997 + 14,939 + 9,372 - 12,801 = 10,862 - 10,314 = 7,337l., or 7l. 6s. 8d.

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-Annuitess) 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.
given sum, and the product divided by twice the expectation of A, will give the value sought.

Case 2. — If the life B be the oldest of the three: From the value of an annuity for as many years of 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.

Case 3. — If the life A be the oldest 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 subtracted; multiply the remainder by the given sum, and the product, divided by twice the expectation of B, will give the answer in this case.

Example. — Let the age of C be 25, that of B 49, and that of A 50. Let the given sum be 1000/., 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 case 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 Life-annuities, is 15,992, from which deducting 10,612, the value of the joint lives of B and C by Table V., we have 5,38, which being multiplied into 1000, and the product divided by 62.42, or twice the expectation of A by Table II., the quotient 86.192, or 86/. 19s. 1d., will be the value required.

Probl XIII.

To find the value of a given sum payable on the death of A, if his life should be the first that fails of the three lives of A, B, and C.

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.

Probl XIV.

To find the value of a given sum payable, if A should be the second that fails of the three lives A, B, and C.

Solution. — Find by Prob. XIII. 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 first that fails. From the sum of the two former subtract twice the latter value, and the remainder will be the value required.

Probl XV.

To find the value of a given sum payable on the death of A, if its life should be the last that fails of the three lives of A, B, and C.

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 be then dead (C being supposing the elder of B and C.) Find next by Prob. V. the value of the given sum payable, if A should die after B. Subtract the former value from the latter, and the remainder will be the value required.

Probl XVI.

To find the value of a given sum payable on the extinction of the lives of A and B, should they be the first that fail of the three lives of A, B, and C.

Solution. — Find by Prob. XII. the expectation of C, on the contingency of A's surviving B, and also his expectation on the contingency of B's surviving A. The sum will be the value required.

Probl XVII.

To find the value of a given sum payable at the decease of A, if his life should be the first or second that fails of the three lives of A, B, and C.

Solution. — Find by Prob. XV. the value of the given sum payable, if A should be the first that fails of the three lives. Subtract this from the value of the given sum payable on the decease of A (found by Prob. XIII, under the article Reversions), and the remainder will be the answer.

Probl XVIII.

To find the value of a given sum payable on the decease of A, if his life should be the second or third that fails of the three lives of A, B, and C.

Solution. — Find the value of the given sum by Prob. XIV, if A's life should be the second that fails of the three lives. Subtract this from the value of the given sum after the decease of A (found by Prob. III. under the article Reversions), and the remainder will be the value sought.

Probl XIX.

To find the value of a given sum payable on the death of A, if his life should be the first or the last that fails of the three lives of A, B, and C.

Solution.—Find by Prob. XIII. the value of the given sum, if A should be the first that dies of the three lives. Subtract this from the value of the given sum payable on the death of A (found by Prob. III. under the article Reversions), and the remainder will be the value sought.

Probl XX.

To find the value of a given sum payable on the death of A, if his life should be the first that dies of the three lives. Subtract this from the value of the given sum payable on the death of A (found by Prob. III. under the article Reversions), and the remainder will be the value sought.

Probl XXI.

To find the value of a given sum payable on the death of A, if his life should be the third that dies of the three lives.

Solution. — Find the value of the given sum by Prob. XVII., if A's life should be the second that dies of the three lives. Subtract this from the value of the given sum payable after the decease of A (found by Prob. XIII., under the article Reversions), and the remainder will be the value sought.

Probl XXII.

To find the value of a given sum payable on the death of A, if his life should be the third that dies of the three lives. Subtract this from the value of the given sum payable on the death of A (found by Prob. XIII., under the article Reversions), and the remainder will be the value sought.

Probl XXIII.

To find the value of a given sum payable on the death of A, if his life should be the first that dies of the three lives. Subtract this from the value of the given sum payable after the decease of A (found by Prob. XIX., under the article Reversions), and the remainder will be the value sought.

Probl XXIV.

To find the value of a given sum payable on the death of A, if his life should be the second that dies of the three lives. Subtract this from the value of the given sum payable after the decease of A (found by Prob. XIX., under the article Reversions), and the remainder will be the value sought.
SUR

SURYA le Contal, a town of France, in the department of the Rhône and Loire; 12 miles N.W. of St. Etienne. N. lat. 47° 24'. E. long. 2° 53'.

Surya en Faux, a town of France, in the department of the Cher; 3 miles N. of Sancerre.

SURYA, a town of Bengal; 43 miles S.S.E. of Chidore.

Surya, in Hindoo 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 castes no doubt superstitiously; but by Brahmans and the initiated, it is affted typically of that divine and incomparably greater light, which illuminates all, delights all, from which all proceed, to which all return, and which alone can irradiate (not our visual organs merely, but our souls and) our intellects. Thee, as we are told by the W. Jones, may be considered as the words of the most sacred text in the Indian scripture. See O'rm.

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, melt into each other, and at last into one or two: for it seems a well-founded opinion, that the whole crowd of gods and goddesses 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 amidst the allurements 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 sublunace 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 probable that the triple divinity of the Hindoos was no more than a perfonification of the sun, whom they call Treyitena, 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 Pavaka.) This, with the wilder 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 holy 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 superstitious. 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 sense, of the sacred text above quoted, "whence all proceeded, and to which all must return." But the Brahmins and the initiated depone, as is implied by the interpolated gloss on the above 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 Sun'stret song
Be thrown with fancy's wreathes,
And emblems rich, beyond low thoughts refin'd,
Yet heav'nly truth it breathes
With attestation strong,
'That, lofter than th' sphere, th' Eternal Mind,
Umov'd, unrival'd, unendeav'rd,
Reigns with providence benign.—

Since thou, great orb, with all-enlightening ray,
Rulest the golden day,
How far more glorious He, who said ferene,
Be— and thou want—Himself uniform'd, unchang'd, unfeel!"

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 coalesce mythologically 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 Trimurti.) It is noticed above, that one of the names of this god is Treyitena, or in shortness Trituna, meaning three-bodied, as embracing the creative power of Brama, in his capacity of producing forms by his genial heat; the protective power of Vishnu, in the property of light; and the destructive energy of Siva, in the concentrated force of his igneous matter. And these are in fact the attributes of the one God, the Eternal Mind, of Hindoo theologians, who is called Brama. The sun, or Surya, is therefore declared to be Brama, Vishnu, and Siva. At night and in the West, he is Vishnu; he is Brama 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 nimbus encircling his head, and sometimes blazing round the whole. Sometimes his car is drawn by one horse with seven heads. (See Oochhisava and Sesh.) A legless charioteer, with a red face, named Aruna, guides the chariot with reins of variegated hue. But we are seduced, by the poetical allusions that so pleasingly delighting with the Hindoo Phœbus and Aurora, to forget again to the hymn addressed to this "lord of the lotus."

"Whole substance Indra with his heav'nly bands,
Nor flags nor underlands;
Nor ev'n the Vedas three to man explain
His mystic orb triform, though Brahma tun'd the brain."

"First o'er blue hills appear,
With many an agate horn,
And patterns fring'd with pearl, seven couriers green;
Nor boas't thy arch'd wolf
That girds the show'r's sphere,
Such heav'n-in'spun threads of colour'd light ferene,
As tinge the reins which Arun guides—
Glowing with immortal grace,
Young Arun, loveliest of Vitan race;
Though younger he, whom Madhava befriended
When high on eagle-plumes he rides.
But Oh! what pencil of a living star
Could paint that gorgeous car,
In which, as in an ark, supremely bright,
The lord of boundless light,
Ascending calm o'er th' empyrean skies,
And with ten thousand beams his awful beauty veils!"
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 ray; 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 reasons 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 Agnis “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 Brahman, or that being which said Br. and the sun war. Surya’s seven horses, and Agnis seven legs, are again referrible 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 have derived a considerable accession of strength in his mind, had he been possessed of the speculation 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 dres; 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 rode, like the Nile, from several distinct sources: and inclined to the opinion, that one great spring and source of idolatry, in the four quarters of the globe, was the veneration paid by men to the sun; and another, the immoderate respect shewn to the memory of deceased ancestors, especially the founders of kingdoms, legislaters, and warriors, of whom the sun and moon were wildly supposed to be the parents. Of the great respect shewn by the Hindoos to the memory of departed ancestors, see our article Sardha; and of the idea of solar and lunar races of mortals, see Rama and Suryavansa.

Although the sun is found, in the Hindoos system, to include the three great powers, Surya externally more resembles Vishnu than either of the others. His forehead is marked with the septaral hieroglyphic of the Vaishnavas, that is, with perpendicular lines; the Saivas, or Saktis of Siva, marking their and their gods’ foreheads with horizontal lines. Surya is also frequently seen with Vishnu’s common attributes, the Shank or shell, and lotos. Vishnu is farther considered as more immediately the sun, than either Brahma or Siva; and his most glorious incarnation in the form of Krishna is of direct solar reference. Among the names of Surya will be found both Vishnu and Krishna; and it may be here remarked, on the authority of general Vallancey, that Krishna is the sun in Irth as well as in Sancert; and Arun is the precursor of the sun (that is, the dawn, Aurora) both in Irth and Hindoo mythology. See Triveni.

The extract from Sir William Jones’s hymn given above, adverters to the equipage of Madhava “borne on eagles’ plumes,” being, like Aruna, “of Vitanian race.” This alludes to the man-eagle of Madhava or Vishnu, the Indian Jove, which vehicle, or udahn, is named Suparna, brother of Aruna, and son of Vinata. See Suparna, Vinata, and Varhan.

The names of the sun are numerous among the Hindoos. It is said they amount to nearly fifty, which our limits will not allow us to introduce. It may lead to extended speculation, to consider that the primary name of the sun means the Atrator. See Sir William Jones’s admirable essay “On the Philosophy of the Atrata,” in the 4th volume of the Asiatic Researches, and in his Works, edited by lord Teignmouth.

As well as many other of the Hindoo deities, Surya has wives assigned him. These sexual tales are allegorical of the powers or attributes of the principals. Thrice helpmates are termed Sakti; which see. The comfort of Surya that we often read of is Prabha, which means bright or effulgence.

Under the article Soma, it is shewn that the Hindoos, like some other distant 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. Græc. c. xix.

Among the Anglo-Saxons, as we are told in Turner’s History, the moon was a male and the fun a female deity; and the name 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 Tograt), page 35, he meet with a female sun and masculine moon. The dictus is,

“Nec nomen fæminimum Soli deducus, 
Nec masculum Luna gloria.”

There is also aolar race in Hindoo fable, like the Heliades of Greece, and the familiar families of the Peruvians. Suryavansa, or offspring of Surya, is the Sanferit designation of these illustrious descendants. (See Suryavansa.) The river Yamuna, called Jumna by European geographers, is riled in Hindoo poetry, “the blue-eyed daughter of the sun.” See Yamuna.

So early as the appearance of the first volume of that valuable deposit of Oriental lore, the Asiatic Researches, Sir William Jones, in his very curious dissertation on the gods of Greece, Italy, and India, had discovered many very striking and unsuspected coincidences. On the subject of the offspring of Surya, and his avatars or de-


cents 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 usuantly renowned in the Indian stories with the Heliades of Greece. It is very singular that his two sons, called Alwina, or Alwini-Kumara in the dual, should be considered as twin brothers, and painted like Castor and Pollux; but they have each the character of Aëculepus 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 suppect the whole fable of Kalyapa and his progeny to be astronomical; and cannot but imagine that the Greek name Cadisopera has a relation to it.” This idea has been fully confirmed by Mr. Wilford’s ingenious essays in the subsequent volumes of the Asiatic Researches. (See Kasyapa, in which article, line 7, for all, read u.) In the 4th volume, art. ii. it is shewn, that the name of Orsippus is also Sanferit; in which tongus, Aëculelapa a name intimately connected with the Dioscuri of Hindoo table, means chief of the tribe of Aśv; it means also mare-defended. The name, country, and history of Aëculepus having
The worship of Surya, from what has been said, may be supposéd very extensive among the Hindoos. Those of the fect who exclusively worship him are called Saura. But besides those who may be said to worship the fun exclusively, a great many others 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 press, that have crept into that article; in col. 5. l. 37 from the bottom, for refearchers, read refeearchers; l. 27 from the bottom, for mouldyflable, read mouldyflable; l. 4 from the bottom, for of one their, read of one of their; in col. 6. l. 24 from the top, for compound a, read compound of 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 situations, 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 dragons, or by one seven-headed, drawn by the imperfect dawn, Aruna. And he is described as followed by thousands of genii, worshipping him and modulating his praises. The following is a tranflation of the first verse of a hymn addressed, with oblations, 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 Recherche. "The divine fun approaches with his golden car, returning alternately with the shades of night; rousing 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.)

SURYA-SAVITRI is a name of the fun, 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 fun, see Surya and Savitri.

SURYAVANSA, in Hindoo Romances, is the name of a solar race of mortals: offspring of the fun is the best translafion of the compound word; Surya being the name of its regent, corresponding with the Phoebus of European heathens. In the older histories extant in India, it is usual to degranate the heroes as being of the solar or lunar race.

SUS, or Suse, a river of Africa, which rises at Ras-el-Wed, about 30 miles from the city of Turdan, 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 Peritia, in the province of Chufilan; 45 miles N.W. of Suita.

Sus, Suse, or Susa, the most extensive, and, if we except grain, the richest province in the empire of Morocco. It is the most fouthly 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 Nun, or Vel de Nun, and on the W. by the Atlantic. It contains many warlike tribes, both Arabs and Berbaks. The climate is remarkably fine; hot in the months of June, July, and August; and about the beginning of September, the fun, or hot wind from Sahara, blows during three, seven, fourteen, or twenty-one days. The violent winds are succeeded by the rainy feason. The soil is in general fertile; and it produces sugar, cotton, indigo, gum, and various kinds of medicinal herbs. The flax is of very abundant, that it is called (alt Suse) the root of Suse. The olive plantations are very extensive, and those of the almond are abundant. It is said that Suse produces more almonds and olive of oils, 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 vine. Dates are found here in perfection. Wax is very abundant; and so are also gum euphorbia, gum sandarach, wild thyme, worm-wood, orris-root, orchil, weed, and coloungth. Antimony, faltpepere, iron, copper, lead, silver, and gold, are found here. It is also richly furnished with a variety of quadrupeds, birds, and fish. Its chief towns are Terodan, Aguauder, or Santa Cruz, Akka, Tetta, and Meffas. Suftu was formerly a province of great trade, on account of its connection with the southern dittricts; but when Santa Cruz was destroyed, it was deprived of many of its reforces 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, chiefly the mountainous districts, are governed by their own sheiks, and acknowledge no obedience to the emperor.

Sus, the Hog, in Zoology, a genus of the chief and order Mammalia Bells, of which the generic character is as follows: The four upper fore-teeth are convergent; the lower fix are prominent; the two upper tucks are shorter, the two lower standing out; the fun prominent, truncate, and moveable; and the feet are mostly cloven. The individuals of this genus dig in the earth with the fun, which is furnished at the end with a strong, round cartilage: they feed indifferently upon almost every thing, even the most filthy; they wallow in the mire, and are in general extremely pro-life. There are fix

Species.

* Scrofa: Hog. Back brizzly on the fore-part; the tail is hairy. There are two varieties: 1. Tail hairy; ears short, roundish; being the wild hog: 2. Tail hairy; ears long, acute; being the common hog; which is subdivided into those that have their hoofs undivided; and into those whose backs are nakedsh, belly reaching almost to the ground. This is the Chines 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 most 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 asserta that the wild boar was formerly a native of this country, as appears from the laws of Hoel daa, who permitted his grand huntman to chase that animal from the middle
middle of November to the beginning of December. William
the Conqueror punished with the loss of eyes those that were
convinced of killing the flag, or the roebuck; and it is
afflicted by Fitz-Stephens, that the vaat forest which in his
time grew on the north side of London, was the retreat of
flags, wild boars, and bulls.

The wild boar inhabits woods, living on various kinds of
vegetables, such as roots, mallow, aeris, &c. It also occa-
ationally devours animal food: it is in general considerably
smaller than the domestic hog, and is of a darkly-brindled
colour, sometimes blackish; but when only a year or two old,
it is of a pale red or dull yellowish-brown call; and when
quite young, it is marked with alternate dusky and pale stripes,
dispersed 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 front is somewhat longer in proportion
than that of the domestic animal; but the principal dif-
erence 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 chief of some dif-
ficulty and danger, not on account of the swiftness, but the
ferocity of the animal. Wild boars, according to Buffon,
which have not passed the third year, are called by the hunters
beasts of company, because previously to that age they do not
separate, but follow their common parent. They never
wander alone till they have acquired sufficient strength to
refill 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 first the enemy, and by preying all round
against the weaker, force them into the centre.

Of the tame 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. Detrude of horns; furnished with
teeth in both jaws; with only one stomach; incapable of
ruminating; and producing at one birth a numerous progeny:
the union of these faculties confers on the hog a remarkable
peculiarity of character. He does not, like other animals,
shed his fore-teeth, and put forth a second set, but retains
his first set through life.

Hogs seem to enjoy none of the powers of sensation in
eminent perfection. They are said to hear distant sounds;
and the wild boar distinguishes the scent of the hunter and
his dogs, long before they can approach him. But to im-
perfect 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 taste they arrayed
a singular degree of caprice. In the choice of herbs they
are more delicate than any other herbivorous animal, yet
to the most nauseous and putrid carrion with more vor-
cacy than any beast of prey. At times they do not cruple
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 eyelids are very diminutive, and deep
sink in his head, is said to be pig-eyed. The form of the
hog is indecent, and his carriage is equally mean as his
manners. His unwieldy shape renders him no less incapable
of swiftness and sprightly, than he is of gracefulness of
motion. His appearance is always drowsy and stupid. He
delights to bask in the sun, and to wallow in the mire.
An approaching form seems to affect his feelings in a very
fingular manner. On such an occasion, he runs about in a
frantic state, and utters loud shrieks of horror.

Tame hogs are often very troublesome in cultivated
grounds, ploughing them up with their snouts, and thus en-
tirely 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 rattle-

snakes and other serpents, upon which he constantly preys,
without apparently suffering any injury.

The few brings forth in the beginning of the fifth
month after conception, and 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 live the natural term of
life, live from 15 to 30 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 fever, eczam, and scrofula.

Contemptible as the hog may appear, he is, in a very
considerable degree, beneficial to mankind. His fleesh is
pleasing, substantial, and nutritious. It affords numberless
materials for the table of the epicure; among these is bran,
which seems peculiar to England. Pork takes salt better
than the flesh of any animal, and is, in consequence, pre-
served 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 com-
monly 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, polishes 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 brilliantly on the hind
parts; tail reaching to the ground. A variety has ecter
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.

TAJASU; Peccary, or Mexican Hog. Back with a glist-
nular orifice; it has no tail. The tusks of this species are
scarcely conspicuous, when the mouth is shut; the ears are
short, erect, pointed; the eyes are sunk in the head; the
neck is short and thick; the bristles are nearly as large as
those of the hedge-hog, longer on the neck and back; in
colour it is hoary, black, annulate with white; from the
flanks to the breast is a collar of white. In fize and
figure this animal bears an imperfect resemblance to the
hog of China. From the gland on the back conflantly
difils a thin fetid liquor, which is the most remarkable
peculiarity of this species. The first Europeans who be-
came acquainted with this animal imagined the gland re-
ferred 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 abun-
dance
dance in all the warm climates of South America. Their
inflint, and arms of offence and defence, are the same as
those of our own hog, but they seem to polish its disposition
much more gregarious. They are usually found associating
together in pairs. Though only an individual be fenced
out, the whole body join together 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 resort, 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 those reptiles; but they do not wallow
and become fat, like the common hog. They produce a num-
ber of young at each litter, and the mother treats them with
the tenderest and solicitous care of a kind parent. Though
existing in a wild state, they are susceptible of domestication,
but nothing can overcome their natural stupidity.

The American leopard, or jaguar, one of their most
formidable enemies, often attacks them, and commits upon
the herd the most cruel slaughter. If killed in the night
season, provided the gland on the back be taken off, and
the liquor which it secretes carefully washed away at the in-
fant 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 flize, 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
front fender; 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 fender, and ter-
minating 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 spe-
cies has sometimes been confounded with the ethiopicus
(next to be described); but the form of the head, the struc-
ture of the mouth, and the manner in which the body is
covered, establish a sufficient specific difference.

Ethiopicus : Ethiopian Hog. This species has no
fore-teeth; under the eyes is a soft wrinkled pouch. It
inhabits Madagascar, and the hot 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 tex-
ture of their f stout enables them to make their way as
readily as the mole.

The Ethiopian hog is nearly five feet long, and between
24 and 36 inches in height; the body is thick and broad;
and the snout is somewhat hairy; the mouth is narrow, as
dwell as delineate 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 dusky
hue; the bristles thinly dispersed in separate parcels over
the body, between the ears and on the shoulders longer than
on any other parts.

Babyrussa. Two crooked tusks piercing through the
upper part of the face. It inhabits the islands of the In-
dian ocean; it is gregarious; feeds on herbs and leaves; of
quick scent; swims and dives well; gnaws; it is the fize
of a flag, and the flesh is good. See Babyrussa.

Sus Agria. See Wild Boar.

Sus Pfeis, in Ichthyology, a name given by Ovid, and
some other of the ancient writers, to the fish called also
ur and mus, and by the later writers capriceus. See Goat-
Fishes.

Susa, in Geography, a town of Africa, in the king-
dom of Tunis, near the E. coast, near which are consider-
able remains of ancient buildings. The chief trade of this
place is for oil and linen, and it may be reckoned one of
the most considerable and wealthy towns of the Tunisians.
Here are several vaults, granite pillars, and other tokens
of its having been formerly a place of some repute; prob-
bly one of those towns which submitted to Cæsar in his
march to Rufpius; 24 miles E. of Caroano. N. lat. 35° 46'.
E. long. 10° 3'.

Susa, a town of Peræa, in Khorasan; 130 miles S.E.
of Nafabour. N. lat. 36° 16'. E. long. 39° 49'.

Susa, called in Scripture Susian, in Ancient Geography,
a town of Peræa, and the metropolis of the province of
Susiana. It was built on the banks of the Eulaos (called
by the prophet Daniel, Ulia) by Memnon, as fone fay,
the son of Tithonus, whom was slain by the Thetisians in
the Trojan war. Strabo and Paufanias compare the walls
of Susa with those of Babylon. It was called Susa, from
the number of lilies which grows in its vicinity, as Stephanus
says, and in the Persian language bore that name. It is
also called "Memmonia" by Herodotus and others, to
Memnon, its founder. The city was flattered by a high
ridge of mountains from the northern winds, which ren-
dered it very agreeable during winter, and the refiidence
of the kings of Peræa; but in summer the heat was fo
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 magnifi-
cent city, as its ruins indicate. Alexander found in it
50,000 talents of gold, besides jewels of an inestimable
value, and an immense quantity of gold and silver vessels.
Here Ahasuerus kept his great feast, which lasted 183
days. Some have supposed, that the present Shutter arose
from its ruins. See Shus and Susna.

Susa. See Zuhan.

Susanyama, in Hindo Mythology, a name of the
ruler of the inferior regions, corresponding with the Pluto
of Western heathen. His commonest name is Tama;
which fee.

Susc, in Geography. See Schuttendopen.

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 Aurarius, in Middle Age Writers. See Au-
raia.

Susapeour, in Geography, a town of Hindooflan,
in Bahar; 35 miles S.E. of Durbungah.

Suselel, a town of the duchy of Holstein; 8 miles
E.S.E. of Eutyn.

Susereat, a town of Cudisiaan; 15 miles N. of
Van.

Susheena, the name of an ape, who bore a part of
some importance in the wars of Lanka, carried on by
Rama to recover his founle Sita from the power of her
rival Raveza.

Susumuna, in Hindo Mythology, a name of Soma, or
the sun. Susumuna is the perfomation of a ray of light
proceeding from the sun; which illuminating the moon,
is fabled to have produced him.

Susia, in Ancient Geography, a town of Asia, in Aria,
a province of Peræa.

Susicana,
SUSANA, a province of Peria, which derived its name from Susa, its capital. It was bounded on the N. by Abyzia, on the W. by Chaldia and the Tigris, on the E. by Elymais, and on the S. by the Persian gulf. Susiana was extended by Proconnesus to the east, so as to include the province called Elymais, which, as Pline oberves, lay within the bounds of this province, and was severed from it by the river Elymais.

SUSICANA, a town of India, on this side of the Ganges, and of the Ganges, which are fixed on the banks of the Indus, according to Proconnesus.

SUSONDII, in Geography, a town of Hindostaunt, in Oude: 4 miles N.E. of Gazorpoor.

SUSUNDAR, a town of Hindostaunt, in Bahar; 33 miles W.S.W. of Arrah. N. lat. 25° 22'. E. long. 83° 13'.

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 polemion of the rent, and the land out of which it issue, is not in effect for a certain time, but temp dormit, or remains asleep; but as it may be revived or awaked. By which, or suspension differs from extinguisment, where time does for ever.

SUSPENSION, SUSPENSI0, the act of preventing the effect or course of any thing for a certain time.

In rhetoric, suspension is a keeping the reader 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 censure inflicted, by way of punishment, on an ecclesiastical, for some considerable fault.

It is of two kinds, viz. 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 upon a clergyman officiating after suspension, if he shall perform therein after a reproof from the bishop, is (by the ancient canon law), that he shall be excommunicated all manner of ways, and every person who communicates with him shall be excommunicated also.

There is another sort of suspension, which extendeth also to the laity; suspension ab inrecco clivic, 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 admirality and ecclesiastical courts, that a person suspended for a suppressed 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 restored to his station, shall have the prize-money. So in civil causes in admiralty, if a master turns his mate, without just cause, before the mail, and he fails 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 bills. This bill, when the desire of it is granted, is a warrant for issuing letters of suspension, which pass the signet; but if the pretender of the bill shall not, within fourteen days after passing it, expostulate the letters, execution may, by act of dement 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 expostulated at any time before this is done; and if the suspender shall allow the protestation to be extracted, the bill fails. Suspensions of decrees in foro cannot pass, but by the whole lords in time of felleon, and by three in vacation time; but other decrees may be suspended by any one of the judges. By the late act of dement 1787, in order to remedy the abuse of preferring a multiplicity of bills of suspension of the decrees of inferior judges, in small causes which have paled in absence, it is declared, that all bills of suspension of decrees of inferior judges, in absence of the defendants in causes under 12l. Sering value, shall be refused 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.

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 juratory caution, i.e. such as the suspender swears is the bill he can offer; but the reasons of suspension are, in that case, to be considered with particular accuracy at passing the bill. Decrees in favour of the clergy, of universities, hospitals, or parish-schoolmasters, for their stipends, rents, or faiaries, cannot be suspended but upon production of discharge, or on confirmation of the fines charged for. A charger, who thinks himself secure without a caution, and wants dispatch, may, where a suspension of his diligence is sought, apply to the court to get the reasons of suspension summarily discussed on the bill.

Though he, in whose favour the decree suspended is pronounced, be always called the charger, yet a decree may be suspended before a charge be given on it. Nay, suspension is competent even where there is no decree, for putting a stop to any illegal act whatsoever; thus, a building, or the execution of a power which one allumes unwarrantably, is a proper subject of suspension. Letters of suspension are confided merely as a prohibitory diligence; so that the suspender, if he would turn provoker, must bring an action of reduction. If, upon discussing the letters of suspension, the reasons shall be sustained, a decree is pronounced, suspending the letters of diligence on which the charge was given suspensation; 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 proceeded, i.e. regularly carried on; and they ordain them not 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 Mufes. Every found 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
Susquehanna, in Geography, a large river of Chefapeak 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 northern point from which any of these streams run south is within 5° 41' 43" of N. latitude. These numerous streams are collected by two large branches, viz. the Trogus, and the east branch, or proper Susquehanna, which takes its name at the outlet of Otsego lake, at the village of Cooperstown. From this place it runs south to Delaware county, then turns south west, and forms the boundary of Otsego and Delaware counties, runs across the south east angle of Chenango, the east end of Broome county, into Pennsylvania, whence it turns west, north west, and west, across Broome, and the south east corner 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 devious, 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, scantling, stringers, &c. &c. defend by this river to Baltimore, on an arm of the Chefapeak. This large river has many rapids; and after running across the state of Pennsylvania, it enters Chefapeak 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.

Sussex, 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 this district has been computed at 933,560 acres; its length 76 miles, and its medium breadth nearly 20; making a figure long in proportion to its breadth, and not varying till it reaches the boundary of Kent, where it is contracted to an obtuse point.

Historical Events.—Suffolk, and the adjoining counties of Hants and Surrey, were, by the Romans denominated Belgae, 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 iatons 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-Scaxna-riec, as already mentioned in Surrey; and by a familiar modulation, has been reduced to its present found. 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 thefe, and the title continued till 1801, when it became extinct: it was then constituted a dukedom, and given to Augustus Frederic, fifth fon 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 valleys, through which the many little streams of the county pursue their respective courses to the sea. The wooded fenery which it presents, and the pature-land with which it is contrived, give to the county in general a rural and a rich diversity of appearance.

The soil may be classed under the usual divisions of chalk, clay, sand, loam, and gravel. The first is the general soil of the South Down hills; the second, of the woodland 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 impregnated
The waters of this county are insig-
nificant streams, when compared with those of other English pro-
vinces. One of the principal is the Arun, which Harrisson, in his "Description of Brittan," entitles "a goodly wa-
ter." 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 mulets, 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.

Leafes, Size of Farms, &c. — Leafes, in Sussex, are in general granted for seven, fourteen, and twenty-one years; but sometimes there are none allowed, and the tenant is entirely dependent on the honour or caprice of the landlord. Farms differ in extent according to their situation; those on the dry soils being much superior to the damp ones. The latter seldom exceed 200l. per annum, and even rarely, that are usuallly 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 from 7l. to 28s. per acre.

Agriculture. — The proportion between paffure and arable land varies in different parts of this county. In the Weald, one-third is paffure, one-third arable, and one-third wood and waste. On the south side of the downs, the arable exceeds the paffure in the proportion of thirty to one. The rotation of crops in Sussex entirely depends upon the district in which they are fown. Some instances have occurred on very rich land, where wheat has been repeated four or five years in succession, and the produce amounted to four or five quarters per acre. The crops commonly raised in Sussex are wheat, oats, clover, turnip, peas, barley, and rye. This county is particularly celebrated for its breed of sheep, fed on the South Downs: they require but a very light quantity of food for their subsistence, and the quality of their fleec is peculiarly swift and tender.

See Sheep.

Forefts, Woods, and Plantations. — Sussex, like the ad-
joining 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 180,000 acres. The timber is principally oak; and its quality may be ascertained by the circumstance of its being preferred to any other species of wood, 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 Afton down forest of at least 18,000 more.

Wife 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 180,000 acres; yet they are everywhere interlaced 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 thin-loam and Ramber rag; and where they 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 project 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 Merthyr, near Regent in Surrey.

Civic 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 159,083, and the number of houses at 36,698. Sussex is divided 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 dio-
cese of Chichester, and province of Canterbury.

 Manufactures. — The principal manufacture 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 Stane-street of the Romans, which passed from Cale to well of the county, with a vicus, or branching road, toward Porchester. 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 Westmoreland," 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 anti-
quities, were discovered near Ealbourne. Similar remains have been found at Chichester, and at Wimfar, near the Roman road from that city; and coins of the lower em-

Sussex Marls, a name given by many to a peculiar spe-
cies 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 little regarded. The ground of this marble is grey, with a faint tinge of green, and it is very thick set in all parts with shells; there are chiefly of the turbinate kind, and they are generally filled with a white spar, which adds very greatly to the beauty of the stone.

Sussex Nidsor, in Agriculture, a sort of tool of the ferrin-
fyng kind, which is much employed in that district or country, 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 six or eight sharp triangular cutting shares or hoos, as the size of it may be, fixed on strong flanks of some length, which are infected and fastened into the strong side-pieces, and the three crofs-bars or framing-pieces, by means of strong nuts, screwd firmly down upon the upper ends of the flanks. 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 of Sciences at Berlin, on the population of the cities of London and Paris, to the latter of which he alluded, in 1750, 600,000 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 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 secundity; 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 difeases 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 Breflaw, Paris and Berlin, in different years. This work has been of great service to writers on population, and is often quoted by Mr. Malhins on this subject. The Abbe Denina says, that the religious zeal of Susmilch sometimes led him to indulge a spirit of perverſity; and that in the Consistory, 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 Prufia, in the province of Ermland; 15 miles S.W. of Heilberg.

SUSTER. See Shuster.

SUSTEREN, a town of France, in the department of the Eure; 9 miles S.S.W. of Ruremon.

SUSTERS, a small island in the North sea, on the coast of Norway; 12 miles S.E. of Touberg.

SUSTINENTE, a town of Italy, in the department of the Mincio; 11 miles S.E. of Mantua.

SUSU, a town of Alfastr Turkey, in Natolia; 26 miles S.W. of Ibarfich.

SUSUGHERLJK, a town of Alfastr Turkey, in Natolia; 44 miles S.W. of Burfa.

SUSUM, a town of Arabia, in the province of Haidjas; 20 miles N.W. of Karac.

SUSZA, a town of Ruffia; 42 miles S. of Polotk.

SUTAGOTCHY, a town of Bengal; 8 miles N. of Hoovyl.

SUTALARY, a town of Hindooßen, in Bengal; 65 miles S. of Dacca. N. lat. 23° 40'. E. long. 90° 19'.

SUTARBROY, a town of Bengal; 8 miles S.E. of Rogonapour.

SUTCHAVA. See SUGAVA.

SUTCHUTZ. See Schüttenhoven.

SUTE, SUTTE, or Suite. See Surt.

SUTEMA, or SUTAMER, in Geography, a town of Africa, in the kingdom of Tommi.

SUTER POIN, a cape of England, on the coast of Durham. N. lat. 55° 2'.

SUTTERA, a town of Sicily, in the valley of Mazara; 16 miles N.N.E. of Girgenti.

SUTHAUSEN, a town of Welfphalia, in the biphopric 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 ufual place where canonical purgation was performed. That is, when a faid could not be proved by sufficient evidence, the party accused came to the south door of the church; and the priest of the people, made oath that he was innocent.

This was called judicium Dii. And it is for this reason that large porches were anciently built at the south doors of churches.

SUTHERLAND CREK, in Geography, a creek of Upper Canada, which runs into lake St. Francis, between Pointe au Bodet, and Pointe Moullefe, in the township of Lancaller.

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 Att. Hors. Kew. v. 4. 327; (in memory of Mr. James Sutherland, who published in 1683 an octavo catalogue of the phytic-garden at Edinburgh,) is founded solely on the Collecta frutusana, Linn. Sp. Pl. 1045. Curt. Mag. t. 181, with the following

Eff. Ch. Calyx with five teeth. Standard without callosities at the base, folded back at the sides, shorter than the oblong keel. Stigma terminal. Style bearded longitudinally at the back; transversely in front at the summit. Legume inflated, membranous.

We always differ with reluctance from our able and judicious friend, and might perhaps admit his present genius, but not Swainson (see that article) appear, in our opinion, to invalidate it. See Colutea, n. 4. and n. 6.

SUTHERLANDSHIRE in Geography, one of the most northern 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 Rosaline; on the W. by the Atlantic ocean; and on the N. by the great
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great North east. This county is one of the largest in Scotland, and contains about 3,210 square miles, or 1,478,400 English acres; yet, in consequence of its vast mountainous districts, its value is inconsiderable. The whole extent of Sutherland is about 80 miles in length, and 40 in breadth, and its population, in 1811, amounted to 23,629 inhabitants, and 4,882 houses.

General Aspect of the County. —The surface of Sutherland is extremely 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, partsakes 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, the west, and the northern sea; forming between the mountains long and narrow gllens, or braiths, which constitute separate districts, sometimes 40 miles in length. The inhabitants at each extremity of these gllens, 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. —Sutherland has in many parts large quantities of free-flone, lime-flone, and flate. The lime-flone, in some places, assumes the form of marble, particularly near the coast. In the mountains on the west coast, traces of ancient iron-mines are yet visible; and as the county was at one period an extensive forlidi, 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-cryfals 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 quantity is too small for working, and the quality is far from being good. Native gold, it is supposed, exists near the base of the mountains; and lead-ore, very rich in silver, has also been discovered, together with a vein of black manganese, near the Frith of Dornach.

Rivers. —The principal river of the county is called the Naver, which rises from a lake in the parish of Far, and after flowing for 28 or 32 miles, falls into the ocean at Strathy Head, and gives the name of Strathnaver to the district through which it runs. The other waters of this county are Holladale river, Torrydale river, and Tongue bay, which is a long arm of the sea, advancing five miles into the land. On either side of this bay, are corn-fields, inlaid pastures, and farm-houses. To the westward the coast is high and rocky, and intersected by several small creeks, in one of which there is a quarry of grey flate, and another of flake, which are both wrought, and the products conveyed by boats to different parts of the country. The rocks along the coast are hollowed 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 Fraigill," 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 Sutherland is varying, according to the different districts into which it is chaled. There are the eastern, upon the German ocean; the western, upon the Atlantic ocean; and the central, or middle district. The air in the eastern district is sometimes keen and penetrating, but it is on the whole healthful and favourable; 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.

Sulfi. —The soil of the long valleys between the mountains is a shallow loam, capable of every improvement, if it were cleared of the great lumps of flone which are found in it. With the exception of those farms converted into sheep-walks, the arable land is occupied in the proportion of one to four acres. The state 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 considerable part of it is an allembage of rugged mountains, pined on each other. There are many goats in this part of the country; 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 eastward of Sutherland, considerable quantities of grain are raised, and black cattle are reared for sale. Some linen-yarn is also spun for the manufacturers of Aberdeen, and other places. The other divisions of Sutherland 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 velliges of those ancient buildings denominated Piets' houles; and in various parts are also to be seen remains of fortifications of different forts. Some of them are old towers, and others confit of large works, which appear to have been intended as places of concealment for considerable bodies of men and cattle. On the east coast, on the south side of Loch Brora, 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 chiefs who fell in battle; and many spots are pointed out, in which the rival clans formerly engaged in fanguinary contests with each other. In the parish of Alist, in the isle of Oldney, is a considerable cairn, in which is a flone hollowed, having a cover also of flone. The hollowed flone 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 Durnef, 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 flone covers the door-way as a lintel. The opposite side has been destroyed. At Mulfes, in the parish of Tongue, are the remains of an ancient building; but so rainious, 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 stones, and ruins of circular buildings, erected on a rising ground near the sea; and the other is Dunrobin castle, the seat of the ancient earls of Sutherland, founded by Robert, the second earl, in the year 1000.—Beauties of Scotland, by R. Forlyth. Statistical Account of Scotland.

SUTHALLI, a town of Abafcia, on the Black sea; 20 miles S.W. of Mamak. N. lat. 45° 21'. E. long. 38°.
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 Bengal, near Cape Ledo.

SUTORS, two capes or promontories of Scotland, at the entrance of the bay of Cromarty, considerably above the level of the sea; the one on the north, the other on the south side of the mount, which is about 13 miles north. SUTRAPARA, a town of Hindoostan, in Guzerat; 18 miles N.N.W. of Puttan Sunkut. SUTRI, a town of Italy, in the Pamphino, the seat of a bishop, united to Nepi; 22 miles N.W. of Rome. N. lat. 42° 13'. E. long. 12° 15'.

SUTTEE, or Sati, a word of the Sanscrit, or sacred language of the Hindoos, meaning pure, and hence extensively applied to their female deity, 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 orthographical system of the late Mr. J. Wilson.

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 traveled many years there, will reply in the negative. In the widely spread territories under the British government, this suciide 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 sutlercraft has achieved over the natural feelings and instincts of mankind, we may expect to find it oftener at the chief feasts of Brahmanical superstitition. 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 JUNCTIONS.

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 shrine 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 a Sati, that is to burn herself; which being of course prevented, she applied to the governor, and on refusal, crossed the harbour to the Mahattar shore, and there received her crown of martyrdom.

"Prodigality, or carelesness of life, has on another occasion been remarked as a confusious trait in the Hindoo character; hence has arisen such an army of martyrs, as no religion, perhaps, can outnumber; as well as meritorious suffering for religion's sake. Suicide is in some cases 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 piety, perhaps it is to boast, occurs at Poona, in ordinary and quiet periods, annually 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 fix times; but it was a tumultuous and revolutionary 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 Mutia and Mula rivers, about a quarter of a mile from the city, at which junction, there is a sawny, called Sangam, the English redundancy is situated; and as my habitation was 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 on 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 abbreviated, 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 horseback to the river-side, attended by music, her friends, Brahman, and spectators, to the period of her lighting the pile, two hours elapsed: she evinced great fortitude. On another occasion, an elderly, 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, then erecting, I faw me, 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 dropped her, and defied me to hold my hand out, that what she was about to give me might be dropped into it; to avoid pollution, I suppose, by touching any thing while in contact with an impure person. She accordingly held her hand over mine, and dropped a pomegranate, which I received in silence, and reverently retired. I was very sorry that it was not some ornament, or something of an unapproachable 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 glass, was also disappointed, and was of course curious to know what was the article presented in so interfering a manner at such an awful time.

"After the Sati was heated in the hut of straw built over the pile, with the cerpse 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 defied me to observe her, which I did attentively. She had a lighted wick in each hand, and seemed composed. I kept fght 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 passenger of confluence, the ashes 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 desirous to obtain some of the ashes, to preserve in lockets, &c. but was not able to get any. A military guard
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guard is generally placed over the spot of sacrifice, and my application was refused by an attendant Brahman; who, after some reluctance, told me, that he could not imagine of what utility the birds were for the purposes of sorcery. A firm belief in the power of witchcraft and necromancy exists, very extensively among all ranks and religions in India; and some instances 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 embossed 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 help 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 Brahmons, received her last blessings and adieu, 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. 433.

The Hindoos, in common with several other ancient people, a veneration for divine impreffions of feet. These are called Sripada: which fee.

Although most of the fanguinary atrocities and folies protected by enthusiastic individuals among the Hindoos, are not only discontenamed but condemned by the Brahmons, this of the Sati is certainly sanctioned by their prefeue; but they deny its being promoted by their perfusion. The faried books also encourage it by painting the joys that immediately await the human soul on its purification by the procefs of Sati. This benefit is also extended to the hudef and family of the purified widow. The latter are exalted in the eillation 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 fortune, is one of the most extraordinary offered to our contemplation, exceeded or equalled only by that of infanticide, found to be fo prevalent in the fame quarter of the world. (See Infanticide.) Referring to this under our consideration, we are induced to extend this article by the inference 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 Hindu Widow."

After noticing the great want of judgment in several late compilations in the felection of their authorities, and the conquent perpetuation of error; and the necelcity 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 felection from the Vedas, or Puranas, or commentaries, fandry texts and explications, connected with the immolation of the Hindu widow.

"Having flirft bathed, the widow, drefed in two clean garments, and holding some kufa graze, tips water from the palm of her hand. Bearing in her hand kufa and tiles, she looks towards the east or north while the Brahman utters the mythic word O'm. (See O'm.) Bowing to Narayana, the next declares on this mouth, &c. (describing the times) I (naming herself and family), that I may meet Arundhati and reside in Swarga; that the years of my stay may be numerons as the hairs on the human body; that I may enjoy with my husband the felicity of heaven, and fancify my paternal and maternal progenitors, and the ancesttry of my husband's family; that lauded by the Upfarastras, I may be happy through the reigns of fourteen Indras; that expiation be made for my husband's offences, whether he have killed a Brahman, broken the ties of gratitude, or murdered his friend, that I attend my husband's funeral pile:—I call on you, ye guardians of the eight regions of the world, fun and moon! Air, fire, earth, and water! My own soul! Yama! Day, night, and twilight! And thou, confidence, bear witnes: I follow my husband's corpse on the funeral pile."

This declaration is called Sankalpa. Of the mythological perfons, &c. mentioned in it, some account will be found under our articles Swarga, Upanara, and Yama. Sanctifying her own and her husband's ancestors is done usually by the ceremony called Sridhas; see that article. Arundhati was the wife of the fage Vahibha.

The ritual quoted above is of the first authority. It shews that there are different forms and ceremonies observed on this occafion. The widow is made to lay the follows her husband's corpse; and the following text points out the method. "When the corpse is about to be confumed in the Sahotaja, the faithful wife, who flood without, rushes on the fire." The Sahotaja 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 defcribe the pit cited in another defcription 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 loosely fuspended. 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 so common a prose 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, confign themselves to the fire. Immortal, not childlesl, nor huifband's, excellent; let them pas 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 muft refer to a crime committed in a former eXistance, 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 fo modify them, as to deprive them of any authority obnoxious to their Brahmanical faniity of character. Although it is doubles held to be the duty of a widow to deify herself, the Hindu notion is that she commits her husband, to live as Brahmapari, or commit herflf to the flames." The authority of Brahmachari confids in chafity, and in divers acts of piety and mortification: such as using no
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ornaments in her drefs, 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 incease 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, perceiving in her determination, for the fitst declaration is not binding, should the widow recede, she incurs the penalties of delusion. "If the woman," says the text, "regretting life, recede from the pile, she is defiled; but may be purified by observing the fast called Prajapatya." This is a severe penance: it extends to twelve days: a spare 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 un solicit; the last three are a rigid fast.

We have before observed, that in some cases suicide is allowed. Generally, it is certainly discouraged and forbidden. The Hindoo legislators have doublets thrown themselves difposed to encourage the sacrifice of Sati; it is declared not to be suicide. The obsequies called Sradha, are forbidden for common suicides; but the Regewa 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 Sradha is to be performed." (See Sradha and Suicide.) It may be noticed here, that the period of mourning is different in different tribes: its shortest 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 Vrihafpati, "who has an infant child, or is pregnant, or whose pregnancy is doubtful, or who is unclean, may not, O princes, accend the funeral pile. So said Nareda to the mother of Sagara." (See Nareda, Sagara, and Vrihafpati.) The mother of an infant shall not relinquish the care of her child to accend the pile; but she may, if the care of her child can be otherwise secured. Uncleanesses allude to periodical caufes, or to certain purifications after child-birth. It has been erroneously alleged, that a widow, pregnant at the time of her husband's death, may burn herself after delivery. This is pointedly contradicted by Hindoo authorities, as well as by the general maxim, "what was unlawful or prevented in its season, may not afterwards be reformed." 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 prohibited by the remote distance 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 provided for by the commentator; but it were superfluous to pursue them through all their frivolous details, and laborious illustrations 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 most of them. But many practices have been introduced, unattached by any ritual. A widow who declares her resolution of burning herself is expected and required to prove her foritude; and it is confidently said, that one who should recede after the commencement of the ceremony, 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 of a work of authority, comprising several particulars of those ceremonies: "Adorned with all her jewels, decked with mumin and other bullous ornaments, with the box of mumia in her hand, having made pujia or adoration to the gods, thus reflecting, that this life is nought; my lord and master to me was all, the walks round the burning pile; the bellows jewels on the Brahman, comforts her relations, and shews her friends the attentions of civility—while calling the funerals and elements to witness, she distributes mumia at pleasure, and having repeated the fankapala, proceeds into the flames: there embracing the corpse, she abandons herself to the fire, calling Satya! Satya! Satya!"

This differs in the material point from the common usage at Poona, where it is reasonably believed that this spectacle is witnessed oftener than at any other city or place in India. At that capital the corpse, after purification 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, is furnished with lighted wicks. The sides of the combustible hut are within her reach, and she is supposed to apply the fire. It is also applied externally; and the bystanders throw on butter, wood, straw, religious gums, &c, according to the circumstances of the parties. For this they are taught that they acquire great merit, exceeding, in their hyperbolical style, ten millions fold the merit of an Afwamedha, which is the sacrifice of a horse, or of any other great offering. On these occasions, wind and other intruments drown notes that might be vahtly more horrible. The merit of participation is extended to those who join the procession from the house of the deceased; for every flay they are ridiculously promised, even by grave authors, indulgences as for an Afwamedha. These promises afford additional grounds for the inference, that the martyrs of this horrid superflition have never been numerous. It is certain, and we are confirmed in our assurance by Mr. Colebrooke's authority, that the sacrifice is now rare: on this point he reasonably appeals to the fact of few of the numerous Britifh residents having witnessed or known of its occurrence. Had they ever been frequent, superflition would hardly have promised its indulgences to spec- tators.

SUTTIKO, or SETTiko, in Geography, a town of Africa, in the kingdom of Woolly.

SUTTLE WEIGHT, in Commerce, the weight to be used when trett is allowed. See TRET.

SUTTON, in Geography, a township of America, in the county of New Hampshire, and county of Hillsborough, first called Perrytown, incorporated in 1784, and containing 1328 inhabitants. Alce, a township in Worcester county, Massachusetts, 46 miles W.S.W. of Boston, incorporated in 1718, and containing 2260 inhabitants. The covenanted called "Purgatory" is a natural curiosity, situated in the south-ealern part of the town. In this township are several mills and manufactories of paper, pot-aff, walls, &c.

Sutton's Quadrant. See Quadrant.

SUTTON-COLDFIELD, in Geography, a town situated in the division of Birmingham, hundred of Hens- lingford, and county of Warwick, England, 10 miles near the north-west border of the county, adjoining Staffordshire, and is placed upon a bleak and barren soil. In the time of Henry I, the lordship of Sutton was presented to Roger, earl of Warwick, with a yearly rent referred 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 foraken, and the town nearly deferted; when John Vefey, bishop of Exeter, who in Henry VII.'s time had acquired affluence, procured for
for Sutton, a charter of incorporation, erected a moot-hall 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, being that of a nave, chancel, and two side aisles, was built by bishop Vefey, 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, steward, and other officers: the warden for the time being is also the coroner. The grammar-school, founded by bishop Vefey, is conducted by trusteés; but the gift of the master-hall 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 2359 inhabitants, with 619 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 15,000 acres, part of which is in the county of Stafford. Sutton park lies to the north-west of the town, and consists of 4000 acres, which were once granted by bishop Vefey, as a common palfurage for the poor of the town.—Beauties of England and Wales, vol. xv. 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 latching-platter received the application 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. There are the interrupted, the quilted, and the twisted futures, with another one, named gaitoraphes. For an account of the twisted future, see HARE-LIP; and for that of the future named gaitoraphes, see the article GASTROGRAPHIE.

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 so shaped as to be curved towards its point, and straight towards its eye, it is obvious that it is not advantageously constructed for pulling through parts with facility. It should be double-edged to the extent of one third of its length from the point; and its broadest 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 platter be deemed insufficient of itself to maintain the part in this state, and a future be considered proper, the needle, armed with a ligation, 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 platter, dressings, and a bandage, are at the same time usually applied.

The quilted future is so called from a quill 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 support of every part of a wound than is done by the interrupted future. The fame kind of needle is used as for this last future; but it must be armed with a double liage. 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.

Dionis 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 platter, 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 superficial pain, we ought to reprobate the practice in general. Did futures only create a little additional pain, and no other evil, fill their employment would be justifiable, if they really professed 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 dilatation arising from the visceræ, and the danger of their being protruded, are reasons which explain the advantage of futures in these particular influences. 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. Futures 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 platter, and bandages cannot effect, are strong motives for reproving their being commonly used. In fact it often happens, when futures are practiced, that considerable inflammation of the wound is the consequence, and its prolonged edges evince marks of suppuration, unless soon relieved from the irritation of the ligatures. In this case, if the surgeon be lascivious enough to cut the ligatures and remove them in time, suppuration may still be frequently avoided. Extensive cryphelatos redness, surrounding wounds, will often be found to originate from the irritation of futures.

M. Pibicac'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 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. 4to.

They who affect, that the good effect of futures is, in many cases, supported upon the fond faith 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 produre of bandages.

Whoever wishes to investigate this subject farther, 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, to distinguised 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. 3.

**SUWART**, in Geography, a river of Darien, which runs into the Spanish Main, N. lat. 8° 57'. W. long. 77° 50'.

**SUYNPOUR**, a town of Bengal; 35 miles E.S.E. of Dacca. N. lat. 22° 53'. E. long. 95° 29'.

**SUVULPOUR**, a town of Bengal; 38 miles N.N.E. of Ramgur.

**SUWAIDA**, a town of Arabia, in the province of Hedseas; 30 miles N. of Medina.

**SUWAROF RYMNIKSKI, ALEXANDER, Count**, in Biography, a distinguished Russian commander, descended from a Swedish family, was born in 1730, and designed by his father for the profluence 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 commissary of lieutenant, with which he quelled the military guards in 1734; 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 Petersburg in 1762, 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 recommissioned, 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 Petersburg 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 Pugatcheff 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 crosses 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 Oczakof; and he relieved the prince of Saxe-Coburg, when he was surrounded by the Turks, after the victory in which he participated with him at Fockzai; and brought on the great battle against 100,000 of the Turkish troops near the river Rymnik, in September 1789, which terminated in a complete victory to the combined armies, and obtained for Suwarof the title of "Rymnikla," and splendid presents both from his own sovereign and the empress. To him was committed, by Potemkin, the enterprise against the strong fortresses of Iimil; 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 refrain a body of victorious soldiers, exasperated by the resistance of the helmed, he acted a very different part respecting the liberty, not refusing for himself so much as a single hair.

After the peace of 1791, which surrendered Oczakof to the Russians, Suwarof received an accumulation of fresh honours, and was appointed commander of all the troops stationed in that part of the Russian empire, fixing his headquarters at Cheriat, where he remained nearly two years. He was employed afterwards in the disgraceful business of extinguishing the liberty of Poland, and gained several victories over the patriots. In 1794 he laid siege to Pregy, a fortified suburb of Warsaw, and carried it by assault, with a carnage little inferior to that of Ilimil. 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 disfurnished purpose of securing the fervitude of that ill-fated country.

When the emperor Paul joined the confederacy against France in 1799, Suwarof was appointed to command 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 sustained a defeat in the bloody battle of Novi. After that event Suwarof 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 Maffeina, Suwarof, who was appointed by Moreau, was obliged to retreat towards the lake of Conflance. The fatigues which he endured on this occasion brought on an illness; and he was ordered to return to Petersburg. The reluctance 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 Petersburg, where he found himself flighted. He soon afterwards fell into a fit of childfickness, and died on the 18th of May, 1800, at the age of 70. Paul manifested his repentance, by refusing to his remains the ordinary military honours, and even deprived his only son of his rank of major-general, and the empress Alexander, however, repaid this injustice, by erecting his statue in the imperial gardens.

Suwarof was hardly 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 used the bath; and by his temperance and activity preferred 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 purposes he was inflexible, strictly true to his word, and of incorruptible probity. In his speech and writing his style was laconic, intermixed with ludicrous expressions, and even in his dispatches and orders, with doggerel verses. He was well acquainted with modern languages,
languages, but declined political or diplomatic correspond-
ence, alleging, that a pen did not suit the hand of a felder.
His early manner, disregard of luxury, and contempt of
danger, rendered him the darling of his fellow, while his
principal officers were his secret enemies, on account of the
strict duty he exacted, and the prerogatives 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, enterprise, and rapidity," says one of his biogra-
phies, "he had no superior; but the critics in the art of
war have cenured him for want of depth in his combinations
and skill in his manoeuvres, as well as for violating humani-
ty in his victories." Cosco's Travels in Russia. Gen.
Biogr.

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.E. of
Sugulmeita.

SUZA, a city of France, in the department of the Po,
formerly capital of a marquisate, and province of Piedmont,
situated on the river Dora Riparia, in a valley to which it
gives name, at the foot of the Alps, anciently called
"Scufium," or "Segufium," or "Seguifina." It was the
capital of the kingdom of Cottius, and the place of his
usual residence. The possession of it has been often con-
tested, and it has suffered much in passing from the pos-
session of different successive conquerors and proprietors.
The Goths, Lombards, and Saracens, have successively plundered this place; but it suffered most from the capture of
Frederic Barbarossa, 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 late
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
Piedmont; 23 miles 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
Cametta. The principal towns are the Suza, Giavonna,
Avignano, and Novalte.

SUZABAD, a town of Bengal; 15 miles N.E. of
Rogonapour.

SUZA, a city of Portugal, in the province of Beira;
21 miles N.E. of Bragança Nova.

SUZARA, a town of Italy, in the department of
the Mincio; 14 miles S. of Mantua.

SUZAVIN, a town of Persia, in the province of
Irak; 90 miles E. of Hamadan.

SUZAY, a town of France, in the department of
the Eure; 4 miles E.N.E. of Grand Andelys.

SUZDAL, a town of Russia, in the government of
Vladimir, on the Nare, the see of a bishop. Peter L.,
after divorcing his wife, Eudoxia Fedorovna, confined her
in the convent of St. Basil in this town; 24 miles N.E.
of Vladimir. N. lat. 59° 16'. E. long. 40° 44'.

SUZE, la Raffe, a town of France, in the department of
the Drome; 18 miles S. of Montmillier.

SWAB, a fort of mop formed of a large bunch of old
wool-yarn, and used to clean the decks and cabins of a ship.

Hence, the verb Swabber.

SWABBER, the title of an inferior officer on board of a
man of war, whose office is to take care the ship be kept
near and clean.

In order to this, he is to see her washed well once or
twice a week at least; especially about the gun-wails and
chains.

He ought also to burn pitch, or some fish thing, now-
and-then between decks, to prevent infection, and to ac-
quant the captain with such of the men as are nasty and
offensive.

SWABENITZ, in Geography, a town of Moravia, in
the circle of Olmütz; 17 miles S. of Olmütz.

SWABIA, or SWABIA, a circle of a Germany, bounded
on the N. by the palatinate of the Rhine and Franconia,
on the E. by Bavaria, on the S. by Switzerland, the lake of
Constance, and the Tyrol, and on the W. by France,
from which it is separated by the Rhine; about 120
miles from exit to west, and 80 from north to south.
The ancient county of Swabia was rather more extensive.
The name is supposed to be derived from the Suevi, who first
inhabited the country between the Weser and the Oder,
but afterwards crossed the Elbe to the Meine 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 abdicated, but Conrad I. restored.
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-
tinct about the middle of the 15th century. In the middle
ages, Swabia was divided into a great number of gauz,
Latin gauze, the names of some of which are still in use.
The states of Swabia, at the diet, were divided into five
branches, viz.: 1. The ecclesiastical princes and abbots;
2. Temporal princes and abbots; 3. Prelates; 4. Counts
and barons; and, 5. 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 branches had its director, but without any peculiar
privilege above the rest of his order.
The directors of the five branches let their seals to all the
recesses, 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 branches 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
directory of Wurtemberg. In the year 1681, 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 1541 horse, 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 propor-
tion was rated at 31,271 florins, 56 kreutzers, 5 deniers.
The number of troops in this circle, consistently kept on foot,
consisted of four regiments of infantry, each composed of
thirteen companies, one regiment of dragoons, and one of
cuirassiers,
cuirassiers, each consisting of eight squadrons. The commander of the circle was styled general field-marshals. With respect to religion, this circle was reckoned among the mixed ones. Under the emperor Frederick III. the circle of Swabia was, for the sake of the peace of Germany, divided into four quarters. The head of the duke of Wurttemberg, of the second the margrave of Baden, of the third the bishop of Constance and the abbott of Kempten, and of the fourth the bishop of Augsburg.

Swabia, Austrian, was composed of the ancient hereditary states 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 annually more than 400,000 livres to the military chiet of Austria. These states were composed of Burgau, Neuenburg, the prefecture of Swabia, Hohenberg, the Ortenau, Brilgau, and some towns and convents.

Swad, in Agriculture and Gardening, a provincial word signifying a pod, as of peas, beans, &c.

Swadha, in Hindu Mythology, is said to be a goddess whose wonderful adventures are very poetically narrated in one of the Puranas, or sacred romances, entitled "Brahma-VAIVARTIKA." (See Purana.) She was originally a nymph of Galaka, the paradise of Krishna. Her celestial charms excited the jealousy of Radha, who represents the Grecian 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 confounded by being given in marriage to the Dii Manes. She is hence the goddess of funeral obsequies; conveying to the souls their offerings in the inferno and rewarding the latter for their piety to their ancestors.

The word Swadha is farther used as a fort of grace or benediction, after eating the food offered in the ceremony called Sradha, in honour of deceased ancestors. (See Sradha.) 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 Lakhimi.) The word Swadha is, however, of profound and mythical import, being sometimes 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 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 with enriched embrasures and purpled pinnacles. The nave is very lofty, and has twenty-six clerihoy windows. Some of the pews are curiously carved; and in the library is preserved a fine miffal. Here are some handsome monuments, among which is an altar-tomb, with an effigy of Dr. John Botewright, a native and rector of this parish, and chaplain to king Henry VI. In ancient days, the earls of Richmend had a prison 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, Grimthorpe, Shropdon, Gilcote, Freebridge, and Clackcote. 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 2570, occupying 490 houses. A weekly market on Saturdays is well supplied with provisions; at which time is held a great mart for butter, recently removed from Downham. Here are also three annual fairs. In the year 1793, a crofs 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 Brume, in a manuscript history, quoted by Spelman in his "Iconia," says, "this was a British city in the time of Utet Pendragon, about the year 500." The name is Saxon, 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 Eastmore-fen, a large fols and rampart extend, by which the hundred of Clackcote was bounded. At the head of this fols was a lofty fortified mount, 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 and the place conspicuous, by cultivating the friendship of Pope and other literary characters. The house was not only a rendezvous of living 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 Raffaele, particularly two very large ciphers of fine form and execution, measuring three feet by eighteen inches each.—Blomefield'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 Weft Florida, near the Apalachicola. N. lat. 31° 3'. W. long. 85°.

Swaha, in Hindu Mythology, is the falk or energy, or in more popular language, the comfort, of Pavaka, the god of fire.

Swain. See Boatswain and Cockswain.

Swaine, in Geography, a river of Prussian Lithuania, which runs into the Ilmen; 4 miles W. of Mulichen.

Swainmote. See Swainmote.

Swainsona, in Botany, more correctly Swainsonia, was fo called by Mr. Salibury, after the late Mr. Isaac Swainfon, who having derived considerable profit from the sale of a medicine called Velno's Vegetable Syrup, bestowed part of his income in the maintenance of a botanic garden at Twickenham, to which his acquaintances, it seems, were liberally admitted. Still it does not appear that he was entitled to the distinguisihed appellation of "a second Cliftort," nor that he was a cultivator of botanical science. We have always gladly concurred with Mr. Salibury in his prudent reserve in bestowing such honorary generic names, as well as in his attention to clathical propriety in contrasting others; and we will always do fo, while, without prejudice, we are ready to unite with any competent judge in sweeping away all that are incorrect or unmerited. If the present genus were to remain, Venentian's name of Loxodiun, previously printed, might be adopted, as but too expressive of the ambiguity of its character. We moth incline, however, to the opinion of Dr. Sims, who hints 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. 752; and Brown in Ait. Hort. Kew. v. 4. 326. In the latter we find the following:—

Eff.
SWALLOWS-TAIL, in Botany. See Asclepias.

The common swallow-wort of the tropics, with a white flower, called vincetoxicum and hirundinaria, 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 France, Spain, and Italy; and is said also to grow wild in gravelly grounds in some parts of England. The root has, when fresh, a moderately strong but agreeable smell, approaching to that of wild valerian, which in drying is in a great degree dilipated; chewed, it impetates first a confiderable sweetness, which is soon succeeded by an unpleasant subacid bitterinhencs: an extract made from it by water is moderately sweetish, balsamic, and bitterish; the spirituous extract is stronger in tafle, proportionally smaller in quantity, and retains a part of the specific flavour of the root. It is recommended as reflexivant, sudorific, and diuretic; in catarrhal, cachectic, and serosolous disordered, and in uterine obstructions; in doles of from a scruple to a drachm or more in subulance, and three or four drachms in infusion. It has been employed by some of the Germans as an alexipharmic in malignant fevers, and even in the plague, and hence received the name of contrayeroca Germanorum. Some, however, have fuscepted it to poffefsious qualities, and obferves, that when fresh it excites vomiting. It has been chiefly used in dropical disordered, and caQies are related in which it was given with great succed; but as other medicines were at the same time employed, its good effects are not sufficiently established. The fame obfervation will apply to Stahl’s pulvis antimonalis hydropicus, a composition in which the vincetoxicum is an ingredient. Among us it is fearely ever made use of in any intention. Louis.

SWALLOW-Wort is also a name given to the Stapelia; which fee.

SWALLOWING. See Deglutition.

It has been observed by Mr. J. Lawrence, that the swallowing of leeches or hen’s-dung, is an accident that frequently happens to country cart-horses, passing off with a flight feckness, and without notice. Whilst the horses are abient, the poultry will always watch the opportunity of examining the mangers, where they leave both dung and feathers, which ought ever to be carefully swept away previously to feeding the horses: Horses drinking at ponds will also often suck in a variety of fith and vermin. The figns of having swallowed leeches, or other vermin, are hanging the head to the ground, and a discharge of impure saliva, sometimes mixed with blood. To remove which, he advises giving a pint of sweet-oil warmed, with a glafs of brandy, and a drachm of ground ginger. Scalded bran and gruel should likewise be plentifully given; and the oil may be repeated if needful. A mild dose of aloes and rhubarb, with one ounce of diapente, may likewise often be given in warm ale with advantage.

SWALLOWING. See Difficulty of, in Infants. See Infant.

SWALLOWS-TAIL, in Fortification. See Quaie d’Aronde.

SWALLOWS-TAIL, in Joinery and Carpentry, denotes a particular way of fastening together two pieces of timber, so strongly as that they cannot fall asunder. See Dove-Tail.

SWALLY, in Geography, a sea-port town of Hindoostan, on the coast of the gulf of Cambay. On a point of land at the mouth of the Taptree, or Tappée, about ten miles S. from this town, is a tower, which lerves 4L
SWA

26 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 peregrinations 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 Raremond.—Alto, a river of France, which runs into the Meuse, 5 miles below Raremond.

SWAMMA, a town of Algiers; 12 miles S. of Taga-

demb.

SWAMMERDAM, John, in Biography, a distin-
guished anatomist and naturalist, was born at Amsterdam in 1617, and designed by his father, who was an apotheca-
cary in that city, for the church: but his own inclinations were directed to physic, which became the object of his study, togethet 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 avidity in anatomical ex-
periments and the art of making preparations. At Paris he visited Nicholas Steno in 1664, whilst he made a tour in the French provinces, and visited the city and France with a view to further improve-
ment. On his return to Leyden he took the degree of M.D. in 1667, publishing on the occasion a thesis on respi-
ration. At this time he began to practise his invention of in-
jecting the vessels with ceraceous matter, which seemed to keep them diffused when cold: a method from which anato-
my has derived very important advantages. He applied very closely to dejection with Van Horne: and in the de-
fecation of insects he was singularly dexterous by the aid of instruments of his own invention. The grand duke of Tuf-
cany, 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 abhor-
rence of the restraint 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 re-
printed, and translated into French and Latin, the latter with splendid figures. In 1672 he published, as a medical anatomist, a work entitled "Miraculam Naturae, seu Uteri Mulhibris Fabrca, notis in V. V. Horne Prodromum illustratum," Leid. 4to., many times reprinted. By intense application he became hypochondriac, and wholly unfit for society. In this state he was so imprudently by the revivers of Antoine Bourgion, as to be plunged into the depth of myeliticm, and to be induced to abandon all his scientific pursuits. At her defire he prefented to the world, in 1675, his last pub-
rication, which was an account, in Dutch, of the insect called Ephemeres. He followed this fanatical 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 one of the paroxyms that feized him not long before his death, he burned all his remaining papers; but in a state of indisgence he had disposed of the greater part to Thevenot for a trifling sum. On the lapse of about half a century, there came into the possession of Boerhaave, who caused them to be published in Dutch and Latin by Gauthier, under the title of "Biblia Natutae, Seve Historia Ephemorum in certis clauso redacta, &c. &c." 2 vols. large folio, 1727, with plates; translated also into German, English, and French. The history of bees in this work is highly esteemed, as particularly valuable. Life by Boerhaave. Haller.

SWAMP, in Agriculture. See Bog and Swampy Land.

Swamp-Or, or indurated Bog Iron-Or, in Mineralogy, an or of iron which occurs in swamps or marls: it is a va-
riety of bog iron-ore, partially indurated by drying. The colour is a dark yellowish-brown, or grey; it appears corro-
scend, and contains cavities, but is sometimes compact.
The fracture is earthy; the darker varieties have a small de-
gree of brittleness, but is more commonly dull: it is very soft and angular. It is the specific gravity is 2.044.

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 ductile iron,
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 marly places is impregnated with a
vegetable acid, formed from decaying vegetables, which ena-
bles 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 de-
gression a deposit of iron is formed, and finally amalgamated by
frequent additions of water, successive depositions take place,
which are at first yellowish, earthy, and of little confis-
cence; this is called marafs-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 paizes into meadow-ore. Mafles
occur in which all the different degrees of induration may be
observed." Jamelton's Mineralogy, 2 ed., vol. iii.

SWAMPY BAY, in Geography, a bay on the coast of
North Carolina. N. lat. 35° 42'. W. long. 70° 7'.

Swampy Land, in Agriculture, such as is of a boggy or
moralv nature. Under this title are also sometimes in-
cluded, according to Mr. Marshall, inland fens, boggy
marshes, swamps, &c., which are, of the way of floods; or yet are liable to be chilled by sur-
face waters, and poached by cattle, in wet seasons; by reason of the natural water-courses below them being in a state of neglect; or for the want of artificial courses be-
ing 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 unappro-
priated and unclaimed wadles. Where the appropriation
of lands has taken place, they are less conspicuous.

It is evident, that all lands of the swampy kind, what-
ever 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 fuid, which is in general the best application of them, as they are seldom fit for the purposes of tillage. See Bog, De-
aining of Land, and Spring-draining.

In the appendix to the account of Elkington's mode of
drainage land, a very full description of the severall dif-
erent methods of improving these sorts 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 unfrequently raised from a
very trifling, or scarcely any value at all, to a very con-
fiderable one, simply by planting them with withy for the
use of basket-makers and others. There are different sorts
cultivated to this intention on such lands, as the red and
the
In former times, this bird was served up at every great feast; and it is said that cygnets are to this day fattened at Norwich about Christmas, and sold for a guinea a-piece.

Swans were formerly held in such great esteem in England, that by an act of Edw. IV. c. 6. no one, that polled a heifer could sell its calves, was permitted to keep any, other than the son of our sovereign lord the king; and by 11 Hen. VII. c. 17. the punishment for taking their eggs was imprisonment for a year and a day, and a fine at the king's will. It is also said, that if swans be lawfully marked, it is felony to steal them, though at large in a public river; and that it is likewise felony to steal them, though unmarked, if in any private river or pond, otherwise it is only a trespass.

These birds were by the ancients consecrated to Apollo and the Muses; and upon this idea seems to have been in-grafted the notion which they had of swans being endowed with a musical voice; and the fable might likewise arise from the doctrine of the transmigration of souls into the bodies of animals, under the persuasion that the body of the swan was allotted for the manifon of departed poets. In time, a swan became a common trope for a bard. Besides these opinions, the ancients apprehended that the swan foretold its own end; for explaining which, Mr. Pennant supposes the consideration of the two-fold character of the poet, viz. "poeta and poëta," which the fable of the transmigration might aferibe to the bird, or they might be supposed to derive that faculty from Apollo, their patron deity, the god of prophecy and divination. As to their being suppos'd to sing more sweetly at the approach of death, Plato (Pseudo, Ed. Cant. l. 683. p. 114.) attributes that unusual melody to the same sort of ecliacy, that good men are sometimes said to enjoy at that awful hour, foreseeing the joys that are preparing for them on putting off mortality. The notion, however, was a popular one long before the time of Plato; for Æschylus alludes to it in his Agamemnon; Clytemnestra speaking of Callandra says,

---σαξιατίς καὶ ταῦτα δίκαια

Ταξιδεύοντας δεινοὶ κύναρε.

κύναρε.

"---She, like the swan

Expiring, dies in melody."


Bartholin has given an accurate account of the anatomy of the wild swan, and of the structure of its ophragius, and the wind-pipe, which is very remarkable. These are fo framed, that they go down together into the heart; and, after reaching its bottom, they turn up again, and the wind-pipe rising out of the front parts of the heart, climbs up the intermediate cavities, on which it leans, on a bale, and then bends to the thorax; but before it come to the thorax and lungs, it forms a fort of larynx, with an os hyoideum, covered with a thick membrane, and resembling a musical pipe, wide above, but with a narrow slit, and straight, and depressed below: under this larynx, before the wind-pipe enters into the lungs, it is divaricated into two branches, like unto bronchia, thicker in the middle, but narrower where they are near the lungs. In this particular it differs from the human apera arteria, which, it is true, is divided into branches, but that is not before it has entered into the lungs. Bartholin. Difert. de Cygni. Anat. See remarks on the wind-pipe of the wild swan in Phil. Trans. vol. xi. p. 205. &c. See also CHANE, Colvin, &c.

41. 2
Swan Shell. See CiguE.
Swan's-Egg Pear-tree, in Gardening, that fort of this tree, which produces this fine eating pear. See Pear-Tree, and Pyrus Malus.
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 Kennebeck river, which it divides into two navigable canals; 3 miles from the chaps of Merry-meeting bay. It contains 51 inhabitants.
Swan Lake, a lake of Canada; 171 miles N.N.W. of Quebec. N. lat. 49° 32'. W. long. 72° 15'.
Swan Point, a cape of the coast of Maryland, in the Cheahapeak. N. lat. 38° 31'. W. long. 76° 22'.
Swan River, a river of America, which runs into the Mississippi, N. lat. 4° 34'. W. long. 93° 15'.
Swan Truth, a town of America, in the district of Maine, and county of Hancock; containing 251 inhabitants.
SWANAGE Bay, a bay of the English Channel, on the coast of Dorsetshire, S. of Studland bay.
SWANEVELT, or SWANFIELD, Herman, in Biography, was born at Werden in 1620, and, as it is said, was a disciple of Gerard Douw, whose style, however, he did not long follow; but as his disposition inclined him to landscape he travelled to Rome, and there, in 1649, 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 sincere attachment to his art, he fludied with incessant care, devoting whatever time he could to the contemplation of the effects of nature among the interesting scenery which surrounded the capital of Italy. So much did he incline himself among her antiquities, her ruins, and varieties of mountain, wood, and water, that he acquired the surname of the Hermit; but his meditations were not confined for 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 delineated and executed more correctly than those of his master.
He was in 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 cognoscenti, who have not unfrequently purchased as the works of Claude de Lorraine, pictures which were completed on the eaf of Swanvelt.
Swanvelt 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 landscapes and animals, which rival the best with considerable effect.
SWANG, in Agriculture, a gristy or other piece of green fodder, lying low, or in a bottom covered, or liable to be covered, with water.
SWANIMOTE, or SWAINMUTE, a court touching matters of the foel, kept, by the charter of the foel, thrice in every year, before the verderers, as judges.
This court is as incident to a foel, as a court of pie-poudre to a fair.
Its jurisdiction is to enquire into the oppressions and grievances committed by the officers of the foel, and to receive and try pretentions certified from the court of attachments against offences in vert and venison.
SWANLINBAR, in Geography, a fair-town of the county of Cavan, Ireland, much reforted to in the summer, on account of its medicinal sulphureous springs. It is situated in the midit of the mountains in the N.W. of the county, and is 15 miles N. by W. from Killahandra, and 74 N.W. from Dublin.
SWANNANO, the ealt 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 Onflow county and Wilmingtom district of North Carolina.
SWANSEA, or SWANSEY, a sea-port and market-town of considerable importance, in the hundred of the same name, in Glamorganshire, South Wales; is situated 35 miles W. from Cardiff, and 205 miles W. from London. The Welsh name of this place, Abertyfa, is derived from its situation on a point of land near the junction of the river Tawe with the sea. The etymology of its English appellation is not to easily ascertained; it is supposed that it was originally written Swanese, or Swaney, as intimated by Camden, from the porpoises which abound in the Bristol Channel. The town lies on the western side of the Tawe, which is here navigable for ships of large burden; and has extensive quays, with every necessary accommodation 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 houses, occupied by opulent individuals, among whom are many professional men of eminence, merchants, and substantial tradesmen. In the return to parliament in the year 1811, Swansea (including the hamlets of St. Thomas) is stated to contain 1702 houses, and 8156 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 circumstance has occasioned the erection of a great number of lodging-houses, in general very handsome, and many of them adapted for the reception of families of the first distinction.
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 patience of the proprietors of the mill. The consumption 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 manufactorufi 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 interior, create an export trade of great extent. The chief article furnished for exportation is coal, particularly of those kinds called lime-coal and culm, brought down by the canal which conveys them to shipping quays by 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 customs-house books. The number of vessels entered out in

<table>
<thead>
<tr>
<th>Year</th>
<th>Tonnage</th>
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<tr>
<td>1768</td>
<td>694</td>
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<td>1790</td>
<td>1697</td>
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<td>1860</td>
<td>2592</td>
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<tr>
<td>1810</td>
<td>2747</td>
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<td>171,672</td>
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The corporation have been laudably exerting themselves many
Swansea is suppos'd to have been another of the earl of Warwick's fortresses, as are also Penarth castle and Penrice castle, of both which some remains are at a short distance from Pfizermouth.

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 Gibson's edition of Camden's Britannia. The supporting stones are fix in number, and about four feet high; and the covering stone is suppos'd to weigh about twenty tons.

Stouthall, 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 Llangennyd, 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. xvii.

South Wales, by the Rev. T. Rees, F.S.A.

Swansea, or Swansea, a town of America, in Bristol county, Massachusetts, incorporated in 1667, and containing 1839 inhabitants; 51 miles S. of Bolton.

Swanshals, a town of Sweden, in Well Gothland; 25 miles W.S.W. of Linkoping.

Swanton, a pott-town of America, in Franklin county, and slate of Vermont, on the E. bank of lake Champlain, and S. side of Michieoue river, which is navigable for the largest boats seven miles to the falls in this town. The town contains 1657 inhabitants.

Swantown, a town of the state of Maryland, in Kent county: 3 miles S.E. of Georgetown.

Swanzy, a township in Chefsire county, New Hampshire, adjoining Chesterfield on the E., 97 miles W. of Portsmouth; incorporated in 1753, and containing 1400 inhabitants.

Swape, in Rural Economy, a provincial term figuring a long pole, turning upon a fulcrum, for raising water out of a shallow well, for churning with, or other similar purpuses.

Sward, or Swardland, in Agriculture, the green or grassy surface of the ground. In order to have a fine fward, much attention is necessary to feeding down the grafs, as well as keeping it free from all sorts of rubbish of the weed kind. See Laying down to Grafs, and Grass-Land.

It is that fort of land which is in the state of grafs, or which has a fward upon it.

Sward-Cutter, an implement invented by Mr. Sandilands, and described in the sixth volume of the Bath Papers, for the purpose originally of preparing old grafs-ground for the plough, by cutting it across the ridges, in the beginning of or during winter, when the land is loft, in order to answer all the intentions proposed by Mr. Tull with the four-couler plough, for bringing grafs-ground that has been long rettled into tillth. This the sward-cutter has been found to do, the inventor says, much more effectually and expeditiously; as Mr. Tull's plough, with four coulers, cuts the sward in the same direction with the plough, and is liable from every fone, or other obstruction any of the coulers may meet with, to be thrown out of its work altogether, or the implement be broken, to which the sward-cutter, confiding of four, fix, 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.
be to three, without its being cut. The furrow, being cut across, falls finely from the plough in squares of any size required, not under six inches, in place of long slips of tough hard, feldon and imperfectly broken by the four-coultered plough. It is supposed, that any person who reads Mr. Tull's description of his four-coultered plough, and what he proposed try it, will soon see the great advantage the four-coulter has over it, in producing the desired effect of bruicing old rolled grass-ground into tith; an object universally allowed to be of no small importance to agriculture.

Besides, it is an implement which is supposed very fit for preparing ground for burning, as it will save much hand-labour. It may also be properly used in crofs-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 crofs-cutting pasture-ground, intended to have manure of any kind put upon it to inten-"morate the grafts. In this it will far exceed the scythe-cutter, as that instrument is liable, as well as the four-coultered plough, to be thrown out of its work when meeting with a stone or other interruption. The crofs-cutting bar is so contrived, that in preparing for barley, the crofs-cutter, it is said, excels a roller of any kind, in reducing the hard clods in clayland, occasioned by a sudden drought, after its being ploughed too wet; and it is likewise very proper for re-"ducing each fhady-clay land, when under a summer fallow. In this operation the one-cutter is greatly to be preferred to the cutting-roller, from its wheels being all dependent one on another, fo that when one is thrown out by a stone, three or four more fhake the fame fate: besides, the cutting-roller has but seven wheels in fix feet, and the crofs-cutter has fix in four feet three inches, at nine inches distant; and, if necessary, may have them fo near as fix inches. It is added, that after old graft-ground is cut acros with the one-cutter, and ploughed, it has a very uncommon and work-like appearance, from each fquare turned over by the plough being raised up an inch or two at the side last moved by the earth-board: fo that the field, when finifhed, is all prettily waved, and refembles 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 froot, and other in-fuences of the air, which cannot fail to have a good effect on it. And it is found that two horses are sufficient for the draught of a double-horse crofs-cutter, and one-horse for a fingle-horse one; one man manages the machine, and drives the horses. The workman begins his operation by fift measuring off twenty or thirty places from the machine, fift or more, as he inclines, and there 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 paff the half furrow about a yard, and the machine is upon the outſide ridge of the field on which it must turn, he must stop the horses, then take hold of the leves, 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 fame distance formerly done on the opposite fide of the field. When the cutting-wheels are exactly over the out-foor furrow, then, on the horsſe being stopped, flip 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 between the firt and fect froke of the machine is all cut. In this manner the field is to be finifhed, after which you may begin to plough when you please. It is remarked, that there must be a pole at each fide of the field. But it is of no con-fuence whether the land to be crofs-cutter is in crooked ridges, or ftraight; in flat ridges, or in very high-railed ridges, fuch as are frequently met with in Scotland. Be the furface ever fo uneven, it does not fignify, as the cutting-wheel, being all independent of one another, are forced by their weights into every furrow or hollow. Further, one crofs-cutter, it is faid, will cut as much in one day as fix ploughs will plough. It is added, that the land may be several months in winter after being crofs-cutter, when there is no vegetation to make the cuts grow together again before it is ploughed; but the sooner it is ploughed after cutting, the better, that it may have the benefit of all the winter's froot, which makes it harrow better and eafeer 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 lefs apt to tear up the furrows all cut into fquares. This need only be attended to respecting the first two times or tining, as they are called, or the harrowing. And it is observed, that a crofs-cutter harrowed, and fronth may make the infamy-ment. It is very fpring, very fimple, and eafily managed, and moved from place to place; and if put under cover, will laft many years. A representation of it may be feen in the work noticed above. Other implements of this kind have been invented, and recommended by different other perfons; and one is faid to have been lately invented and contrived in Lancashire, which has much superiority.

Sward-Dreffer, the name of an implement contrived for the purpose of drefling and improving the fward of lands in the flate of grafts. An useful tool of this fort has been decried by Mr. Amos, in his Minutes on Agriculture and Planting, where he has advising the ufe of it for fcarifying and drefling grafts-land, whether it is to be mown or deftroyed with animals; and that the belt 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 one way may be fufficient; but if the fward be very mofty or adhesive, it fhould, he thinks, be drefled length and crofsways, cleaned and rolled; the implement being occasionally cleared from rubbith.

And it is fuppofed, that if the fward be thin, it may be thickened very much, by laying eight or ten tons of rotten dung on, and fowing seven pounds of white clover, four pounds of wild or cow-clover, four pounds of treffoil, four pounds of rib-grafs, and one peck of the bell ree-grafs, feeds, per acre, previously to its being drefled in the fall, bufh-harrowed, cleaned, and rolled. He thinks, that by drefling land in this way by this tool, mofts is tom up, and mole-hills levelled and deftroyed, the roots of the grafts cut, and horfe-hoed, which caufes them to throw out fresh lateral fhoots or items, the fward thickened, and the surface made fo clean as to put on the finest appearance, when kept clofe fed down. And that by fuch management, and daz-"zing as much flock as will keep the grafts in a young lucce-"lent state, and hobbing or mowing all the tufts and weeds three times in the course of the fhummer, the grazer will be enabled to receive every benefit from his land, and likewise prevent the flena of fveral grafts from running to feed, and being thereby injured, as well as the land.

This fort of tool is contrived in somewhat the fame man-"ner as other implements of the fame nature, having two strong pieces of wood which form the outer side-frames, fix feet long, and twelve by three inches square, shaped as in the ordinary tools of this fort; there is a couther-bar, five feet eight inches long, and four by three and a half inches square, out"side
outside nature, which is divided into nineteen equal parts, in which nineteen coulters for sharpening the blade of the ground are fitted: there are also four bars, five feet eight inches long, and three and a half by two inches square, for bracing the side-frames together, and for fixing the thorns in, which bruch the blade after it has been sharpened. There are likewise two pieces of ash-wood, three inches square and about forty inches long, for flogging the machine upon from one field to another; and a chain, by which the whole machine is drawn with two horses abreast. The coulter are ten inches long, and one and one-fourth inch broad, and three-eighths of an inch thick for three and a half inches within the wood of the coulter-bar, below which the fore-edge is made sharp, for cutting the turf or turf off the ground. There is a screw-bolt, which regulates the depth at which the coulters scrape and cut the land; in which are fastened iron-plates twelve inches long, and three by one-fourth of an inch square, with two iron bolts, twelve and a half inches long and half an inch in diameter, for fastening the iron-plates to the upper and under sides of the different parts. There is also an iron bolt twelve and three-fourth inches long, half an inch in diameter at top and bottom, and three-quarters of an inch diameter where the screw is made to turn: a nut-screw, three inches long, three-fourths of an inch by one and a half inch square, is fixed in the coulter-bar for regulating the depth of the coulters; which being turned by the screw-key near or well hand about, raises or drops the coulters at pleasure.

In using the tool, the broader part of the machine must be drawn and filled well with long black-thorins, when it will be ready for being made use of in the work.

SWARDEVI, in Hindo Mythology, a name of the Hindo goddess Parvat, comfort of Siva.

SWARDY, in Agriculture, a term used by the farmers for a soil well covered with grasses.

SURE, or SCHWARZ, in Commerce, a money of account and coin at Bremen. As a money of account, the grote (2/3 grotes being = a thaler or rixdollar) is subdivided into five tarew current. It is also a copper coin. See COIN, and MOVES.

SWARLAND, in Geography, a river of Sweden, which runs into the Flumslake, near Orebro.

SWARM, denotes a large body or number of bees, or of other small animal: the term is particularly applied to a number of bees that emigrate in a body from a hive. Every swarm is composed of a queen, many common bees, both old and young, and drones, the number of which is uncertain.

The nature of the annual new swarms of bees, which we see depart from old hives, is not to be truly understood, otherwise than by knowing the history of the propagation of the species among these animals, for which see BEE and QUEEN-BEE.

Some have supposed that these swarms which have maid drones are the most likely to prosper; but this has been controverted by others. The multitude of swarms does not forbode the property of an apiary: neither do those earliest swarms, such as those that rife towards the latter end of April or the beginning of May, prove the belt or proper molt; but those that happen at the latter end of May, or beginning of June, are the most promising.

If a hive has been very well peopled during the winter, the young brood go out early in the spring; and if it hath been very thinly peopled, it is sometimes as late as the middle of June long, before they go, even without any accidental delay from the want of a queen. But the two principal swarming months are May and June.

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 too peopled, that many of the bees cannot find room within, but fling in choppers 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 stormy season, the first swarms seldom or never rise, though the ealfe, 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 observing, that though the hive be not 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 noife in them, which is not to be heard at such 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 different 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 princes, addressing herself to the queen-mother, petitions 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 princes perishes in her suit, and at last succeeds. The second night the queen, with a very audible voice, infuses her royal grant, and proclaims 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 sound, 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 infusing from the stigmata of the body was very instrumental 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 flapping of its wings against the air; and it seems very easy to imagine, 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 throoving them in several different directions may also add greatly to the variety.

The hour 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 upon the surface of the hive: the effect of this, in causing them to go out, is easily conceived. The few that are nearest the middle 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 irresolute in the inner parts.
SWA

parts of the hive, now find the natural heat of the place increased to so great a 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 habitations. 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 prodigious 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; thence 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 choosing a place where to fix themselves. It does not appear that the female bee chooses the place for them, but they all seem to be affianced 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 cluter in one part of it. The female does not place herself at the head of this cluter, but fits on the branch near it, to see how the approves the management: as soon as the cluter is of a proper size the adds herself to it, and from that instant it thickens in a surprizing manner, all trying first to fix themselves to the ree, 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 looie 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 warm letters upon some branch of a bush, or low tree, the hiving of them is an easier matter than could be imagined. See Hiving.

The hives of bees are commonly placed in gardens, that the bees may have room to fly in their own neighborhood, and be compelled to go far in search of food; and the swarms from these hives usually succeed better, when there are some bushes, as of filberts, 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 setting; in which case, all attempts to search for them are usually 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 custum is to throw handful of dust and fain 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 unfavourable 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 beingestroyed.

Another very ancient custum, and which is continued to this day, is the beating on instruments of brass, and the like, to make a great noise while they are gathered in the air: it is pretended, that this is to provoke to fix themselves the sooner. The origin of this custum 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 found 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 send one thraggen home. Reamum Hist. Inf. vol. x. p. 290. Thorley's Enquiry, &c. c. 6.

SWARM, After. See After-Swarm.

SWAROCHESHA, in Hindu Fabulous History, is a name of one of the holy men named Menus. (See Menus.) The name of this person is seldom met with.

SWARTA, in Geography. See Schwarta.

SWART, a town of Sweden, in Sudermannland; 4 miles N.E. of Nyköping.

SWARTEBERG, a town of Weft Gothland; 18 miles N.W. of Uddevalla.

SWARTH, in Rural Economy. See Swath.

SWART-HORN, in Geography, a mountain of Switzerland; being part of the Scaleta Alps, which communicate with the Julian Alps, the Sät, and the chain that separates the Valteline from Upper Engadine and Pregalia.

SWARTOW, a river of Holstein, which joins the Tave; 3 miles N. of Lubeck.

SWARTSLUTS, a fortress of Holland, in the department of Overijssel, situated on the river Vecht, in a marshy country, defended by five battlions; 28 miles W. of Covorden.

SWARTZIA, in Botany, a name given by Schreber to the Townes of Aublet, in honour of Olof Swartz M.D. the present Bergian professor of botany at Stockholm, a faithful pupil of Linnaeus, and one of the best botanists of this or any age. His various Cryptogamic works, no less than his Wet Indian Flora, entitle this amiable and liberal writer to universal respect. Rittera of Schreter, see that article, proves the fame genus. Another Swartzia was indeed founded by Hedwig, in his Crypt. v. 2. 73; but this latter, a genus of Moisses, is unquestionably not different from Trichostomum, as we hope hereafter to demonstrate, in its proper place.—Schreb. Gen. 518. Wildl. Sp. Pl. v. 2. 1219. Mart. Mill. Dict. v. 4. (Tounatea; Aubl. Guan. 549. Jull. 440. Lamarck Dict. v. 7. 716. Illutr. t. 462. Rittera; Schreb. 364. Swart Ind. Occ. 935. Polifira; Aubl. Guian. 934. Schwartz Prodr. 81. Jull. 351. Lamarck Dict. v. 5. 776. Illutr. t. 461.)—Clafs and order, Polyandra Monogynia. Nat. Ord. Potaminos, Linn. Capparides, Jull.

Gen. Ch. Cal. Perianth inferior, of one leaf, coriaceous, permanent, in four deep, ovate, rounded, concave, reflexed, nearly equal segments, coloured on their infide. 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; anther roundish, incumbent. Pipf. Germin italked, oblong, compressed, declining, or incurved; style short; stigma oblique. Peric. Pod oblong, tumid, compressed, of one cell and two valves. Seeds few, oblong, tunicated.

Eff. Ch. Calyx in four deep segments. Petal solitary, lateral. Pod of one cell, with two valves, and a few tunicated fees.

Obf. As the Swarta and Rittera of Schreber are aorted
sferred 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 seen more than the enlarging germens of Rittera only, and the head-shaped Swartzia. Willd. n. 1. (Rittera simplex; Vahl Symb. v. 2. 60. Swartz Ind. Occ. 896.)—Leaves simple, elliptical, with a blunt point. Petal roundish, longer than the calyx. Stamens very numerous. —Native of thick woods in the Caribbean islands, flowering in June. A shrub, ten feet high, with alternate, round, smooth, leafy branches, minutely dotted with whitish elevated points. Leaves folded, 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, decurrent, terminal teeth. Stipulas opposite, falcate, deciduous. Flower-stalks axillary or terminal, racemose, shorter than the leaves, bearing from two to eight or ten large, yellow, fragrant flowers; whose upper stamens are thickened and elongated, with obtuse curved anthers; the lower, next to the petal, shorter and capillary, with ovate twin anthers. Seeds lanceolate more than two, black, with a white aril, attached to the lower future of the pod; we nevertheless can hardly term it a legume.

2. S. grandiflora. Large-flowered Swartzia. Willd. n. 2. (Rittera grandiflora; Vahl Ed. v. 2. 37. Plant. Amer. dec. 1. t. 9.)—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 distinct. The leaves are narrower, thinner, and more pointed. Teeth of the footstalks not decurrent. Petal larger. Better characters may hereafter be discovered by those who have an opportunity of comparing good specimens of both plants. Vahl.

3. S. dodecandra. Dodecandrous Swartzia. Willd. n. 3. (Rittera dodecandra; Vahl Symb. v. 2. 63. t. 34.)—Leaves simple, ovate, nearly falcate. Petal oblong, about the length of the calyx. Stamens less than twenty. —Native of South America. Von Roth.—The branches are round; downy towards the extremity. Leaves alternate, on very short, minutely toothed, stalks, ovate, two, or three inches long, membranous, 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 bracteae under each partial stalk. Petal ovate-oblong, rather longer than the calyx, but shorter than the stamens, which are from fourteen to nineteen in number, yellow and thread-shaped. Vahl.


—Found by Aublet, in the forests of Guiana, bearing flowers and fruit in May. The French call it Bois à fleur, 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 compound, entire, decurrent, pointed, Stipulas shield-shaped, somewhat falcate, with pairs of falcate bracteae like the former. Petal rounded, emarginate, yellow, twice as long as the calyx. Stamens twenty-five or twenty-fix (Aublet) fix or few in number, which, next the petal, are short 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 recepiel."
They or See the township corresponding, may come to... Brahma fever. This instrument is in some counties called a dew-rake, and much used in Effex for gathering barley after mowing.

SWATKA, in Geography, a town of Bohemia, in the circle of Chrudim; 8 miles W. of Politza.

SWAY, To, in Rigging, denotes to haul down upon a rope or cable.

SWAYAMBHU, a name or epithet meaning in the Sanscrit language self-existent; and as the Hindoos, like the Jews, had an awful reluctance in uttering the direct name of the Supreme Being, they had recourse to epithets expressive of his attributes. See Jehovah and Om.

SWAYAMBHUVA, a periphrasis of considerable importance in the history and chronology of the Hindoos; in which much confusion and contradiction occur at almost every step taken into ages at all remote. The name of this periphrasis means son, or offspring of the self-existent: the latter epithet being a received translation of Swayambhu, understood to mean the Deity; the final syllable denoting son or offspring. In the Infitutes of Menu it is said, that the Mighty Power, meaning the Deity, having divided his own substance, became half male half female; or, says the commentator, "nature active and passive." From the female portion proceeded Viraj, and from him the first Menu, the subject of this article, who is supposed to have revealed the Infitutes bearing his name. Of the five who followed, little is said in the Hindu books. (See MENU.) In the time of the seventh, named Satyavarta, the general deluge occurred. The first Menu, fir W. Jones (Af. Ref. vol. ii.) judged to be the same with Adam; the last with Noah, "the great progenitor and restorer of our species."

Swayambyhuva appears sometimes to be Brahma, in a human shape, and is said to have descended at a sacrifice. In this character a wife is assigned him, named Sataraupa; which agrees with the commentary. They are said to have had two distinguished sons and three daughters, and to have had ten sons. The eldest is named Priyavrata; his three daughters are named Acuti, Devarutri, and Vilruti; the latter is also called Parapruti, but their names are seldom heard.

Sataraupa is sometimes represented to be the wife of the first Menu, named Swayambyhuva, or son of the self-exiliating, and said also to have been his daughter. This Menu is the reputed author of the Infitutes known by his name. (See MENU.) If the latter, as has been surmised, be allowed to be Adam, his consort Sataraupa corresponds of course with Eve. But as there is much confusion in the history of the Menu, we find this important female mentioned as the consort of the last, or seventh, Menu, Satyavarta; in whose days the general deluge occurred, and in whom our patriarch Noah is without doubt to be recognised. Both these Menus are said to have had ten sons by wives, named Sataraupa, who appears sometimes as the comfort or fakht both of Brahma and Siva; corresponding, in this case, with Sarawati and Parvati. See Satka.

The following extract from Wilford's learned Essay on the Chronology of the Hindoos (Afiat. Ref. vol. v.), will introduce us more particularly to the subject of this article, and to some other important periphrases mentioned herein.

"Swayambyhuva, or the son of the self-exiliating, was the first Menu, and the father of mankind; his consort's name was Sataraupa. 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 Swayambyhu, or self-exiliating.' From him proceeded Swayambyhuva, who is the first Menu; they call him Adina (or the fril, or Protogenus): he is the fril of men; and Parama-Parusha, or the first male. His helpmate, Prakriti, is called also Sataraupa: she is Adini, or the fril; she is Vriva-jenni, or mother of the world; she is Iva, or like I, the female energy of nature; or she is a form of, or descended from I; she is Para, or the greatest; both are like Mahadeva and his fakht, (the female energy of nature), whose names are also Iha and Ih." Another legend from the facred books of the Hindoos, explaining, after their manner, the origin of Sataraupa, and of Brahma's four faces or heads, may be here introduced. "According to the Matyia Purana (see Pa Amu, Brahma, in the north-west part of India, about Calmim, assumed a mortal shape; and one half of his body springing out, without his suffering any diminution whatever, he framed out of it Sataraupa. She was so beautiful that he fell in love with her; but having sprang from his body, he confedered her as his daughter, and was ashamed. During this conflict between flame and love, he remained motionless, with his eyes fixed upon her. Sataraupa perceiving his situation, and to avoid his looks, stepped aside. Brahma unable to move, but still defirous to se her, caused a face to spring out in the direction to which she moved. She shifted her place four times, and as many faces, corresponding with the four quarters of the world, grew out of his head. Having recovered his intellects, the other half of his body sprang from him, and became Swayambyhuva." (Wilford, in Afiat. Ref. vol. vi.) A legend, something similar, of Brahma's producing and falling in love with his own works, is given in the article Menu.

In these several allegories, to which the Hindoos, in common with the poetical chronicles of Egypt and Greece, were so prone; and which, if taken literally, we see little else than absurdity and indecency; in many of these allegories are doublets buried historical and physical facts. We shall not endeavour to develop whatever may be hidden in the tales above quoted. We may, however, just hint, that in the confederation of Brahma being an anthropomorphism of matter, or the earth, a clue may be found to some of the fables relating to his offspring, emaculations, absorptions, revivifications, &c. &c. See Sarawati.

SWAYING, in Sea Language. See Jere.

SWAYING of the Back, among horses and other animals, is a kind of lumbugo, known by a pain and weaknefs in the loins. It may be caused by a fall, the carrying of some heavy burden, or some other violent accident; or a relaxation of the muscles of the back. Bleeding, blurring, and sweating, are useful in these cases, for the most part; and the diet must be opening, and all imaginated 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.

SWEARING.
SWEALING. See Swaling.
SWEARING. Prophan. See Profaneness.
Sweating the Peace. See Peace.
SWEAT, a sensible moisture escaping 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 Intemperance and Perspiration.
SWEAT. See Swath.
SWEATING-House. The natives of North America, when we first settled among them, had a great many houses to sweat in, it being their general remedy for diseases of whatever kind; but at present they are left unused among them.
The cave, or sweating-houfe, 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 as 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 heat 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 fit around the heat 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 dress themselves, and go about their busines.
This has been for many ages used among them with success, in cases of colds, fevers, febricums, and pains fixed in their limbs; and the English have often used the same means, and found relief by it. It is practiced equally at all times of the year, and the Indians do it not only in the dead of winter, but by way of refreshment after long journeys, and other fatigues, and to strengthen themselves for any expeditions. Philos. Trans. No. 384, p. 131. See Bath and Sudatorium.
SWEATING-Turf. See Turf-Sweating.
Sweating-iron, in the Mange, is a piece of a fCyth, about a foot long, and of the breadth of about three or four fingers, very thin, and such as cuts only with one fide. When a horse is very hot, and the grooms have a mind to let him off 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 again; 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, No. 461. Feb. 20. See Hypocaustum.
Sweating-Room for Cheefe, in Rural Economy, that sort of room or place which is appropriated to or for the purpose of sweating in them. It should be so constructed, as to be readily capable of being kept up to the most suitable temperature for this use; and be conveniently situated for the cheefe-room, and other places defined for carrying on the practice of cheefe-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 cheefe is made, there is certainly a specific time when its contained air and juices incline to fermentation; and that that natural tendency should, at that particular time, be allured. But that in the present mode, the whole is left to chance; and that at the very period, probably, when a cheefe is beginning to ferment, the weather becomes suddenly cool, or changed in other respects; which, if the proofs 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 pulorum Anglicum, ephemera Britannica, ephemera sudatoria, hydropneumatis, and hydro pneumata. 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 limb, 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 inexpressible thirst. Extreme restlessnes, headache, delirium, nausea, cardialgia, and an irresistible propensity to sleep, characterized its progress; together with great prostration of strength, producing constant 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 off frequently in one, two, three, or four hours from the eruption of the sweat. Thiose more especially who bore their sufferings with impatience, and who fought relief from the heat of heat, by which they were tormented, by exposing their bodies to the air, or even by putting their arms in bed, were often suddenly struck with death.
The sweat, when promoted, is represented as being unusually clammy, as well as abundant, and as having a very strong and peculiarly fetid odour. The violence of the attack generally subsided 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 much vague and inconclusive reasoning, concerning the mode in which it was propagated, is to be met with 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-veffels, 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 and contagious disease might have been generated under these circumstances, especially as this body of troops is described by a contemporary historian (Philip de Comines) as the most wretched he had ever beheld; collected, it is probable, from jails and hospitals, and buried in filth. The most general opinion at the time, however, certainly appears to have been, 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 any other epidemic, with a specific condition of the air, nor detected any peculiarity in the circumstances attending its first appearance, or subsequent returns.

4 M 2
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; when 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 1528; 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 afflicted 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 mortality was so great, that in Wiltshire 120 died of it in a day, and, among others, the two sons of Charles Brandon, both dukes of Suffolk. In Shrewbury, particularly, according to the testimony of Dr. Cius, who resided in that city, 960 died within a few days. The disorder had also, in the main time, been devastating many parts of the continent. In 1520 it first flourished 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 Zuinglius, about the eucharist. From the description which Wierus has given of this as an epidemic, in Germany, it seems to have commenced with a violent cold stage 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 thickeness of the hands at the beginning of the attack, and vomiting of black blood or bile, are also noticed by this author in particular. Eramus, an eye-witness of its devastations, describes it in very forcible terms, "visit ed ex alme Philogogene mihi 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 promoting the sweat, which appeared so manifestly to be a critical discharge. The moment a person was feized 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 stirring a limb, if possible, nor putting a hand out of bed. He was enjoined abstinence 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 lying in the same posture. At the expiration of about fourteen hours, the bed-clothes were gradually to be removed, and the sweating to be restrained; 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 copiously: 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 pursued, 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 surprize of nature, than obliurate to remedies." Great relief 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 to 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 conflagrations, 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 debris or depravation in wheat, or to some noxious vegetable growing with it in particular situations. This idea seems to have been suggested by some analogy to be traced between the fatal epidemic, called ten facé, feu St. Antoine, mal des ardens, &c., which is supposed to have originated from eating rye damaged by a parastic plant, constituting the disorder in corn termed by the French ergot. This opinion appears, however, to be untenable, and has been ably combated in a paper in the Edinburgh Medical Journal, vol. ii. p. 464.

The books from which original information may be collected on the subject of this article are the following: "A Boke or Confeil against the Diseafe commonly called the Sweat, or Sweating-Sicknesse, made by John Caus, Doctor in Physic," 1555, 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 Ephemeria Britannica"; a short account by lord Bacon, in his "History of Henry VII.;" Joh. Wierus, "De Sudore Anglico" C. V. Dubourgheiden, "De Pelle;" Eramus, in "Epitola ad Carolum Utenbovium;" Foribus, "Schol. Obscur;" vi. 8.; Sennettus, iv. 15.; Thomas Cogan's "Haven of Health;" "Lord Bacon's Relation of the Sweating-Sicknesse examined, &c. by Henry Stubbe, Physician at Warwick," 4to. Lond. 1671; R. Forris, "Ephemeria Anglica Petillens."
the Norwegian Alps to the limits of Russia about 600. The contents in square miles have been computed to be 288,922; and the inhabitants, supposed some years ago to have been 2,977,445, must have been 14 to the square mile, including Swedish Pomerania, estimated at 14,400 square miles, and 162,345 inhabitants. The population of Sweden is very disproportionate 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 7,000 inhabitants. Although geographers are very much disagree 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. Wargentin, the rate of population, in the annexed years, was as follows:—

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1752</td>
<td>1,045,622</td>
<td>1,170,017</td>
<td>2,215,639</td>
</tr>
<tr>
<td>1776</td>
<td>1,184,965</td>
<td>1,386,962</td>
<td>2,571,927</td>
</tr>
<tr>
<td>1781</td>
<td>2,676,000</td>
<td></td>
<td></td>
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</tbody>
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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 XI.; and that within the interval of 30 years, the number of inhabitants has increased 5,31,361, or a fifth part of its population in 1781; and as it has since been upon the increase, it is supposed that it must now exceed 3,000,000. The nobility are supposed to include 25,000 families, and the clafs of peafants to comprehend 2,000,000.

The manners and customs of the Swedes, in the higher ranks, resemble those of the French; and the peafants 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 call 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 peafants 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, Norweigan, and Iceland. 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 idiom. The Swedish language is sufficiently numerous, 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. These languages are only different dialects; and the old Saxon, 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. Brigt, who flourished in the 14th century, and whose prophecies were published in Latin, or John and Olaus Magnus, who retired to Rome, when the bishops were expelled from the kingdom by Gudavus Vasa; because Swedish literature can hardly be said to have dawned till the middle of the 17th century, when queen Chriilina invited Grocius, Defcartes, and other learned men, to sow the seeds of literature, which gradually prospered under the reign of Charles XI. The names of Linnaeus, Wallerius, Cronfalt, 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. tho' of Upsal, Lund, and Abo; and twelve seminaries for the education of youth, called "Gymnasia," of which six were founded by Chreliina. 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, Gothenburg, and Carlifornia; which are respectively Stockholms, Gothenburgs, and Carlifornias. 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 sell-cloth, and the construction of ships. Many perfons are employed in the manufactures of wool, silk, 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, silk, wines, &c. From a table of commerce published by Mr. Coxe, it appears that the balance in favour of Sweden in 1781, was 366,437.

As the kingdom of Sweden is situated between the 20th and 30th degrees of E. long., and the 55th and 70th degrees of N. lat., the winters are long, cold, and dreary, and the summers are short, and also hot, on account of the reflection of the mountains and the length of the days. The transition from one season to another is in similar climates, sudden and rapid. The dreariness and darkness of winter are relieved by the duration of twilight and moonlight, by the reflection of the snow, and by the auroa
SWEDEN.

aurora borealis. No country can be diversified in a more picturesque manner, with extensive lakes, large transparent rivers, winding streams, bold cataracts, gloomy forests, verdant vales, ripponhous and cultivated fields, than Sweden. Although the soil is not very propitious, it is cultivated with skill and industry; and in the fourth of Sweden, which 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 ella or elfs. The most considerable, such as the Gota, flow from lakes, and have a short course; others assume the form of creeks, and outlets of lakes, such as the Motala: 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 Gelle, preëmpting not far from its mouth a celebrated cataract, little inferior to that of the Rhine at Schaffhaufen; the breadth of the river being near a quarter of a mile, and the perpendicular height of the fall between 30 and 40 feet. Farther northwards, and especially in Swedish Lapland, there are many considerable rivers, that rise from the Norwegian Alps, and after circuits of about 200 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 Bothnian 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 Wetur, the Meled, &c. which successively. The most considerable lake in Finland is that of Pjedjon or Peijon, about 80 miles long, and 15 broad, from which flows the river Kymmen. The lake of Saima to the E. is more considerable, estimated at about 160 British miles in length, by 25 at its greatest breadth; which flows into the Ladoga, by the noisy current of Woxen, a vast cataract 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 a compact flaty freeflone, but having towards the west maffes of a different nature; and where it inclines to the lake of Tammund, there are apertures from two to four fathoms in width, and of an equal depth; those lying in length to three hundred ells. Bergman also mentions the high mountain of Mollevola, near the fame lake, as being formed of a pudding-flone, consisting of balls of freeflone, with a few of hornblende and lime-flone, united by a sandy cement. The calcareous mountain of Raatvik is estimated by him to be 6000 feet high above the sea; and lie observes, as a singularity, that upon this mountain, and that of Rodenburg, are found vast blocks of reddish felspar, mingled with quartz and brown mica. On the mountain of Olundm, 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 Wettro-Gothia, the mountains are often of trap. The forests of this kingdom are numerous; and Dalecarlia especially, abounds with thofe of beech, poplar, mountain ash, pine, and fir; and the lakes of Sweden are generally skirted 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 horfes of Sweden are commonly small, but fiery, and are preferred, by lying without litter, from many difeases. The cattle and sheep pre-

fent no remarkable trait. Among the wild animals, may be reckoned the bear, the lynx, the wolf, the beaver, the otter, the glutton, the flying squirrel, &c. Sweden affords alfo two fingular kinds of falcons, and an infinite variety of game. The mineralogy of Sweden claims peculiar notice: the gold in the mines of Adolphus; the province of Smaland, is fometimes native, and fometimes combined with sulphur. In the production of filver, Sweden is very much inferior to Norway: yet the mines of Salla, or Salburg, about 30 British miles west of Upfal, maintain some reputation. Silver is rarely found native, but is procured from the galena or lead-ore. The chief copper-mines of Sweden are found in Dalecarlia: nor is Sweden deficient in lead; but iron forms the principal product, and the mines of Danemora are the molt celebrated for the superiority of its metal, called with us Oregrund iron, because it is exported from Oregrund, an adjacent port. There are other iron-mines at Tabery, in Smoland; near Tornea, and at Luleo. Cobalt is found at Bofna, and zinc at Danemora: and the mines of Salla afford native antimony, and Norberg supplies molybdena. Coal has been recently discovered in the province of Scone.

Sweden abounds with beautiful granite; and porphyry is obtained from the mountain of Swuchu, and in other parts. The molt famous mineral waters of Sweden are those of Medewi, in Eastern Gothland.

The religion of Sweden is the Lutheran; and this kingdom has retained an archbishopric, a pre-eminence abolished in Denmark, with 13 prelacies. The number of parishes is 2537. The priests are computed at 1378, with 134 vicars, and 192 prebends, or infpectors. A confideration of the clergy of the diocese elects the archbishops, and the bishops, by prefenting three to the king for his nomination. Some of the parishes are under the royal patronage; others in the gift of individuals: but many are called confessional, and the priet is appointed by the votes of his brethren.

The form of the Swedish government has frequently varied. Before the fuccesion of the house of Vafa, in the peron of Gustavus I., it was a monarchy wholly elective, and laboured under all the evils inefparable from that molt defective species of sovereignty. The union of Calmar, which took place in 1397, ripulated that the fame monarch should rule over Denmark, Sweden, and Norway, and be chosen by the deputies from the flates of the three kings during the whole period in which these regulations subsisted, Sweden was a tributary kingdom to the sovereigns of Denmark; or, in its temporary exertions to shake off the yoke, drew on itself all the horrors of foreign invasion and infeline discord. From this flate of alternate oppreffion and anarchy, it was rescued by Gustavus Vafa, on whom the gratitude of the Swedes conferred the dominion of the country which he had delivered: they even renounced in his favour the right of electing their kings, and declared the crown hereditary in his male issue. The form of government establifhcd at his accession, though in appearance of a mixed nature, and though it lodged the fupremacy in the assembly of the flates, yet entrulld very extensive prerogatives to the king. These powers, transmitted to his immediate potterly with little diminution, were augmented under Gustavus Adolphus, and the right of succession was extended to the female line. But, during the minority of his daughter Chrilina, the government underwent an alteration unfavourable to regal authority: the privileges of the fenate, or council of flate, being enlarged, gave ascendancy to the aristocratical party, or order of nobles; and this power was, by
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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 death, Charles Frederic, duke of Holstein, son of his eldest sister Hedwidge, nephew, by the law of succession, to have ascended the throne; but the Swedes conferred the crown on Ulrica Eleonora, the youngest sister of Charles XII. Ulrica purchased her election by ratifying 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 Swedifh sovereign the most limited monarch in Europe. The supreme legislative authority, and the power of declaring war and making peace, resides in the states of the realm, which regularly-assembled every three years, 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 policed only two votes, and the calling voice in case of equal suffrages, he was subordinate to the senate, and could be considered in no other light than the president. 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 gross defects in this new form of government occasioned constant struggles between the sovereign and subjects, on one side to increase, on the other to deprefte, the royal prerogative; until Gustavus effected the revolution of 1772. In consequence of this revolution, the executive power was virtually vested in the king; for though it is said to be entrusted to him conjunctly with the senate, yet as he appoints and removes all the members of that council, and in the administration of affairs only asks 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, and fills up all commissions; he likewise nominates to all civil offices. He has the sole power of convening and dissolving the states, and is not obliged to assemble them at any stated 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 tender degree of authority possessed by the throne before that period; yet, says Mr. Coxe, they by no means amount to despotism. 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 refides jointly in him and in the states; and the 46th 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 be urged, govern without control, as 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 1789, 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 deputies of towns, and those of the peasantry. Each of the four states has a speaker: the archbishop of Upfal being always the speaker of the clergy, while the king nominates the others. The diet of 1786 consisted of 49 counts, 136 barons, 188 knights, 396 gentlemen, 51 ecclesiastics, 94 burgesses, and 166 deputies of the order of peasants. The revenue of Sweden is computed at about 15 million flerling; which is equalised by the expenses of government. The revenues are chiefly drawn from the rents of the royaldomains, part of the great tythes, a poll-tax, duties on exports and imports, on mines and forges, on distilled spirits, deductions from salaries, pensions, and places, tax on chimneys, and monopoly of saltpetre. The national debt amounts to little less than 10,000,000 flerling. The Swedish army consists of national soldiers, 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 forders 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 respectably bound to furnish and maintain a stipulated number of troops. Each holder of a certain quantity of crown land, called a hemman, provides a soldier, eliglons for his maintenance a small portion of ground, a cottage, and a barn, and allows him 100 copper dollars, or 11. 7s. 6d. 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 a labourer. On the death of the soldier, his widow and children cease 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 hemmans 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 alligned 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 left employed, the companies of each regiment are separately assembled for a fortnight or three weeks. The landlord is obliged to transport the man and his baggage to the place of rendezvous, and maintain him during his stay at the review. Before 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 folders 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 shoals, 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 faciliated to a more useful connexion with Denmark and Prussia, which alone can guard the north of Europe from the progress of the Ruffian 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-reitt; at Stockholm for Sweden Proper, at Jonkioping for the kingdom of Gotland, at Abo for South Finland, and at Vafa 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 capitaly 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 120 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 cafes of high treason, previous notice must be sent to the crown before any court can commence an inquiry, an ordinance which has put a stop to many frivolous and vexatious accusations. Before the accession 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 arraigned within a short period after commitment, the good effects of which alteration require no comment. His majesty increased the salaries of the judges, and conferred their share of the fines inflicted by their decision to other ufe: 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 intereited in convicting the criminal. The king also promoted the rights of humanity, by suppressing, in 1773, the cruel and abfurd 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 protector denounced a person suspected of guilt to the king's officer of justice, who carries on the process at the public charge.

In Sweden there are four orders of knighthood: 1. The order of the Seraphim (see SERAPHIN), or the blue ribbon; which is appropriated to persons 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 coat. 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 pendent from the button-hol. The number of these is indefinite, but generally amounts to above 1000. III. Polar Star, or the black ribbon. Of this order there are two classes: 1. Commanders, who wear the great cross pendent 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 pendent from the button-hole, are, exclusive of foreigners, 48; and six to be added for the clergy. This order, before the institution of the following order of Vafa, was conferred on men of letters. IV. The order of Vafa, 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 coat. 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 pafs for 1 rikfalter 46 skilling specie, or 11 dahler 24 ore silver, or 35 dahler 8 ore copper. The copper coins are single and double flats, at 1 and 2 ore, or, and 3 and 6 ore copper, and rundtycken of 1 ore copper, and also half rundtycken: 96 double flats, 192 single flats, or 576 rundtycken, are to pafs for 1 specie rikfalter: but in large payments, no person is obliged to take more copper coin than the value of half a rikfalter. As the Swedish ducat weighs 1 English grains, and contains 52 2 grains of fine gold, it is worth 934 d. sterling in English gold coin; but in Sweden this ducat passes for 47 skilling, which are worth only 46 d. in English silver coin. The following is the report of an average alloy lately made on a quantity of Swedish dollars at the London mint, by order of the bank of England: "weight of 2000 dollars 1874 2 oz.; average weight of each, 18 dwt. 17 grs.; average fineness 143 dwt. worth 113.6 d. sterling."

Hence the value is 41. 6d. in English silver coin; but the dollar sells for more, in proportion as the market price of silver in England exceeds the mint price. See MONEY and RIXDOLLAR.

The smallest denomination of weight in Sweden is the afs, which is the same as the afs of Amsterdam, where 10,000 are equal to 7417 grains, English troy weight. The mark for weighing gold and silver, called "Silfermarck," is 4384 afs = 3252 grains, English troy weight: hence 40 such marks = 271 ounces troy. In apothecaries' weight, the pound is 7416 afs = 5400 grains troy: hence 16 such pounds
1 Skalpund, or Pound Virtuallie-Wigt, or Provision Weight
1 Marck Bergh-Wigt, or Miner’s Weight
1 Marck Upplads-Wigt, or Inland Town Weight
1 Marck Stapelads Metal Wigt, or Sea-port Town Weight for Iron

The pound virtuallie-wigt is divided into 32 lbs., or 128 quin-tes: the mark of all the other weights is divided into 16 lbs., or 64 quin-tens: 20 lbs. virtuallie-wigt make 1 lipund, and 20 lipunds 1 skippund; 32 lbs. viit. wigt make iten; 120 lbs. a center; and 16 lbs. a wung.

Corn, and other dry commodities, are measured by the tunna. The tunna is divided into 2 spann, 4 liuff-spann, 8 fjerdingar, 32 kappar, 56 kannor, 112 lipund, 144 quarters, and 1728 port. With the allowance for good measure of 4 kappar for every tunna of wheat, rye, barley, oats, or pea, and of 6 kappar for every tunna of malt, and of 2 kappar for salt or lime, a tunna of corn contains 63 kannor, of malt 66 1/2 kannor, and of salt 59 1/2 kannor. The common tunna of 32 kappar measures 8940 English cubic inches, and therefore contains 4 Wincheller bushels, and 5 quarters.

The liquid measures are as follow: the oxfund is 1 1/2 m = 3 cimer = 6 ankare = 90 kannor = 180 flop = 7 20 quarter = 2880 jungruf = 2 oxfund = 1 pipe, and 2 pipes = 1 fuder. The tunna of liquids or fist habilances, and alfo of flour, meat, and fish, is called 8 kannor, and a tunna of pitch or tar may contain 1 flop, or half kannor, les. The oxford tunna measures 14,381 English cubic inches, and therefore contains 624 English wine gallons. The kanna, both for dry and liquid measures, contains 1591 English cubic inches; hence 100 kannor = 69 1/2 English wine gallons.

The Swedish foot is 131 6 French lines, or 11 5/6 English inches, and 40 Swedish feet = 39 English feet. A Swedish ell is 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 = 73 English miles. A degree of the meridian, measured in 1st., in N. lat. 66° 20' 16" by M. Swanberg, is = 57196-159 French toises = 69,260 English miles. A Swedish square foot contains 132 1/4 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 tunneland.

A fath of pitch, potash, Luneburg salt, or beer, is 12 kannor; of tar, or tram-oil, 13 kannor; of Spanish and French salt, 18 kannor; of hemp, flax, cordage, tallow, or hops, 6 kippunds, or 120 lipunds, answering nearly to a ton avoider-poids. A wali is 20 katz, or 80 pieces. Stockholm and the other cities of Sweden exchange with London at 4 riksdaler 15 killling, more or less, for 1 l. hering, at 75 or 90 days. The ufance is reckoned at one month after flight: six days of grace are allowed for the payment of bills, in cafes of necessity; but a person who wishes to preserve his credit must not claim any days of grace, but pay his bills the day 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 comprised of Fins, who probably about 7 or 8 centuries before the Christian era were uprooted by the Goths. (See Scandinavia and Goths.) The southern parts of Scandinavia were inhabited by the Sueves in the time of Tacitus; and Procopius mentions five or six tribes, among which are the Gutes of Gothland, as inhabiting the portion of Scandinavia known in his time. Jornandes, in the fifth century, describes 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 Upfal was chief. As cultivation spread, and deferts were converted into fields, new kingdoms arose; and of these Snorre enumerates nineteen. The king of Upfal subjected those inferior rulers, and Ingialld, who perished in the invasion of Ivar Vidfadame, destroyed by treachery of the petty kings, and the king of Upfal received tribute from the red, called on that account tributary kings. But these subordinate rulers sometimes amassed so much wealth by piracy, as to be more powerful than the inferior lords. 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 continent, however, was still so scantily peopled, that Olaf, the son of Ingialld, flying from Ivar in the eighth century, found the country from the W. of the kingdom of Upfal to the Senner or Wemmer 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 Varme land rose under his auspices. It was not till the ninth century that Jamtia and Helingia, 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 Upfal kingdom was conquered by Ivar Vidfadame, the little potantate of Scania, whose father was one of the chiefs de-
dropped by Ingiald. Upfal afterwards continued to gain increasing power and preponderance. From the year 769 there is an obscure period till the reign of Bjorn I. A.D. 821, commemorated, with his immediate successors, by Adam of Bremen. Jagerbring, one of the bels native historians, divides the ancient kings into the Unglingian race, the most ancient according to traditional report, and terminating at the conquest by Ivar Vidfadne, who was succeeded by his grandson Harold Hildatan, 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 Christianity, but Praegulin was not finally abandoned till the reign of Iagt the Pious, A.D. 1066, whose father, Stenklis, is regarded as the founder of a new dynasty, though he sprung from the house of Sigurd. At this time the crown, which was before hereditary, became elective. The Swedes, discontented with their king, Albert of Mecklenburg, elected, A.D. 1388, as their sovereign, Margaret, heiress of Denmark and Norway. Thus ended the Folkungian race, whose accession had taken place about the middle of the 13th century; and by the celebrated treaty of Calmar, A.D. 1397, 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 complain of their liberties, and in 1449, when Charles VIII. was elected king of Sweden. However, having asailed the property of the church, he was forced to leave the kingdom in 1457, but was afterwards restored. The struggles between Denmark and Sweden continued until the cruel and tyrannic reign of Chrifiin 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 Danifi yoke, and under him Sweden recovered its independence. The revolt may be considered as having commenced when Gustavus appeared at Mola, in Dalecarlia, A.D. 1520, and completed three years afterwards, when he entered Stockholm in triumph. Distinguished by 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 affict 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, the devoted worthy of it as long as the wife Oxen- hillen was her minister and confidential counsellor; but disregarding the counsel of that irrepeable veteran, the affection of her subjects abated; and disgusted with the cares of government, and having formed a kind of classcal attachment to Italy, she abandoned the Swedish throne, her country, and her religion, and retired in 1654. Charles Guftavus, or Charles X., was appointed by Christina to succeed her, and the flates 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 1653, soon after his death, restored tranquillity to the North. Charles XI. was mediator at the peace of Ryfwic in 1667, 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 disasters, and by cessions 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 defended by the female line from the family of Vaf, was declared successor to the throne. The revolution of Gustavus III. in 1772, though perhaps upon the whole beneficial to Sweden, prepared the way for a despotic government. In 1792 this prince was assassinated at a ball by a nobleman, of the name of Auerstrom, a captain of the guards, who confessed that he was the person who had endeavoured to deliver the country from a maller and a tyrant. Gustavus IV. was deposed in 1809, and succeeded by his uncle Charles XIII. duke of Sodermania. Subsequent events are of little general importance. Coxo's Travels. Pinkerton's Georg.

SWEDENBORO, Emanuel, in Biography, the son of a Swedish bishop, was born at Copenhagen in the year 1689, and educated under the tuition of his father. Such were his talents and progress in literature, that, at the age of 24 years, he published a manuscript collection of Latin poems, entitled "Idus Hellicius live Camica Minoflanea." At this time he bet out on his travels to England, France, Holland, and Germany. Two years after his return, in 1716, Charles XII., by whom he was highly esteemed, appointed him afoffor 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 Sweden, wrote on the subject of the integral and differential calculus. At the siege of Frederiessan 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 sifer and successor 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 afoffor to the mines, he visited foreign countries, in order to acquaint himself with their mines; and on his return in 1722, he devoted himself partly to his official services, and partly to his private studies, of much that in 1733 he had completed his great work, which was published in the following year, under the title of "Opera Philosophica et Minofaria," 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 distinguished foreigners wished to have the honour and advantage of corresponding with him. 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 light 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 state of men after death, the true worship of God, the spiritual fountains of the scriptures, and many other important truths tending to salvation and true wisdom. Among the various works which he published we may enumerate the following, viz. : "De Cultu et Amore Dei," Lund, 1745. 40.; "De Telluribus in Mundo nostro Solarri," 1758; "De Equo albo in Apocalypsi," 1758; "De Novo Hierololyma;" "De Caelo et Inferno;" "Sapientia Angelica de Divisa Providentia," Amsterdam, 1764; "Vera Christiana Religion," Amst. 1720.

Concerning the spiritual world he supposed that he had discovered, that it exists not in space. To this purpose he alleges, in his "Universal Theology," that he could there see Africans and Indians very near him, though situated at a great distance on earth; and be present 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 Mælandt, 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 delights as in this world; and so great is the resemblance between the two worlds, that in the spiritual world there are cities with palaces and houses, and also books and writings, employment and merchandise, gold, silver, and precious stones. But all these objects are as an infinitely more perfect state than they are in this world. His zeal in propagating these philosophical, 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 honour and employment, and devoted his time and labour to the instruction and benefit of mankind.

He had no trait of precocity or melancholy in his conduct or temper, nor of enthusiasm in his conversation or writings. Thus he is described by his partial friends; and others, less attached to him, represent him as an ineffable 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-clofe square. Gen. Biol.

SWEDENBORGIANS, the followers of Swedenborg, who form a considerable sect; and whose number has increased after the death of its founder, and still subsists 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 tenets of this sect. Whilft 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 hells 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 one act of them, by which Christ glorified his humanity, perfecting 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, consisting of the divinity, the humanity, and the operation of them both in the Lord Jesus; a trinity not existing 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. Priestley and some members of the New Jerusalem church, particularly Mr. R. Hindmarsh, a printer. It is one of the distinguishing tenets of Swedenborg, that the sacred scripture is to be interpreted in three distinct senses, denominating 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, loft ever 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 and signify things in the spiritual world. He says, that men are attended by angels, which refute 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, Inspiring 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 sun on the natural world. Swedenborg denies the doctrine of predestination, free-will, and conditional election, justification by faith alone, the resurrection of the material body, &c.; and on the other hand, he maintains, that man is posessed 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 included 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 Chrisitian church, both among Roman Catholics and Protestants of every description; and that the last judgment actually took place in the spiritual world, in the year 1757: 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 defending thence.
In their worship, the Swedes 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 dres 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. Molheim's Eccl. Hist. by Coote, vol. vi. Priesley's Letters to the New Jerusalem Church.

SWEDES, in Agriculture, a term often applied by farmers to signify the Swedish turnip. See Ruta Baga.

SWEBESBOROUGH, in Geography, a small post-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 furlong of Philadelphia.

SWEDISH TURNIP, in Agriculture, the name of a hard turn of turnip, of which there are two kinds, the yellow and white, the former 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 slicing this hard turn of turnip. It is prepared and to be had of most implement-makers.

SWEDLER, in Geography, a town of Hungary; 7 miles S. of Kapflor.

SWEDONG, a town of the Birman empire, on the left bank of the Ava; 10 miles N.E. of Pegoungmew.

SWEP, among Refiners, the almond-furnace. See Almond and Furnace.

SWEP, among Goldsmiths, Moneyers, &c. See Washing.

SWEP, in the Sea Language. The leamen 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 futtock.

SWEP 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-ripe, in which groove-rollers are fitted to enliven the rope. On the aft-side is a ledge or rabbit, defended with an iron plate, on which the gooseneck of the tillar traverses.

SWEP-BAR OF A WAGGON, is that which is fixed on the hinder part of the fore-guide, and paddles under the hindpole, which lies upon it.

SWEP, Hay, in Agriculture, that sort 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 flacks 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 cars, 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 flack by it in a few hours, as two or three, as is usually done in half the day, in the ordinary cart mode.

SWEP, at Sea, signifies dragging along the ground, the hight, or loose part of a small rope, in a har- bour or road, in order to hook or recover some anchor, wreck, or other materials funk at the bottom. It is performed by falfening the two ends of this rope to the fides of two boats which are abreast of each other, at some distance. To the middle of the rope are fufpended two cannon flot, or something which weighs heavy, in order to fink it to the ground; fo that, as the boats advance, by rowing a head, the rope drag along the bottom, to hook any anchor, &c. for which they are fearching.
duty, without a permit, incurs a forfeiture of 10s. a gallon, and also the liquor and calves. (6 Geo. c. 21.) See Winemakers, Domestics.

**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 Quicker Hedge.

Sweet Corn, a term used by the Indians to express a sort 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 boil it, 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 grossly 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 fathers also commonly go out to war against their enemies about this time of the year, and find this supply in their enemies’ fields. See Mauze.

Sweet Flag. See Acorus.

Sweet Meadow-grass, a name sometimes applied to a grass of the meadow kind by writers on husbandry. See Holcus.

Sweet-Scented Soft Grass, a sort of grass which is met with in meadow fields, 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 grasses, at the time of flowering, bears to that at the time the feed is ripe, is as 17 to 21.

The grass 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 grasses 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 grasses, it is tender, and the produce in the spring is incommodable. 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 feeds both by a small number of flower-blacks, and is 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 grasses at the time of flowering, and the latter-math. See Holcus Lignosus.

Sweet-Scented Vernal Grass, an early field-grass, which is cultivated to advantage on some sorts of soil. It has been remarked in a paper in the third volume of the Transactions of the Highland Society of Scotland, that this grass flowers early, grows in every variety of soil, is chiefly eaten down by cattle in pastures, but seems chiefly advantageous in meadows for hay, which it sweetens to a high degree. No plant, it is thought, answers better in manured soils confining of peat-earth. In soft fields, it arrives at a very considerable size, and is certainly grateful to all domestic 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-cleared meadows, but enters generally into the hay of most of our natural meadows, and is eaten sweetly in the tap. For although it does not much abound in leaves, that is not, it is supposed, a good reason for calling the plant into disrepute. The flake, 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 grass, and it makes excellent hay, it may be doubtful whether it is profitable as a meadow-grass. It is by no means productive; and as it flowers and ripens its feeds much earlier than any of the other grasses, it is ill adapted to mix with them. It is common in that district on sandy loams.

Its properties and qualities have, however, been fet 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. Sir-clair, his grace’s gardener, but our limits will not allow a detail.

It appears upon the whole, that the proportional value which the grasses, 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 grasses of the latter-math bears to that at the time the feed is ripe, nearly as 9 to 18.

It is thought, that the small-lands of the produce of this grass renders it improper for the purposes of hay; but that its early growth, and the superior quality of nutritive matter which the latter-math affords, compared with the quantity afforded by the grass at the time of flowering, causes it to rank high as a pasture-grass, on such soils 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 Liquidambar.

Sweet John. See Dianthus.

Sweet Mauzlin. See Achillea.

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 Rye. See Acorus.

Sweet Sap. See Annona.

Sweet Sultan. See Centaurea.

Sweet Weed. See Cuphea and Scoparia.

Sweet William, the English name of several species of pink. See Dianthus.

Sweet William of Barbadoes. See Scarlet Convulvulus.

Sweet Willows. See Myrica.

Sweet Milk Chefs, in Rural Economy, a term used to signify that which is made from the whole milk, without abridging 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 Cheese.) The theory of preserving all the richness possible to cheese of this kind, seems, it is laid by the writer of the Account of the Agriculture of the County of Peebles, to depend upon the following principles and circumstances, which experience seems to have fully and abundantly ascertained: 1. That cream is evaporable in a degree of heat not very intense; as is evident from the equal coherens, both of the cheese and of the whey, when the milk is too much heated before putting the rennet or coagulating to it. 2. That the addition of the cream to the curd part of the milk is but slight; as is evident
dent 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 preffed at firft, immediately upon its being committed to the cheefe-press. 3. That the whey, if not soon separated, specifically contracts the acid flate, and then the putrid fermentation in the cheefe; making the cheefe swell, tainting its finell and tafte, and rendering it unfit for keeping.

Hence the propriety and utility, it is thought, are fhewn and indicated, firft, of putting the rennet or yearning to the milk as cool as may be; secondly, of the moderate working of the curd by the hand in extracting the whey; together with a due and well-regulated pressure, moderate at firft, and gradually increafing, when it is put into the cheeke-well or vat, and submitted to the action of the cheefe-press; or the practice which is in use in fome places, of taking the curd repeatedly from under the cheefe-press, and flicing it into small pieces, which are exposed, at each fuch operation, upon a fea, for the purpofe of draining and drying by the air; that, thus, the aqueous particles of the whey dripping off or exhaling, the cream becoming dry, may continue adhering to the curd, while undergoing the laft more strong confroming pressure.

The length of time of the preffure is moftly about twenty-four hours, as fuiting the usual practice in this fort of businefs, without increasing the expence of apparatus.

The cheefe, in thefe cafes, is sometimes falted in the curd; at others, only by rubbing falt in upon the skin or outsides of the curd after it is made; and occasionally, by putting it in salt pickle, but which is thought to extract none of its richnefs.

The principle on which the practice is founded of making the richest cheefe of this fort, is, it is faid, established in experience; and is, that a small quantity of the whey taken off, made boiling hot, and poured upon the remainder, caufes the curd initially to conflate and expel the whey, the cream part meantime remaining united with the curd; the mafs of curd is then lifted from the whey, and plunged into the coldefpring-water, which congeals the cream, from its flatte of liquefaction by the heat; it is then put into the cheeke-well or vat and submitted to the press.

This practice 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 Sublimate of Mercury. See Mercury.

Sweet Herb Lake, in Geography, a lake of North America. N. lat. 54° 40'. W. long. 96°.

Sweet Edinburgh's Keys, a cluffter of iflets and rocks in the Spanifh Main. N. lat. 14° 55'. E. long. 82° 5'.

Sweet Spring, a post-town of America, in Virginia; 38 miles S.W. of Philadelfia. The philadelfic fprings of this place draw four or five hundred people together for health and amusement, 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 fprings of excellent water with which it is fupplied.

SWE, a town of Sweden, in Harjedalen; 32 miles S.E. of Langafanchiz.

SWEINY, a town of Africa, in the kingdom of Darfur; which is a place of general refert for merchants trading to Egypt: 45 miles N. of Cobbe.

SWELL, of an Organ. See Organ.

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 fitting into the bay. It is, however, more particularly applied to the fluctuating motion of the sea, which remains after the expiration of a storm: and also to that which breaks on the shore or on rocks and shallows, called surf, which fee. Falconer.

SWALLOWED COLUMNS. See Column.

Swelled Hoof. See Hoof.

Swelled Legs, among horfes, are infirmities to which they are sometimes fubjeft, by hard riding or much labour, when they are too grofs, or careflely put to grafs, or put in the iftable too hot, whereby they take cold, which caufes their legs to fwell. But sometimes it comes by long ftanding in the iftable, efpecially when the planks where their fore-feet stand, are higher than where their hinder-legs are. The remedies muft be applied according to the nature of the complaint. See Greafe.

SWELLINGS, in Surgery. See Tumour.

Swelling or Leg-Evil, or Ill, a difafe among hfeep, which affeets them in the legs as well as fome other parts. It is faid in a paper in the third volume of the "Tranfactions of the Highland Society," that it, for the moft part, begins at the knee, which swelle and enlarges to a confiderable degree, caufing fo much lamenfe, as to prevent the fleep from affected from following the reft of the flock. But fometimes it begins at the head part of the hoof or claw. It is of a blueifh or livid colour; fometimes, Indeed frequently, having fmall bladders scattered over the leg affeeted, of a red colour, and filled with a blueifh-coloured watery fluid. When the fkin bufhles, it leaves be- low it a blueifh confident of the fame colour, or rather darker, which extends even to the bone. It commonly firft begins in one of the hind-legs, but as it advances affeets all the four, unlefs death takes place before this happens. It occasionally fpreads from the hind-legs to the belly, and in every cafe the kidneyes are affeeted, being loofe and fhabby, having fome renomeance to the swelling of the legs, and being fometimes of a livid colour. In fome cafes the difafe proves very quickly fatal, while at other times it will continue in a mild flate for weeks. It fpreads 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 affeeted with it. Indeed, many hfeep-farmers kill the diseafed hfeep whenever they are leen to be affeeted with it, in order to prevent its fprreading. In this difafe, too, the eye of the fleep is languid, its tongue dry, it cannot eat, and in general is foon cut out by the complaint.

It commonly appears about the latter end of fummer, but at times in the beginning of the autumn; arifing at firft, it is fpofed, from fuch fleep as have unhealthy conftitutions, being too much expofed to wetnefs during rainy warm weather. Scratches in the legs, it is faid, will produce it in fuch fleep as have bad conftitutions. If the fleep get their legs dirtied in the time of clipping, or fmearing, in a houfe where there is much dufh, they will be liable to be readily affeeted with the difafe. Boggy ground has also a tendency to produce it, from a fimilarity of caufe.

The hfeep molt fuljeft at firft to take the difafe are, it is thought, thofe of the South Down and Leicetdef breeds; but that, when it has appeared in a flock, the black-faced, heath, or Scottish fleep, are equally liable and subjeft 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 hifers of Selkirk, Roxburgh, and part of that of Peebles. It is conjectured that this may,
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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 to 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 16th century 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 quicklime may be dusted on the sloughs, and the legs dressed with a cloth, spread with fresh butter, and a little tar. The dressings 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 mols or peat-earth has been soaked or steeped, may sometimes be preferred, in caves where it can be had, on account of its stringent or antisepic 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, the disease may possibly, 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 feasons in which it suddenly grows or becomes warm, after showery weather, in the early spring, as from towards the beginning of the month of May until they are shorn.

The appearances of it are, that they lie down, roll on their back, to relieve the irritation and itching there; when, if the ground happen to be level or hallow, or if they should be weak, heavy with lamb, fat, or full-fleeced, they are not infrequently unable to get up, and of course soon fatten, swell, and die. It is noticed also, that the fleh of the sheep which die away, or of this swelling disease, refembles much in the taffle, colour, and flesh, that of sheep which are carried off by the flriking-sill, blood, or ficknels.

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 does of calomel might be used daily, for two or three days, with much advantage, as about half a dram for each does; 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 diuresis and uncleanliness.

Swelling in Sheep, 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 confedered 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 rankness 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 cheefe, whereas, by other kinds of management, this has scarcely ever been the case. This is often supposed to depend on force substance being secretly employed as an antidote, which has either the power of lowering the milk, or of counteracting its dispersion or tendency to ferment and heave. Such a secret substance is pretended to be podified 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 fort has, however, been flated to have come to a farm on which the cheefe 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 nilling 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 those which is necessary for the milk of about twenty cows. In other caves, the same practice has, however, failed of success.

In Cheshire they consider this mischief as constantly arising from the too great generation of air in the cheefe, as the sweating in it is unquestionably a fermentation; and that where this process has been regular and complete, the over-proportion of air is expelled, and the cheefe not subject afterwards to heave or swell. But that when this fermentation or sweating has been incomplete, as may happen from all the causes that check it in other caves, the cheefe 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 molt, which abound most with impure air; which are mostly those made from rich, various, artificial grains 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 cheefe-rooms in this or other views. See Sweating-Room 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 cheefe may perhaps be left 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 liquid together may dispose to the generation of air in the cheefe. 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 cheefe is also an effect which proceeds from the same cause, but which only affects the more 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 prefling the riud well down, covering it with salt, and placing some flaty substance, with a small weight on it upon the parts.

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Careful management is, of course, all that can be really depended on in this business.

SWELLY, in Geography. See SWILLY.

SVERAGE, in Hindoo Romance, is the heaven of Indra, the regent of the firmament. (See ISVNA.) The Hindoo gods have each a paradise celestial and terrestrial. Stantana is the name of the earthy abode of the Hindoo Jove, placed on the wonderful Meru. (See MERU and STANTANA.) The Hindoo heaven has many mansions. Swerta seems to be the first, whence deities may be banished for misdemeanors, and condemned to be again "born below."

SWERT, Francis, in Biography, was born at Anwerp 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 Belicarum Annales Chronici et Hilariorios Antiquos et recentiores" 2 tomo. fol.; "Athene Belgica," fol.; "Deorum et Dearum capita ex antiquis Nummis etiamis," 4to. inserted in Gronovius's Greek Antiquities; "Monumenta Sepulchralia Ducatus Brabantiae." He died in 1629. 


Gen. 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 at the base. Nectaries ten, containing two or more depressions, at the bottom of each segment of the corolla, on the inner side, each surrounded with minute upright bristles. Stam. Filaments five, awl-shaped, moderately long, shorter than the corolla; anthers oblong, incumbent. Pet. Geranium superior, ovate-oblong; style very short, deeply divided; stigma two, limpest. Petio. Capsule ovate, slightly compressed, acute at each end, of one cell and two valves. Seeds numerous, small, nearly orbicular, with a membranous border, "all infected into the margins of each valve." Garth.

Eff. Ch. Corolla wheel-shaped, with two nectariferous pores at the base of each segment. Capsule superior, of one cell and two valves. Seeds numerous, bordered, infected into the margins of the valves.

Obi. Some species, as Linnaeus remarks, have four-cleft flowers; others have the nectaries projecting behind, in the form of little horns.

1. S. pentenas. Marsh Sweertia. Marsh Felwort. Linn. Sp. Pl. 328. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 1141. Jacq. Auctr. t. 243. (Gentiana duodecima, punctata flore; Clus. Hill. v. 1. 316. G. Pennei minor; Ger. Em. 433.)—Corolla in five segments. Radical leaves ovate.—Native of clear watery places, on the mountains of Switzerland, France, Germany, and, as some report, of Wales. Hudson, at least, affords that it was found in the last-mentioned country, by Dr. Richardson. It flowers in Aug. and is perennial. The root contains of long, cylindrical fibres, intensely bitter. Whole herb quite smooth. Stem a foot or more in height, square, slightly leafy, terminating in a forked erect panicle, of large greyish-blue flowers, in opposite purplish-flaks. Corolla with many fine purplish ribs, and greenish nectaries. Anthers blue. Geranium often abortive. The leaves are flaked, ovate, or ovato-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 Sweertia. Linn. Sp. Pl. ed. 1. 226. ed. 2. 328. Willd. n. 2. (Sweertia; Gron. Virg. ed. 2. 30. Chionia paniculata; Michaux Boreal-Amer. v. 1. 146. Sabattia paniculata; Pursh 138.) Stem erect, quadrangular. Leaves linear-lanceolate. Panic. Oppositely branched, somewhat level-topped, with very long flaks. Flowers with five segments; the terminal one with five."—Found in the bogs and cedar swamps, of New Jersey and Carolina, flowering in July and August. Flowers white. Clayton, Purfs. Not having seen even a dried specimen of this plant, we retain it here merely in conformity to Linnaeus, who, after having described the species from a specimen of Clayton's, subsequently forgot its appearance, and placed in his herbarium, under the above name, a morrel of the following, which we have Mr. Purfs authority for being totally different. As to our ideas 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 Sweertia. (S. difformis; Herb. Linn but not Sp. Pl. Fraera carinthiaca; Walt. Carol. 88; F. Walter; Michaux Boreal-Amer. v. 1. 100. Pursh 101.)—"Stem erect. Leaves oblong-oval, 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. Root biennial. Stem from three to six feet high. Flowers greenish-yellow, sometimes mixed with purple. The whole plant has a very flatter appearance. Purfs. We received from the late Mr. Fraer, in 1788, a very incomplete specimen of this, much like what Linnaeus pollinated, and which led us into an error respecting that plant. See the foregoing species, and our article Fraera.

4. S. rotata. Wheel-shaped Sweertia. Linn. Sp. Pl. 328. Pall. Roff. v. 1. part 2. 98 t. 89. (S. n. 78; Gmel. Siber. v. 4. 112. t. 53. f. t. Gentiana rotata; Willd. Sp. Pl. v. 1. 1351.)—Stem erect, panicked, leafy. Leaves lanceolate, sessil. Flowers cleft, flat.—Native of swamps in Siberia, flowering in August and September. The root is small and annual. Stem about a foot high. Leaves very various in breadth. Flowers copious, above an inch wide, of a fine blue. It appears to us as evidently that this is a genuine Sweertia, as that Gunner's S. rotata, figured in Fl. Dan. t. 345, is a real Gentiana. See Willde, now as above.

—Native of the loftiest mountains of Carinthia. Annual. Stem very short, leafy; in flowered plants quite simple and single-flowered. The flowers are bright-yellow, about as large as the last, each on a simple **flatt**, about two inches in length, which is almost the height of the whole plant.

6. **S. decumbens**. Decumbent Swertia. Vahl. Symb. v. i. 124. Wild. n. 3. (Parnassia polycephala; Forsk. Egyptt.-Arab. 207. Lc. t. 5. f. B.)—Stem decumbent. Leaves sessile, linear-lanceolate, taper-pointed. Flowers **five-cleft**.—Found by Forskall, near Hadès, in Arabia Felix. It is remarkable that he should have taken it for a *Parnassia*. The whole plant, according to Vahl, is perfectly smooth. Stem slender, obliquely angular, leafy; branched in the upper part. Leaves narrow, spreading, an inch long. *Flowers* on long slender stalks, solitary, or in pairs at the ends of the branches. *Corolla* white, with violet ribs, its diameter scarcely an inch. *Nectaries* as described in the generic character.

7. **S. corniculata**. Spreading-horned Swertia. Linn. Sp. Pt. 328. Willd. n. 4. Pall. Roff. v. i. part 2. 99. t. 90. f. 1. (S. n. 50; Gmel. Sib. v. 4. t. 53. f. 3.)—Flowers four-cleft, bell-shaped, with four ascending petals. 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 herein 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 long slender stalks, yellowish-green, not much expanded, each segment of the **corolla** furnished, at the base behind, with a spreading ascending spur to the neafy, nearly as long as the corolla itself.

8. **S. defixa**. Drooping-horned Swertia. (S. corniculata; Pursh n. i.)—"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 Linnaeus, first found by Kalm, from the Siberian, and we adopt the characters he has pointed out, not having ourselves seen a specimen.

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 Eiffalon, and sent to Linnaeus by Muttis. The *flame*, 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 sessile, 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.


simple.—Gathered by Steller in Kamtschatka, at the mouth of the river Appals. *Pallas*. Annual, six inches high. *Leaves* elliptical-lanceolate, nearly or quite reflexed. *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 Pallas as well as Willdenow; an inference, among many others, of the negligent manner in which synonyms are too often compiled.


13. **S. papula**. Dwarf Swertia. Pursh n. 3.—"Corolla flat, twice the length of the calyx. Stem quite simple and single-flowered. *Leaves* oblong."—In the alpine 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 considerably-fixed blue flower. Segments of the corolla oblong, pointed; those of the calyx obtuse. *Pursh*.

**SWETADEVI**, meaning the white goddevs, a name of the Hindoo goddevs *Parvati*; which fee.

**SWETARA**, in *Geography*, a river of Pennsylvania, which falls into the Susquehanna from the N.E., about 7 miles S.E. of Harrisburg.

**SWETOE**, a small island in the Caspian sea, separated from the W. coast by a narrow channel, called the "Strait of Apheiron," through which vessels often fail. In this island is found black and dark grey naphtha, which is carried from the springs into pits or reserovers by means of trough, whence it is conveyed into boats; 25 miles E. of Bachu.

**SWIDDEN**, in *Rural Economy*, a provincial word signifying to fence or burn off, as heath, or the coasts of swine.

**SWIECICA**, in *Geography*, a town of Lithuania; 50 miles N.E. of Pńsk.

**SWIERZNO**, a town of Lithuania, in the palatinate of Novogrodek; 36 miles E. of Novogrodek.

**SWIETEN, Gerhard Van, Baron, in Biography**, first physician to their imperial majesties at Vienna, was born at Leyden, on the 7th of May, 1700. He was descended of an ancient and reputable family of the Low Countries, but lost his parents at an early age, in consequence of which his early education was said to have been somewhat neglected. Having failed through the usual grammatical studies, he was sent to 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 affability 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 celebrated
brated colleague, the medical students of Germany, France, and England, flocked to the city; 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. The leisure, thus 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 adhered at court with his own lank hair, and without ruffles, till the empress preferred him with a pair worked by her own hand.

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 essentially benefited by 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 chucdcal establishment in one of the first hospitals, and the augmentation of the botanical garden. His extensive erudition obtained for him the still further honour of being deemed the most proper person to be entrusted with the interest of learning in general in the Austrian dominions, and he was appointed imperial librarian, vice-president of the imperial commination supervening 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 of the imperial library, by allowing its visitors to make notes and extracts from the books, which was a barbarous regulation had before prohibited. In discharging the duties of the censorship, the rigour of his temper and principles induced him to proscribe without mercy the writings of the French philosophers, some of whom repaid his hostility by vilifying him. The fame indefixiety 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, aided by good health, to fulfil his various duties with unremitting assiduity; but the vigour of his constitution began to fail about the year 1769, 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 Schoebrunn; but the empress caudled him to be interred in the church of the Angullines 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 Hermann Boerhaavi Aphorismos de cognoscendi et curandis 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 although much alteration has taken place both in the theory and practice of medicine, since the commencement of this work, yet the immense mass of well-selected and well-arranged facts 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 eighteen 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 régissent communément dans les Armées, avec la Methode de les traiter," Svo. printed at Vienna, 1759. See Eloy, Dih. Hist. de la Med. Gen. Bot.


1. S. Mahagoni. Common Mahogany-tree. Linn. Sp. Pl. 548. Cavan. Diff. t. 209.—Leaves pinnate, of about four pair of ovato-lanceolate leaves; equal at the base. Panicles axillary.—Native of the West Indies, whence it was
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, flaked, entire, pointed. Panicles compound, with about eight flowers in each, small, white, occasionally of a reddish or saffron colour. Fruit large, woody, ruddy-coloured.

The excellency of this, the old Jamaica Mahogany wood, is sufficiently known.

2. S. febrifuga. Febrifuge Mahogany-tree. Willd. n. 2. Roxb. Coromandel. v. 1. t. 18. t. 17.—Leaves pinnate, of about four pairs of elliptical, roundish leaflets; unequal at the base. Panicle terminal, divaricated.—Native of mountains in the East Indies.—A very large tree, with a lofty straight trunk, covered with a grey, febrifuge bark. Branches numerous, the lower ones spreading, the upper ascending. Leaves alternate, abruptly pinnate, about a foot long; leaflets opposite, flaked, obtuse, emarginate. Panicle large, terminal, diffuse, bearing numerous, small, white, inconspicuous flowers. Fruit large, greyish. 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 Gymnoda.

3. S. Chloracryli. Willd. n. 3. Roxb. Coromandel. v. 1. t. 62.—Leaves pinnate, of many pairs of somewhat heart-shaped, obtuse leaflets. Panicle terminal, spreading.—Native of mountainous parts of the East Indies. A middle-sized tree, with large, spreading branches, and a tolerably erect trunk, covered by a dark, ruddy-coloured bark. Leaves abruptly pinnate, six or seven inches long; leaflets alternate, obliquely oval, obtuse. Panicles pretty large, terminal, composed of numerous, small, yellowish flowers. Fruit smallish, brown.

The wood of this tree is of a deep yellow colour, close-grained, heavy and durable, much relishing that of the Box-tree. The Telingas call it Bilbo.

SWITZERIA, in Gardening, furnishes a plant of the exotic kind for the house, of which the species cultivated is the mahogany tree (S. mahagoni).

Method of Culture.—This plant may be increased by fowling the seeds obtained from abroad in small pots, filled with loose sandy mould, in the spring, plunging 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, replacing them in the hot-bed, giving them shade till re-rooted: they should afterwards have the management of other house plants. They afford variety and curiosity in flower collections with other plants.

SWIETLĂ, in Geography, a town of Bohemia, in the circle of Crailau. N. lat. 49° 39'. E. long. 15° 2'.

SWIFT, JONATHAN, in Biography, the celebrated dean of St. Patrick's, was descended from the younger branch of an ancient family in Yorkshire, of no small note and considerable property. His grandfather, Thomas Swift, was a clergyman, poofled of a good estate near Rofs, 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 distressful 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 Whitehaven, whether she went to visit a sick relation, from whom the legend 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 Kilkenney, 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 difficulties of his circumstances restrained the efforts of his genius, and discouraged his application to those branches of literature to 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 flock 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 affluence 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 declined 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 anything in his purse.

Swift was now in his twentieth 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 sullen, morose temper, occasioned, or at least aggravated, by his dependent, penurious, and diftcred 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," to the want of money, want of learning, want of friends. His poverty and his pride were the subordinate 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-first year, Swift left Ireland, and determined to visit his mother, who had found an asylum, in her state of penury and distress, among some of her relations in Leicestershire. His mode of travelling was that of a pedestrian, with an occasional relief, if the weather proved unfavourable, in a carrier's waggons.
SWIFT.

His mother, altogether dependent, could afford him no permanent protection and subsistence. But she was related to the lady of sir William Temple, who then lived in retirement at Moor Park in Surrey; 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 intimate, at Moor Park and Shenley 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 revisal 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 sought relief at this time from a disorder of the stomach, which occasioned those 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 oblate his disgrace at Dublin. Here he was treated with great civility, and obtained the honour of which he was deficient 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, but without formal 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's relentment had subsided soon after his departure, and that as he was sinking under infirmities, he much wished his return. A kind letter from sir William himself confirmed these expectations, and was the immediate 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 stock which he then possessed, he embarked for England, and arrived at Moor Park in the year 1695. 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 Mifs Johnfon, afterward well known by the name of "Stella," partook of the benefit of the same instruction. Mifs Johnfon was daughter to sir William's steward, and being at that time about fourteen years of age, beautiful in her perfon, and poffeffed of fine talents, Swift took very great delight in cultivating and forming her mind. At this time he also wrote his famous digressions, found in the "Tale of a Tub," and the "Battle of the Books," in honour 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 deposed, that the first vacant prebend of Canterbury or of Welmingham should be conferred on himself; but no further 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-juridices 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 lay secretary; and as his lordship intended to present his chaplain to the deanery of Derry, just become vacant, Swift was again disapproved 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 conjointly were not of half or one-third the value of the deanery. The effect of these disapprobations was the increafe of that irascibility and misanthropy, which are 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 entertainment of the earl's family. After lord Berkeley's removal from Ireland, Swift went to reside on his living at Laracor; where he continued for some time in the strict and constant discharge of his duty, occasionally diverging into strains of humour. Soon after his settlement at Laracor, Swift visited "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-houfe when Swift was absent; but they were never known to lodge in the same house, nor to fee each other without a witness. This mysterious connexion lasted till her death, and he usually celebrated her birth-day 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 parifh, and the charming conversation of the amiable Stella, in hope of finding some favourable opportunity of disfiguring himself in the world. Engaged in these schemes, but thirty-four years old, he, in the thirty-fourth year, published his first political work, without his name, entitled, "A Difcourfe of the Contelps and Diflentions in Athens and Rome," the main scope of which seems to have been to bring difcredit upon the impeachments then carrying on by the houfe of commons against some of the whig-leaders, to which party Swift was then attached. Upon the accession of queen Anne, whom 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 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 no use in his political capacity, he turned his thoughts to other matters; refided on his living for the greatest part of the year, performing his parochial duties, and hardly ever employed his pen, except in writing sermons. In 1703, however, he published his "Meditation on a Broomstick," for which he was much cenfured on account of the ridicule contained in it of the style 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 enthusiasm and simplicity of heart, and to generate himself from the talk of reading to her writings, which were not at all suited to his taste. In the same year he also published the “Treatise of the Faculties of the Mind.” In 1704 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 religious. 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 Tilt,” afforded full proof of his adherence to the principles of the Tories. In his “Argument against the Abolition of Chrifhianity,” he exhibits a specimen of that talent for grave irony in which he was almost unrivalled. His other piece was a ridicule of astrology, under the title of “Predictions for the Year 1708, by Izaac Bickerlaff, Esq.” The popularity of which induced Steele to borrow the name for his Talker. 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 prospects of advancement, till the Tories came into power, in 1710. In a commination 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 sixteen 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 October 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 imdered as he was in politics, he still adhered to the cause of literature, and in 1711 published “A Proposal for correcting, improving, and animating 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 dispirit the nation to peace, was much applauded, and furnished him with all the support by his indignation. The same strain of argument was pursued 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 fancy of his personal antipathy to that prelate. It has been observed of Swift, that no man of letters ever affirmed and maintained so much consequence, as he did, in his allocation 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 expostulation 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 defied 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 flail 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 suspicions of his faith, and other prejudices being raised against him, he was overlooked. The highest prevarication which they could bellow upon him was that 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 Publick Spirit of the Whigs,” in answer to Steele’s “Crises,” he reflected on fiercely and contumeliously on the Scots nation, that the peers of that nation went up in a body to the queen, and demanded a reparation. A proclamation was issued, offering 500l. 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, caused 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 indignity 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. Mr. Johnfon, who had lodgings near the deanery, regulated his table on public days, though the fare at it merely as a gue", in 1716 he was privately married by Dr. Ashe, 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 censurable than any other occurrence of his life. About the year 1712 he became acquainted, in London, with Miss Either Vanhomrigh, an accomplished young lady of fortune, with a literary taste, which Swift took pleasure in encouraging. She became enamoured of his person, and actually made proposals of marriage to him. The flame on this part seems to have been mutual, and dictated his “Cadinus and Varella,” 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 1723, 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 Vanella." The poem was published, but the letters were suppressed.

In 1720, 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 1724 he resumed his political character, by exerting all his powers for defeating a scheme for supplying the currency of that country by coining a large quantity of copper money, a person named Wood of Wolverhampton having obtained a patent for this purpose. With this view he wrote a series of letters under the name of "M. B. Drapier," which caused the coin to be universally refused, 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 suspected of having betrayed his master. On his return he was ordered to tidy 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 Drapier triumphed, and the dean became the idol of the Irish nation.

In 1726 he published his "Gulliver's Travels," which were the product of spleen, as the author having betrayed his master. For 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, preludes, 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 julems of many of its strokes cannot be denied. Some of the pictures are also highly digusting, 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 Miscellanies, 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 was afterwards spoke of queen Caroline with malevolence. His Stella 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, he adjured the dean, by their past friendship, not to deny her the satisfaction of dying with 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 reality of the marriage, the proof of it seems to be uncontrollable. They were probably suggested by some determinate panegyrics, who wished to vindicate his conduct with respect to both this lady and Miss Vanhomrigh; but each of these cafes fixes an indelible blot on his memory, nor can any talents he possessed or popularity he acquired, ever efface it.

The death of Stella very much affected Swift, though he 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 finit and interesting of his poems, written about this time, was the "Verses on his Own Death," formed on a misanthropic maxim of Rotarii, having indulged his hatred and contempt of the Presbyterians in a bitter poem, in which he introduced the name of a counsellor Betteworth, who was obnoxious to him as an active leader in the Whig party at 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 fates 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 elected from the inferior class, and especially from among females, who were always ready to admit him. Having indulged his hatred and contempt of the Presbyterians in a bitter poem, in which he introduced the name of a counsellor Betteworth, who was obnoxious to him as an active leader in the Whig party at 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 fates 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 elected from the inferior class, and especially from among females, who were always ready to admit him. However, after his death, in which 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 decease, 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 verses on his own death.

"To fly by one stanic touch,  
No nation wanted it so 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:

"Ubi
"Ubi fave indignatio uterius cor lacereae requit." His predominant temper and disdaining character are strongly marked in his life and writings. We shall select some fects of both from the portraits furnished by his biographers. "A stern inflexible temper, and pride in a supreme degree, were the basis of his character," on which were built firmness, sincerity, integrity, and freedom from all mean jealousy; but alloyed with arrogance, implacability, carelessness 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 meaners alone could tolerate. Of his obdurate and unfeeling nature, many more examples might be added, if those already given were not more than sufficient.

"As a writer, Swift was original, and probably will always remain unparallelled. 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 abounds in ludicrous ideas of every kind, with which his poems are abundantly interspersed, but which too often deviate into offensive grossness. Indeed it is remarkable, that one so faddishly 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 associations of sounds coming as it were spontaneously, in words the poet adopted to the occasion. That he was capable of high polish and elegance, some of his pieces sufficiently prove; but the humorous, familiar, and sarcastic, was his habitual tinge. 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 fail a rival. He has secured a lasting place among the chiefs of English literature; and his memory is still honoured in Ireland as a patriot, with a fervour that excites and almost panegyrics his defects." Biog. Brit. Johnson's Lives of the Poets. Life of Dr. Swift, by Mr. Sheridan, prefixed to the Collection of his Works, in 10 vols. Svo. with Notes, historical and critical, by John Nichols. Gen. Biog.

SWIFT, in Geography, a river of England, which rises in the county of Leicester, 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 Orthonology. See SWALLOW.

SWIFT, in Zoology, a name given by many to the common newt, or eft.

SWIFTER, in a Ship, a rope used to confine the bars of the capstern 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 tolisteners them firmly together like the spokes of a wheel, which is accordingly called swifiting.

SWIFTER is also a strong rope sometimes used to encircle a boat longitudinally, as well as to strengthen and defend her sides, to a s to enable her to better resist the impetition of other boats which may run against her occasionally. It is usually fixed about a foot under the boat's upper edge or gunwale.

SWIFTERS are likewise two throids fixed on the larboard and larboard side of the lower malts, above all the other throids, as an additional security to the masts. Falconer.

SWIFTENING of Shrouds, denotes stretching of them by tackles, to prevent any future extention.

SWIFTTEST DESCENT, Line of the. See CYCLOID and DESCENT.

SWIFTING of a Ship. See SWIFTER.

SWIG, or SWIGGE, in Mechanics, a name given by feamen, probably by corruption from swing, to a pulley with ropes that are not parallel. When the directions of the ropes of the 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 fifth 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 PULLEY.

SWIGAN, in Geography, a town of Bohemia, in the circle of Pilfen; 12 miles N.N.E. of Jung-Buntzel.

SWIGGING, a particular way of calibrating 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 forelegs as tight as possible, and fixing it there, the part is amonted with fresh botten. The head is then left to feed, and in two or three days the tendons grow so rotten, as to fall off with the string, or may be peeled away with a small force. Boyle's Works, abr. vol. i. p. 87.

SWINGING-Off, in Rigging, denotes pulling upon the middle of a tight rope that is made fast at both ends.

SWIHAU, in Geography, a town of Bohemia, in the circle of Pilfen; 18 miles S.S.W. of Pilfen.

SWILLS, 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-Tub, a term applied to a fort of hog-tub.

SWILLY, Long, in Geography, a large bay of the county of Donegal, Ireland, which lies on the west of the peninsula of Inishowen. It runs 16 miles into the land, but never exceeds fix, whilst it is seldom more than two miles in breadth. It takes its name from the small river Swilly, which flows into it, on which is the town of Letterkenny. The herring fishery is chiefly carried on at the islet of Inish. (See Inish.) There is another small river in the same county, called the Saylly, which flows into the Foyle.

SWILLY, a small island or rock in the South ocean, about 13 miles S. from the South Cape of New Holland, surrounded with rocks and shoals. S. lat. 43° 55'. E. long. 147° 6'.

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 was made to essential a part of the discipline of their youth, that to represent 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 strength, 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.

M. Thevenot has published 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 scarcely 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 it 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, immergeing 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, there, having but little brain, and there being abundance of bones 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 liteics.

In effeét, 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 no bladder, either have none of its parts, the pectoral and ventral fins are so situated, that the water Curriculum contents them, and they have remarkably thin and flat bodies, as the rays and thornbacks, and the pleuronecti; or remarkably long and flexible ones, as the petromya; 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 fuch fish as have the assistance of their air-vessels.

It has been supposed by some, that the motion of fish in the water depended 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 sideways, upward and down, as well as it did when it had them on. If a fish be carefully observed, while swimming in a baillon of clear water, it will be found not to keep these pectoral fins constantly expanded, but only to open them at such a time as it would flop or change its course, this seeming to be their principal, if not their only use. The pectoral and ventral fins, in the common

Swimming of Giddens in the Head, a disease sometimes affecting neat cattle and sheep, and which is not unfrequently a troublesome and dangerous disorder in these forts of live-stock. Where the brain is affected with a fort of irration or inflammation, the muscles of the body seem to have their 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 these fins have each its peculiar use, fully sufficient to the buffaloes. 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 Seed-Wheat, in Agriculture, the practice of floating it in a tub or other proper vessel, nearly full of water, in order to prepare it as feed, by having the light imperfect seeds removed. The methods of effecting this are performed in a somewhat different in different districts. But in Elex 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 vessel be full within about three or four inches of the brim; the wheats is then well stirred together with a flout stick, or, which is better, a light shovel. All the light and imperfect or
SWINE

or 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 refuse of the wheat, with the water, is then put together into a basket-trainer, 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 may be brick, clay, or any other. When a sufficient quantity for the next day's sowing is thus prepared, the heap is spread out and leveled to about three or four inches in depth or thickness, or to such a thickness as may be thought the most proper and convenient, and then some well-flaked meal is evenly sifted over it; after which it is stirred over and over again, until the meal and wetted wheat be as uniformly mixed as possible, and the grain sufficiently dried to be capable of being sown on the foil-wing morning. In some places, different flake or other substances are mixed in 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 sifting and liming it only on the floor, the use of medicated and other keeps, &c. as have been shewn under the proper heads. See Steeping of Seed-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 sowing 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 injurious contagion that may be present, as well as all sorts of light seeds of the weed kind that may be among the wheat.

SWINCANY, in Geography, a town of Lithuania; 39 miles N.E. of Wilna.

SWINDON, a respectable market-town in the hundred of King'sbridge, Wilthire, England, is situated 36 miles N. from Salisbury, and 83 miles W. from London. From the diligence of our early historians respecting this town, it is presumed to have been anciently of little importance, and no way connected with any remarkable civil or military events. The name, however, is at least coeval with the Conquest, "Swinhusse" being the appellation by which it is distinguished in Domesday-book. According to the parliamentary returns of the year 1811, the parish contained 263 houses, and 3,441 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 munificence contributes materially to ornament it. The pursuits of husbandry, and the working of some extensive quarries in the vicinage, afford employment for the mass of the people. The flows 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. Five 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 south side of the north aisle, commemorates Mrs. Millicent Neate, who died July 9, 1764, in the 73d year of her age. Adjoining the churchyard, and not far from the south-well, is a mill, worked by water con-
However, in regard to the native pigs of Ireland, France, and Germany, at least fuch of them as he has seen, they are of the large, flat-headed, heavy-eared breed, with longer legs, and of still worse form, but resembling our old breeds of York and Shropshire. And it is further stated, that the hogs of Curdlan, in Aisa, are of the largest size and weight. Also, that Aristle and other ancient writers mention a peculiar variety of swine in Ilyria, which do not divide the hoof. Malcal 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 sight 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 Neorro, not far from Saffari, 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 constantly pay better than those of the more inferior kinds. Each breed may be distinguished by certain peculiar qualities, and the farmer, by attending to the nature of the ground, and the circumstances of the management under which the farm is conducted. They should pollee, as much as possible, the points and properties mentioned below; which the farmer should never neglect or be inattentive to in selecting them for his different uses. The chief marks made use of in distinguishing the breeds of this animal, are those of the form or shape of the head, and the quality of the hair. The pendulous hanging down, or lap-eart, and the coarse harsh hair, are commonly allotted to indicate largeness of size, and thickness of skin; while erect or prick-ears flew 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 check; thick and rather short in the neck; fine in the bone; thick, plump, full and compact in the carcasse; full in the quarters; fine and thin in the hide; and of a full size, according to the fort, whatever it may be; having a disposition to fatten well and expeditiously at an early age. Varro, and also Columella, however, desire 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 brittles, particularly on the neck, thicket, erect, and strong.

And it is observed by the author of the General Treatise on Cattle, that depth of carcasse, lateral extension, breadth of the loin and breast, proportional length, moderate shortness of the legs, and subsidence of the gammons and fore-arms, are great essentials. These are qualities, he thinks, to produce a favourable balance in the account of keep, and a mass of weight, which will pull the fcale down. In proportion too as the animal is capacious in the loin and breast, will be generally the vigour of his constitution; his legs will be thence properly extended, and he will have a bold and firm footing on the ground, to which, however, it is further necessary, that his claws be upright, even, and bound. He adds, however, that a good hog may have a coarse, long, ugly head and ear; and these may be safely classed among the non-essentials; yet a short, handfome, sprightly head, with light, pointed, pendulous ears, of moderate size, are pleasing to the view, and may sometimes have a favourable effect in the market. For head and ears, the Oxford, or rather smaller Berkshire pigs, are good models; and for true shape, the improved Shropshire, Hereford and Gloucester. If colour or furfay any consideration, he should prefer the light and sandy and yellow-sotted, at least such skins appear far the most delicate when dead. In respect to the skin of pork, he gives a preference to the thick over the thin skin. And he remarks, that our best breed pigs are often thick-finned, but such skin is tender, gelatious, slimy, and often form a barrier of rosted crackling, and very nutritious; whereas to eat the crackling of thin-skinned pork, case-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 gloss upon their coats, and their skin being whole and free from erosion. It is an extremely unfavourable indication when the head is hung down, the front 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 in possession of a particular kind. But we may be distinguished into four classes, the superior of the former of which, the following are the most valuable breeds:—the Berkshire, the Hampshire, the Shropshire, the Gloucestershire, the Herefordshire, the Ludwick, the Woodburn, the Wiltshire, the Yorkshire, the Northamptonshire, the Leicestershire, the Lincolnshire, the Norfolk, the Suffolk, the Essex, &c. And the principal districts for the breeding and rearing of these animals at present, are Berkshire, Hampshire, Shropshire, Gloucester, Herefordshire, Wiltshire, Northamptonshire, Leicester, Lincolnshire, Yorkshire, Norfolk, Suffolk, Essex, and Sussex or Surrey.

The Berkshire Breed.—This is a breed which is distinguished by being in general of a tawny, white, or reddish colour, spotted with black; large ears 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-stock, 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-footed; having large heavy ears; body long and thick, but not very deep; legs short, with much bone. They formerly made great weights. But the new breed is, he maintains, lighter in the head and ear, shorter in the carcasse, 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-crofts, by not repeating it to the degree of taking away all shape and power of growing flesh, in their flock; and he is informed they now mean to discontinue any farther mixture. The breed, as it now stands, is about in the third clafs in point of size, excellent in all respects, but particularly as a crofs for heavy flow-feeding farts. The small porking variety of Berks, and those of Oxfordshire, with round carcases, short and handsome heads, appear to him to have descended from the Axford breed. On the whole it is an useful breed, that has extended itself from the district from where it takes its name, over most parts of the island. It is the fort mostly fattened at the distilleries; it feeds to a great weight, and is good for either pork or bacon. This fort
The Hampshnre Breed.—This is a kind of large hog 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-Stock 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 Effex. 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 indifferent to any distinction between the two varieties.

The goodneths 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 shand 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-sided, harsh or rather wiry-haired, the ear large, head long, sharp and coarse, leg too long, slim, although very substantial, yet not sufficiently wide, considering the great extent of the whole frame. With all their defects, they are, he says, ever excellent stock, and have been improved within the last fifteen years by the Berkshire crows, which has reduced the length both of their legs and carcase, and rendered their heads lighter: in consequence the new variety, flowing the Berkshires and Portland, forms, feeds quicker than the old fort of these animals. Shropshire has long been employed in breeding hogs for the supply of the London feeders, and of the Effex farmers, who thus turn their clowers 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 have been 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-Stock, this breed is a fine under the Hereford fort, and a shorter and more trifled pig; there is also, he thinks, a handsome roundness of the bone and frame, which distinguishes this breed. Formerly he used to see many many pigs among them, and some with very heavy, thick ears, but they are not now so heavy-cared. They are, he says, good stock for any purpose.

The Herefordshire Breed.—This is also a large useful breed, but perhaps without polishing anything advantage over those that have been described above. The same writer on Live-Stock thinks it a variety of the Shropshire, or an intermediation, that cannot now be traced. He says they are shorter, have shorter, and lighter heads; ears smaller, thinner, and more pointed; coat 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 form; they are generally good found stock, full of growth, and sufficiently among the most profitable bacon-hogs we have. They have been of late crossed with the Berkshire boars, of which the bell of them did not, he thinks, stand in any great need.

The Budgwick Breed.—This is a large kind of swine, which 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 belt in many cases, such a breed deserves to be attended to in the future of hog management.

The Large Spotted Woolow Breed.—This is a breed introduced by the late duke of Bedford, being large in size and of various colours. It is a hardy, well-formed, proficent fort, rises quickly to a large weight.

The Wilshire 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 flayed by the above writer on Live-Stock, 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, handsome 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 Berks, originated in the same source.

The Yorkshire Breed.—This, in the old kind, was, it is said by the above writer cited, probably the work large variety we had; extremely long-legged and weak-joined, their conluction not of the loundfort; and bad fly-pigs in the winter leafon; 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 still inferior to the north-western flock, fetching a less price at market. Probably short-legged Gloucestershire boars might succeed with this breed, or the entire adoption of Hereford stock 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 handsome, light-cared, white, deep-sided pug, with middling bone, and quick of profit: the breeders have since, he says, tried the new Leicesters, and, if he is rightly informed, without success. They have again, it seems, returned to their old breed, adopted some improving crofs, and at present breed middle-sized well-shaped pigs, both for their own and the Buckinghamshire dairy farmers.

The Leicestershire breed is, in the original itock, large, deep, and flat-sided, light-spotted, with rather handsome head and ear. The above writer on Live-Stock does not inform whether the Bakewell variety has much merit in its own country.

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 Leicesters boar, which has much spread, and given a roundness to its frame,
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 sty. By a farther cross with the Chincote breed, these croffes 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 hogs.

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 still, he says, middle-sized, quick-proving pigs.

The Norfolk breed is a small, flat, up-eared, porking fort, various in colour, white, bluef, fricated; generally an inferior kind, which the same writer on Live-stock thinks it would be to the interef 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 fide of the county, there is a larger-spotted 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 out of it. They are shorter, and more pug formed than the Norffoks; and by their dif- face and pendent belly, it may be supposed that the variety proceeded originally from the white Chiincife. Some of the Suffvfts are very handfome, and very regularly flaged; their defects are, he thinks, that they are great conftomers in proportion to their small bulk, and that they produce little flesh. He supposes that the small Hampshire boar would be a profitable crofe for fows of this breed.

The Essex breed is a fort which are up-eared, with long sharp heads; roach-backed; carufes flat, long, and generally high upon the leg; bone not large; colour white, or black and white, bare of hair, quick feeders, but great conftomers, and of an unquiet disposition. A mixture of the tonky, 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 farts of them, is thought in that district to be inferior to none in the kingdom. They feed remarkably quick, grow falt, are thin in the skin, and light in the bone and offal, and they are also an excellent quality of meat. The fows are good breeders. There are, it is faid, a great many pigs bred and fattened in the above neighbourhood, and fent to market for felling pork, weighing from fix to eight or ten tons, which weight they come to at five or fix months old, without putting up; they have some beans given them as they run.

In other counties, also, there are many other varieties, which it is unneceffary to mention here.

In refpeét to the varieties of these animals, Mr. Donald- fon remarks, that the Berkfhire and Hampshire hogs are the largest; but that it is molt probably from the Berkfhire flock, that the greatest number of varieties of the country have fprung. And that they are of a very large fize, the four quarters frequently weighing, when fat, not lefs than from 600 to 800 weight; the medium weight of the hogs fattened for 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, whole appearance, being very different from that of any other fort in the island, denotes them, it is thought, to have been the or- ginal breed of the country. They are small, ill-formed, bril- liant, 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 breeds of these animals, there is likewise much divefity or differsence in regard to the size, as well as other qualities. But that the principal forts of them are the Chincife, the English white, the fwing-tailed, &c.

The Chincife breed is a breed which is distinguished by the neck being thick; the body very clofe, compact, and well-formed; the legs very short, and the fize small; the flesh delicate; the colour various, as black, white, brown, and tawny. This breed is particularly dispofed to fatten in an expeditious manner, and has, in conquence, spread over a great part of the kingdom. It is molt adapted for being used as pork; but is much too small for being cured for bacon. It is mifchievous when not well run.

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, thick, compact, and well made in the body; short in the leg; the head and neck well formed, and the ears fanning a little downwards. It is well dispofed to fatten, and perfectly hardy. It prevails much in the northern districts.

The fwing-tailed breed is an useful fort of the smaller kind of hogs, that is hardy in its nature, and of coniderable weight in proportion to its fize.

It is however, common for some farmers to prefer mixed breeds, as being more beneficial than either of the large or small perfect breeds. Where this is the cafe, the Berksfere, with a crofe of the Chincife, has been found a very profitable fort, as being capable of feeding to a coniderable weight with a moderate proportion of food, and in a short time.

It has been well remarked by the author of the General Treatife on Cattle, that nothing can be more groundfiefs, than the common affertion, that there is no fuch thing as a breed in pigs, the only meaning of which is, he thinks, that the affertors have not taken the pains to fearch it. The number of regular breeding counties of this article of flocks is considerable, and the peculiar characteristics of form, in each variety, as diftinctly marked as in any other clafs of animals. That there are numberles intermiftures, that ra- dual changes are introduced in the course of time, even in fuch districts molt 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 fettled breed, is a com- mon cafe with every other fpecies of cattle-stock and ani- mals. 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 molt other kinds; and that in order to have good pigs, it is neceffary to be attentive to the breeds, as in the other forts of domestick 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 greateft advantage. See Breeding, and Live-Stock.

Therefore whatever the breed, or fort of fwine it may be, that is employed in the raising of the flock, the multi- perfect and belt formed male and female animals of the fame or other
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The proper kind should be selected for the purpose. And in providing hogs for the purpose of breeding, they should constantly be well fed, and taken care of, as by being flourished in their food and neglected, their growth and healthy condition are considerably affected.

By former is has been observed, that in cafes where there is a certain vent for the flock produced, the breeders 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 it if be intended to breed for sale, in a flour rate, it is of the more consequence 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 districts. The nature and size of the breed should depend upon the abundance or scarcity of food. In the former case, the large breeds are laid 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 fowls should be kept open for breeding, unless they have large capacious bellies. Being well fed from the test, the fow will procreate at seven months; and if the be 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, imposing upon her the tention of constant breeding and sucking, would double the keep 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 the 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 fowls, 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 saw 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 the greatest number, and the most early.

General Management and Store-feeding.—In the ordinary management of swine, fowls, 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 fowls, and to substitute 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 fowls, in order that a proper succession of young pigs may be produced. And by this means the fowls are likewise made to take the boar more expeditiously.

Fattier, it has been observed by a late writer, that as there is greater difficulty and expense attending the rearing of young pigs in cold seasons, the farmer should contrive as much as possible to have his litters early in the spring and autumn seasons, 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 less loss will be sustained in the death of the pigs, and less expense 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 cause much loss thereby. With a late litter, it may, however, sometimes be beneficial to fatten them to suckle and feed with the fow, the keep being of the most forcing kind, during three or four months, from which management the most delicate pork might be provided at a select season.

In all cafes, however, great care should be taken that the fowls, 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 swine 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 fowls 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 fowls as have the unnatural propensity of devouring their young, should be well secured at the time, and be disposed 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 fowls and pigs not being turned abroad by any means in bad weather. The pigs may be weaned in about eight weeks, after which the fowls may be shut up, feeding them well, and on the return of their milk, they will mostly express very plainly their desire of taking the boar. The fowls 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 also of much consequence, both in respect to economy in the labour of their attendance, and in 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, rendering the food, and flavouring, and cisterns to contain water for the animals. See Hac-Sy.

Also 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 fowls in pig, those with pigs, and the fowls according to their ages; as it is only in this way that they can be kept to the most profit and advantage.

It may be observed in regard to the food of this fort of farm-lodge, that as the breeding of pigs is a business 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 fowls that will be necessary 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 instance, are beans, peas, barley, buck-wheat, potatoes, carrots, parsnips, 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 disposing of them; but whatever number may be kept, an equal proportion of root crops, and those of the greasy kind, will be requisite, with about half as much of those of the farinaceous or grain kind, as those of the root crop; and a quantity of the luxuriant vegetable kind, fully in proportion to the number of hogs that are to be fed on such
fuch forts of food. And that in the supplying of the hogs
with food, a distinction is to be made according to the dif-
ferent kinds; in order that the most may be made of the food.
The fows considerably advanced in pig, and those with pigs,
should be fed in a better manner than the fowes pigs. The
former should be supplied with good wash twice or oftener
in the day, and have a sufficient allowance of cabbages, po-
tatoes, carrots, or other similar vegetables, so as to keep
them in good condition; which is fhown by the glos of
their coats. The fows with pigs should be kept with the
litters in separate fies, and be still better fed than those in
pig. Where dairying is practifed, the wash of that kind
which has been preferred for the purpose, while the dair-
ying was at the height, in brick fiffinens, constructed for
receiving from it the dairy, must be given them, with food
of the root kind, fuch as carrots, parnips, potatoes, and
cabbages, in as large proportions as they will confume them,
in order that the pigs may be properly supported and kept
in condition. But where the bulfines of dairying is not
carried on fo as to provide wash of that fort, meal of some
kind or other must, Mr. Young thinks, he had recourse to
for the making of wash, by mixing it with water, which in
the summer fentinens, will be fufficient for their fupport; and
in winter it must be blended with the different forts of roots
prepared by boiling, or, when for the young pigs, with oats
and pea-foup. With this foup and dairy-wath, where
proper attention is belthowed, young pigs may, he conceives,
be weaned and reared in the winter fesfon even with profit
and fuccefs. The pea-foup is an admirable article when
given in this intention; it is prepared by boiling fix pecks
of peas in about sixty gallons of water, till they are well
broken down and diffufed in the fluid; it is then put into a
tub or fcinern for fufence. When dry food is given in combina-
tion with this, or of itfelf, he advifes oats, as being much
better than any other fort of grain for young pigs, barley
not anfwering nearly fo well in this application. Oats
coarfly ground have been found very ufeful for young hogs,
both in the farm of wash with water, and when made of
a somewhat thicker confidence. But in cafes where the fows
and pigs can be supported with dairy-wath and roots, as
above, there will be a confiderable faving made, by avoiding
the ufe of the expensive articles of barley-meal, peafe, or
barley and pollard. The farmers fhould however, as cau-
tiously as poifible, avoid having recurre to fuch fubstances
in thefe circumstances, as being unprofitable. Indeed Mr.
Donaldfion 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 refuge of the garden,
kitchen, fculleery, &c. together with fuch additions as they
may pick up in the farm-yard. Sometimes they are lent
into the fields at the clofe of harveft, where they make a
comfortable living for feveral weeks on the gleanings of the
crop; at other times, when the farm is situated in the neigh-
bourhood of woods or forests, they are lent thither to pick
up the beech-maft 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 fies fitted up for the purpose, or fold
to distillers, fthch-makers, dairy-men, or cottagers.
And he adds, that fwine are fold 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 fix months; and as full
grown hogs, at from eighteen months to two years old.
The young pigs are commonly roafed whole; the porkers are
used as freh or pickled pork; and the full-grown hogs are
for the molt part converted into ham and bacon. The

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demand for porkers, which for London in particular is very
great, and which continues almost throughout the year, is
chiefly supplied from the dairies within reach of that metro-
polis. From the time they are weaned, they are kept con-
stantly on whey, or flimed or butter-milk, with fre-
quently an addition of peafe or beans, or barlehy-meal.
Such good keeping not only makes them increafe 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 fraw, or fome
other similar article, as by this means they are kept per-
fecfly clean and healthy, and at the fame time a large quan-
tity of manure will be raised. And it is obfous, that where
the practice of cultivating crops of various kinds purpofely
for the food and fupport of ftwine prevails, the fows and
fowes pigs will of course be fupported during the winter
feafon, as from the beginning of November to the middle or
latter end of May, by the various roots, as above, that have
been ftored in this intention, in combination with the pre-
ferved diary-wath, and other articles. Besides, it is advised
by Mr. Young, that at the latter end of Winter, and the early
whole of the fall, the hogs fhould be turned out and forted ;
such as have attained half or more of their growth
being drawn and turned upon the clover, lucern, or chicory
crops, where they fhould 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 found, 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 ftem, the material difference from the
former mode is, he fays, in selecting the fiuficiently 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
wath, with fuitable green food, fuch as lettuce, 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 lettuces for thofe that
have autumn litters. It is observed, that thofe plants are of
great ufe for fows and pigs, promoting the increafe of milk
in a great degree; affording great affurance where the
dairies are fmall; and in all cafes tending to prevent the con-
fumption of grain, which is of great importance in hog
management. From the sweet juicy quality of the lettuces,
the hogs are not only extremely fond of it, but it becomes
highly nutritious. In this way, the fwine may be well sup-
ported and carried forward till the fhibbles 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 feed of the sun-flowcr may
also be ufed in this way, it is faid, with great benefit.

Further, it has however been flated by fome, that al-
though this fystem of management be advantageous, that of
foiling the hogs in the yards with green food is, notwithstanding
the increafe of fpace of it, and the unavoidable waft of a certain portion of the food, highly preferable, on account of
the vaft flore of manure that may be raised. It cannot,
however, be attempted with propriety, unlefs the farmer
be provided with abundance of fome fort or other of mate-
rials for the purpofe of litter, and fubfances of the peaty or
earthly kinds, for the purpofe of covering the floors of the
hog-yards, in order to afford and prevent the waft of any
portion of the liquid matters that may fall upon them. In
this method, clover, chicory, tares, and lucern, are the kinds
of food that are molt commonly employed; but there are
others
SWINE.

SWINE.

others that may be brought to their affluence when necessary, especially on the stronger sorts of land, such as beans eaten green, which afford a large quantity of food in proportion to the land they occupy, the whole items being consumed; 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-iles should have gates sufficiently large for bringing in carts loaded with the different articles of both food, floors, and litters, as well as for removing the manure that is made in them. In this system of practices, instead of a few fows 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 it has been mentioned above; as by this means there will never be a long and expensive season for rearing the pigs before they are put to the staple food of clover or potatoes, &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, Gloucestershire, to a very much extent. He was led to the use of this liquid, from noticing its effects in weaning of calves. In his experiments, as stated in the Agricultural Magazine, the fows of hay made use of were clover, fainfoin, and lucerne: 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 excellent, he had none); sometimes adding two or more of these articles, as his flock of either sex enabled him. And he had the great satisfaction to find, that he made a single flock of boiled potatoes, when mixed with wash, and without any other ingredient, go as far as four or five facks (though boiled), when he gave them to the pigs alone; and the expense of the wash, thickened with potatoes, is considerably lower than potatoes alone. With this view of the practicability of procuring the plan individually upon a larger scale, he gradually increased his flock to upwards of four hundred; and in the course of his experiments he used nearly fifteen hundred hog-heads of the wash, consuming, when his flock 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 flour order, and many of them fit for the butcher. It deserves 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, surely, 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 be down contented for the remainder, provided he was well ringed, and had a warm and dry place to shelter himself under. And this he attributes to the following causes, besides the nutritive properties of the wash. He found it beneficial to these boiled potatoes in large cakes (in which he conceives they would keep good above a twelvemonth), and when they had remained in them some time, freed from the water that they were boiled in (which is considered nutritious), they only went farther, but they generated a spirit; and the wash being also, as he apprehends, of considerable strength, they disposed the animal to betake himself to rest, from their soporific and intoxicating qualities; a circumstance evidently conducive to his quicker growth. Nor can an objection be raised, it is supposed, to this food, when applied to the flesh of the animal. So far from polluting any pernicious quality, it communicates, 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 eagerly 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 confident he could make one fack of meal, of whatever description, 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 fattest stages of fattening, both for pork and bacon; indeed that method should be followed throughout the process, using the wash instead of water. The increased quantity of a cheap and highly nutritious food, thus administered, will satisfy the voracious habits of this animal, and yield, he says, the greatest profit; and this alone would cause an immense annual faving of corn, which would tend to ensure plenty and cheapness; the grand defiderata in all experiments. For the price of a commodity, in 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 observes further, that clover, or fainfoin hay, at 4l. 13s. 4d. per ton, is 4s. 8d. per hundred, and one halfpenny per pound; and that twenty pounds of either boiled, will make, with the addition of the incorporating ingredients, sufficient wash or food to maintain throughout the day fifty fure pigs, from three months old to an indefinite age upward.

It is remarked that carrots, either raw or boiled, are excellent; and these, with oatmeal and grains, would make a cheap and good addition. And that the hay, when put into the furnace to boil, should be inclsted in a net, or a halter, with a lid to it, or in a tin-kettle and cover, filled with large holes, and the potatoes (or carrots, &c.) should be steamed over the hay-tea, whilst gently boiling or simmering. This may easily be done, by fitting to the furnace a vessel, having a number of holes of the size of a common auger bored through the bottom of it, fo as to allow the steam to pass through the potatoes with which the vessel is filled, and having a little moist clay, or a wet flannel or cloth put circularly round the bottom, where it rests on the mouth of the furnace, fo as to secure the steam from escaping. By this mode of steaming the potatoes, a considerate faving will be made in the article of coal. The potatoes should be but slightly steamed or boiled, and not reduced to a pulp, and whiff hot, should be trod or rammed in cakes for future use. The hay, after boiling, may be dried, and perhaps offered to fure cattle; or else thrown to the pigs as litter, or, to add to the dung-heap. The wash 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 immediately after boiling the wash, and well mixed together; but steaming the meal or pollard, and even the grain, might be a further improvement. The water, where there is a sufficient 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 side of the furnace. To convey the wash to the pigs, he used an open barrel or hog-head, suspended
furnished 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 titubing (which is frequently ploughed into the land,) or carpenters' shavings and sawdust, or virgin earth, or sand, especially sea-fand (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-fand will add fatine particles to the manure, and check evaporation. And he thinks it necessary to remark, as a most favourable circumstance, that the hay-tea 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 allur'dly be either bad in quality, or not properly blooded, 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 farinaceous juices, should have the preference. Bad hay is certain destruction to the pigs. Clover flanks first, next fannin, 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 fates of lean hogs should, Mr. Young observes, annually take place in October, the litters of April being then dispersed as fowls, and those of August kept till the same 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 flore-swine, it must obviously vary considerably, according to the convenience of procuring their food, and the excellence of the management that is pursu'd. In feeding fowls, it has been estimated upon the average at from eighteen-pence to three shillings the week; and while in pig, from one shilling to eighteen-pence; weaned pigs, at first, from one shilling and fourpence to two shillings and sixpence per head; and afterwards, till they be 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 sustenances have been recommended; but those most commonly employed are some sort of farinaceous material, with skimmed milk, and dairy or other kinds of waft. For the smaller sorts of fattening hogs, coarse ground oats mixed with these waftes 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; but for 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 lasting in their effects on the fyltem, from their undergoing the processes of digestion more slowly, perhaps on account of their containing a larger proportion of the nutritious matter in their composition. Malted barley given whole has likewise been found highly beneficial in the fattening of hogs, the quantity of sweet nutritious matter being thus greatly augmented, according to Mr. Bannister. Acorns in the same state have likewise been found to fatten hogs, but they cannot be depended on as a food for this use. Potatoes and carrots have also been occasionally tried in the same application; but as they never answer well without being boiled and combined with the meal of some fort of grain, it is a much better and more economical practice to convert them to the purpose of flore-feeding, and depend upon farinaceous sustenances for fattening the animals. It is illustrated by the author of Modern Agriculture, that in Hampshire, Gloucestershire, and some other of the most extensive dairies, beech-malt and acorns are much used, not only as food for hogs while rearing, but also as a means of fattening them. In the former case, the hogs are driven into the woods, and allowed to forage for sublitude for a considerable part of the year, as well as in autumn; in the latter, those intended for slaughter in the end of the year, are brought home from the forests soon after the fall of the acorn and beech-malt is over; they are then put into fyltes, and their fattening is completed with the fame fort of food, (a great quantity of which is collected by the poor people, and sold to the farmers for the purpose,) with an addition of peas or beans or barley-meal. But that the dairies are the great sources whence the butchers draw their supplies of hogs, as well as porkers. Jully, says he, as the dairies are employed, either in the making of butter, or of cheese, so whey mixed with barley-meal, or skimmed and butter-milk, are the chief sorts of food on which the hogs on a dairy-farm are fattened. Many are the incidental additions daily made to the flock of provisions set apart for the fattening of hogs; in short, every part of offal from the dairy, the kitchen, &c. is thrown into the trough; but milk and whey, or barley-meal, with an allowance of peas and beans, for a few weeks before they are killed, comitute the chief articles of food given to fattening hogs on all dairy-farms. And it is added, that very great numbers of hogs are annually fattened at the dillileries in the various parts of the kingdom. It is attested by the Report of the County of Surrey, that between nine and ten thousand are fattened on the grans, wath, and other offals of three dillileries only in that district. From this same idea may be formed of the total number of hogs thus annually made fit for the butcher. In the first stage of fattening, they are only allowed grains and wath; but for some weeks before they are ready for market, they are permitted daily a certain quantity of meal or grain; this not only brings them fatter forward, but renders their flesh firmer, and better adapted for curing as salt provisions, the use to which it is for the most part applied. But he thinks, that perhaps of all the modes in which hogs are fattened, that adopted at the corn-mills and flour-mills is the best; while the food on which the hogs are fattened (the refuse of grain) is freed from any nauseous mixture; it is also more nutritive than any other that is applied to the same use. It is desirable, it is said, to correct an error too much believed by the vulgar, that the malt-dilliller's pork is not good, the hogs, it is asserted, being kept in a state of intoxication; whereas the contrary is the fact; it being notorious, that the bell pork for sea-voyages is that from the malt-dillillers (who always simm with hard meal); and it is equally certain, that the bell bacon in the kingdom is made from those hogs; and he would be a bad workman, who left spirit enough in his wath to make his hogs drunk. It is, indeed, not probable that this prejudice should be well founded,
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 a pig forward in flesh, weighing 70. 50 lb. stalls in twenty-eight days increase in weight to 140 lb.; the gain of 70. 50 lb. live weight may be called 45 lb. dead weight, which, at 8d. per pound, is 30s., or 7s. 6d. a week. This is a very considerable amount, and gives the farmer a great encouragement for conceiving that the method is a real improvement. The quickness of these flies causes them to fatten more quickly, as they have only to eat and sleep. See Pig-Care.

Thee 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 size, 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 hough 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, which when fat will weigh twenty score, will confine in the proportion of six or seven bushels of peas or other similar materials.

It is said, that the produce of the native Devonshire hog, crossed with the Hampshire or Leicesters, 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 pea and barley ground in equal quantities into meal, well mixed together. The meal must be seasoned 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 pea and barley. This breed again crossed with the Chinefe, 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, too, that the proportion of fat to lean, or, in other words, of pork to bacon, in the above breeds, may be thus flatted. 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 Leicesters or Hampshire breed, will produce, for three quarters of a pound of pork, one pound of bacon. This cross, again varied by the Chinefe, 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 materials that are employed in the fattening of swine, there are different opinions entertained; some contending that they should be used as much as possible in a solid form, wath, 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, flitting it well several times a day for three weeks in cold weather, or for a fortnight in a warmer season, 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 the other, is 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 expences 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 revolt; 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 sizes, and the difference in their dispositions to fatten; but it is in general from five or six weeks to two or three months, according to the weather; and it is going on. It is likewise of great importance to keep the clean, dry, and warm, by having them frequently well littered 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 carafated while young, as the male pigs may be galed't at about three weeks old, without danger, and the female ones be cut or fayed when a month old; though, in the latter cafe, the operation is frequently performed at a much later period. The flies, when not wanted for the purpose of breeding, may also be fayed. This business is mostly done by persons who are in the constant practice of it, and requires experience and care. See Staying.

It may be flated, that there is a constant necessity to keep all arts 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-
terials that would otherwise be waisted on the farm. There cannot, however, be any doubt but that swine will pay for their keep, as well as any other fort of live-stock whatever, where a judicious system of cultivating crops purposely for them is pursued. This has indeed been fully shown 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 Wellphalo, 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 superior excellence of swine's flesh is materially to be attributed to the superior food which they require; and that pork or bacon will always be solid and good, in exact proportion to the solidity and goodness of the articles on which the animals have been fed. For although garst, 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 pulle. 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 finge off the hairs, by making a straw-fire round the hog, an operation which is termed saweling. The skin, in this process, should be kept perfectly free from dirt of all forts. When the fetches are cut out, they should be rubbed effectually with a mixture of common salt and faltpetre, and afterwards laid in a trough, where they are to continue three weeks or a mouth, according to their size, keeping them frequently turned; and then, being taken out of the trough, are to be dried by a fack fire, which will take up an equal portion of time with the former; 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 mostly the custom to have clofts 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 fort of meat is that 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, loin, 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 salting-tub, and every piece rubbed on each side and on every part with common salt, having some better faltpetre 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 faltpetre, as too much makes it hard. In about a month or five 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 necfary 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 Welfmorend, where the curing of hams has been long practiced with much success, the usual method is for them to be at first rubbed very hard, generally with hay-falt: by some they are covered close up; by others they are left on a fhone-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 falt of the same fort, mixed with rather more than an ounce of faltpetre to a ham. Having lain about a week, either on a fhone-bench, or in hog-heads amongst the brine, they are hung up by fome in the chimney amidst the fmoke, whether of peats or coals; by others in places where fmoke never reaches them. If not fadded, or they are fuffered to remain there till the weather becomes warm. They are then packed in hog-heads with fraw, or oatmeal feeds, and fent to the places of sale. It has been found by experiment, as flated in the survey of that district, that hams lose 20 per cent. of their weight in the curing, which fully demonstrates the advantage and economy of confuming them without this fort of preparation.

Bacon is faid to be belt cured in Yorkfhire, and the belt cut up in Wiltfhire; but it is well managed in many dis- tricts.

Further, swine are fubjeft to many disforders, mort of which will be found under their proper heads. Where the parts behind the ears, as is often the cafe in fome forts of them, crack and become foie in hot fefons, they should be anointed with a little faturine ointment; and where the udders of the fows take on hard glandular dwellings, as is sometimes the cafe, the ufe of camphorated faturine waters or ointments may be employed with benefit, care being taken to have the parts clean wiped before the pigs are ad- mitted to fuck. And in fuch cafes, half a drachm of cal- mel may likewife be ufefully 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 confidered 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 Crefets. See Cresses.

Swine-Cafe, the name of a fort of wooden building for containing and fattening swine, in fome places. See Pig- Cafe, and Swine.

Swine-Coat, a term pomerially applied to a hog-fly in many places, as in mok of the northern disficts of the king- dom. It signifies a fort of hovel of this kind. See Hog- Sty, and Pigstey.

Swine-Cave is also a pomerially term used for a hog-fly.

Swine-Herd, a term applied to a keeper of swine.

Swine-Out, Piles, or Pillars, in Agriculture, a particular kind of oat, which is cultivated for the ufe of pigs in fome places, as in fome parts of Cornwall. It is the naked oat, or averas nula of botanists. By the writer of the corrected account of the agriculture of the above district, the culture
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 stated to grow something like the common oat, but that the item 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 mels. It should be ground, and be well mixed and incorpo-rated with the potatoes. It was, however, noticed, that in some of the little hovels and cottages in the tract for this grain, in the above county, they dried the whole or un-ground grain over the top of the potatoes, in preparing them; the steam from which makes it swell much, when it is mixed with the potatoes and the swine devour it with avidity.

In using it for poultry, they molly consume it in its nature state, without being in any way reduced.

In other parts of that, as well as some 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, moory, moist soils; and the tillage, culture, and harvelling of it is much the same for oats.

How far it can be grown in this intention, and for fodder, with advantage, requires not to be proved by further and more correct trials.

Swine-Pipe. In Ornithology, a name used in many parts of England for the red-wing.

Swine-Pox. See Varicella, and Chicken-Pox.

Swine-Stone, or Stink-Stone, in Mineralogy, a name given to those kinds of lime-stone which emit a fetid odour when rubbed, resembling that of naphtha combined with sulphured hydrogen. Several kinds of lime-stone pollute this property; the most important is the black, or the common black marble, sometimes called Luculite, from Lucullus, the Roman conful, 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. These spots become more distinctly visible, when the marble has been exposed to a warm temperature, as is the case in chimney-pieces. When this kind of marble is dissolved in sulphuric acid, a smell of sulphured 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 alkal.

Black marble forms one of the upper beds of mountain lime-stone in Devonshire, and one of the middle beds of mountain lime-stone in the mountains of Craven, in Yorkshire, adjoining Westmorland. The latter is extremely black, and takes a most beautiful polish. It was first discovered in that district by Mr. Francis Webster, flatelyman of Kendal, by whom it is extensively used for chimney-pieces, and other articles. The dark-brown lime-stone in the vicinity of Bristol is another variety of swine-stone, forming an upper stratum in the mountain lime-stone. Some beds of the magnesian lime-stone near Sunderland are swine-stone: these occur above the coal formation. In other characters, swine-stone resembles common lime-stone and sand stone, see Marble and Lime-stone.

Swine-Thistle, in Agriculture, the same as the sow-thistle. See Thistle.

SWINEFORD, in Geography, a small poilt-town of the county of Mayo, Ireland; 103 miles N.W. by W. from Dublin, and about 14 N.E. from Castletiar. SWINEHEAD, or SWINEHEAD, a small market-town in the wapentake of Kirkton, Holland division of the county of Lincoln, England, is situated 7 miles W. from Boston,line 113 miles N. from London. A degree of importance has attached to this town, from its having been the first resting-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 Sleaford, 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 Sleaford, 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 imprudently eating peaches and drinking new cider. But an author, who lived about a century after the event, affirms that the king died in consequence of poison, administered by a monk of a religious house which then existed at Swinehead. This allention is combated, and the circumstance fully discussed, in a letter from Mr. Pegge to the Society of Antiquaries, published in Archzologia, vol. iv. This religious house was an abbey of Cistercian monks, founded in the year 1134, by Robert Grelle. The site was granted, 5 Edward VI., to Edward lord Clinton. Of the abbey buildings are vellige now remain; but a manion was erected out of the ruins by 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 stated, 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 Creffley-Hall, the property of Mr. Heron, a descendant of Sir John Heron, privy councellor to Henry VII., who mother was here once sumptuously entertained by sir John. The state-bed on which she lay is described by Stukeley to be made of curiously embossed oak: it is preferred in a farmer's house in the neighbourhood. Creffley-Hall was rebuilt in 1595, 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 of late, on account of the damage the birds do to the land.—Beauties of England and Wales, vol. ix. Lincolnshire, by J. Britton, F.S.A.

SWINEMUNDE. See SWINEMUNDE.

WINESUND, a town of Norway, in the province of Aggerhus; 5 miles S.W. of Fredericshall.

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.

Swing-Bridge, or Swivel-Bridge, a kind of moveable bridge on canals, much used for occupation bridges.

Swing or Leaf-Drag, in Agriculture, a name applied to that sort of tool of this kind, which is formed in something of a leaf-nanner, 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 a good deal in the same manner, but in which the tines or prongs are often placed much too uprightly in the wood, which, in the opinion of many farmers, is no inconsiderable fault; as they are said to work better, and more easily, where they are set in a somewhat leaning-forward direc-tion.
tion, thereby cutting the land over in a more effectual manner.

This fort of tool, when made use of on five-holt lands or ridges, or those of any other number of bouts of small dimensions, should constantly be formed so as to suit pretty exactly to the sizes 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 fort of tool is often found of very great utility on the stronger kinds of land, which have had some length of time in the ploughed state, before they are intended to be prepared for the seed, and which have not had sheep folded upon them. Some of the lighter forts of these tools also, in some cases, answer well to be run over the ground after the seed has been sown.

Swing-Gate. See Gate.
Swing-Plough. See Plough.

Swing-Tail Hog, a name applied to a particular breed of these animals. See Swine.

Swing-Tree, of a Hoggen, is the bar fastened across the fore guide, to which the traces of the horses 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.

SWINGE, in Geography, a river of Germany, which runs by Stade, and discharges itself into the Elbe, a little below.

SWINGING was preferred by ancient physicians, as good exercise in some cases. See Agitation.

SWINGK, or ISim, in Geography, a town of Ilfria; 6 miles N.W. of Mitterburg.

SWINGLE, in the Wire-works in England, the wooden spoke which is fixed to the barrel that draws the wire, and which, by its being forced back by the cogs of the wheel, is the occasion of the force with which the barrel is pulled.

Swingle, in Rural Economy, a term signifying a crank; also an implement used for beating rough flax, which is sometimes called a flaxkin.

Swingle-Hand, another term applied to the same implement; also to the hand which uses it.

Swingle-Tree, a term signifying a splinter-bar whippin, or whipple-tree. See Whipple-Tree.

Swingle-Tree, Indented, in Agriculture, that fort of contrivance of this nature which is formed with 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 indentures 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 flirp of thin iron about an inch in breadth, doubled up together at every tooth, and nailed fall upon the fore-part of nearly the middle of the swing-tree, on which the draught loop moves in each direction.

This fort of swing-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 swing-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 swing-tree, at one-third of the length of it from the end towards the furrow; the land-horse, having 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-most horse is commonly less than either of those behind, probably in consequence of being at a greater distance from the point or centre of draught; so the land-horse usually draws or works with left length instead of width on the side of the swing-tree 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 horses, the sliding loop is placed in the first notch from the left, which is equidistant from the ends of the implement, bar, or contrivance of this kind.

This fort of swing-tree is consequently of much importance in all cases where the teams are employed double, but more especially where the number of animals in them is unequal. They should be had by all farmers who have teams working double.

SWINGLING. See Brake.

SWINHOLM, in Geography, one of the small Shetland islands.

SWINHULT, a town of Sweden, in East Gothland; 40 miles S. of Linkopiing.

SWINNA, one of the smaller Orkney islands, having about 20 inhabitants, near the S.W. coast of South Ronaithay.

SWINOE, one of the Faroe islands, in the North sea.

SWINGROD, a town of Rulian Poland, in the palatinate of Braclaw; 70 miles E. of Brachlaw.

SWINOY, a small island in the Coptian sea, about 12 miles from the W. coast. N. lat. 5° 52'.

SWINTON, John, in Biography, a learned antiquary, was born at Baxton, Cheshire, in 1703, and entered as scholar at Wadham college, Oxford, in 1710, 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 Prefsburg, and became a member of the academy "Dei Apatitii" at Florence, and the "Etruscan 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, Etruscan, Phenician, 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 Carthaginians and other ancient African nations, the Turks, Tartars, Moguls, Indians, and Chinese, and dissertations on the peopling of America, and on the independency of the Arabs. Gen. Biog.

SWIRSEN, in Geography, a town of Farther Pomerania; 7 miles E.S.E. of Pohow.

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,
S W I

SWITZERLAND, in Geography, a town of Moravia, in the circle of Olmutz; 26 miles W. of Olmutz.

SWITHA, one of the smaller Orkney islands. N. lat. 58° 44'. W. long. 2° 58'.

SWITOCZ, a town of Lithuania; 65 miles S.E. of Mink.

SWITZERLAND, SWITZERLAND, Helvetian Republic, or Helvetia, 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, and 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 8,000,000 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 Franconie Comte. Its boundaries are rather arbitrary than natural; though on the W., mount Jura separates it from France, and on the S. the Piumina alps form a kind of partial barrier from Italy.

History.—This country lies between 5° 50' and 10° 20' E. long., and between 45° 50' and 47° 43' N. lat. The provinces to which the appellation of Switzerland is now applied, were in ancient times variously denominated. The Romans regarded them as a part of Gaul; and they were principally policed by the Helvetii on the W. and the Rheti 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; but others, with greater probability, deduce their origin from a Gothic race, and regard them as an ancient colony of Germans. (See HELVETI.) The Rheti are said to have been a Taufen colony; but this hypothesis is liable to objections. (See RHEIJA.) Before the commencement of the Christian era, the territories of the Helvetii were divided into four provinces, whose capitals were Zurich, Zug, Orbe, and Avenches or Avanche. These cantons formed one state, in which Caeser found 12 towns and 420 villages. When Helvetia was reduced to the form of a Roman province, it lost its name; a part of it being united to Sequiadia, and the remainder to Rhaetia superior. After the fall of the Roman empire, this country may be considered, in a general view, as policed by the Alemani on the E., who made an irruption in the beginning of the fourth century, and are suppos'd by some authors to have expropriated the ancient Helvetians. They also held Swabia and Alasse. This country on the W. may be regarded as a part of Burgundy; 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 Reuss, 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. Alemania was invaded by the Huns in the year 569, and infrequent contests with these barbarians lapsed till about the middle of the eighth century. The abbey of St. Gal was ravaged by the Huns; but they were afterwards defeated by Conrad, king of Burgundy, about the year 928. About the year 1038, the provinces which now constitute Switzerland began to be regarded as a part of the empire of Germany. Divided among several lords, ecclesiastical and temporal, 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 Schwyz, distinguished in that revolution, or from the general name of Schwitzers, given by the Anitrians to the Alpine people. For the sake of precision, modern writers relinquished the orthography of Schwitz and Schweitzer to the canton; while the general appellation for the people is the Swiss, and for the country, Switzerland or Swisserland. While the greater part of the country was rent in pieces by faction and civil discord, the three cantons of Uri, Schwetz, and Underwalden, environed by ridges of mountains, lakes, and rivers, remained in profound tranquillity. 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 seats and subjects in those 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 accustomed 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 endeavoured to extend their power and to encroach upon the privileges of the people. Uri, Schwetz, and Underwalden, 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 accession to the imperial throne, Rhodolph listened to the ambitious schemes of his son Albert, who was desirous of forming Helvetia into a duky. For this purpose the emperor purchased the domains of several abbeys and other considerable fiefs in Switzerland, as well in the canton of Switzerland as in the neighbouring territories. The three cantons, alarmed at this incautious power, obtained a confirmation of their privileges, which, upon the death of Rhodolph, was renewed by his successor Adolphus of Naffau. 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 Helvetian 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 Glar Last, gave strength and solidity to the union; and a century and a half elapsed before a new member was admitted. At length, in 1501, Friburgh 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 Stants," by which the articles of union and mutual protection were finally terminated. No change was made in the federal constitution of the three remaining cantons, Bale, Schaffhausen, and Appenzel; as they subcribed to the same terms which Friburgh 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 convention 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 Helvetic 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 dispositions shall be finally settled between the contending parties in an amicable manner, and with this view particular judges and arbitrators are appointed, who shall be empowered to compose the difference that may happen to arise. To this is added a reciprocal guarantee of the forms of government established in the respective commonwealths. No separate engagement, which any of the cantons may conclude, can be valid, if it be inconsistent with the fundamental articles of this general union. With these exceptions, the combined states are independent of each other; they may form alliances with any power, or reject the same, although all the others have adhered to it; they may grant auxiliary troops to foreign princes; they may prohibit the money of the other cantons from being current within their own territories; they may impose taxes; and, in short, perform every other act of absolute sovereignty. The public affairs of the Helvetic 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 those of the eight ancient cantons; those of the Protestant cantons, with the deputies of the Protestant cantons, with the deputies of the Protetants of Glarus and Appenzel, of the towns of St. Gallen, Bienne, and Mulhausen, called the "evangelical conferences," those of the Roman Catholic cantons, with the deputies of the Catholics of Glarus and Appenzel, of the abbot of St. Gallen, and of the republic of the Vallais, called the "golden alliance" as also 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 is held in the territory of any other canton, in which case the deputy of that canton is president. Each canton sends as many deputies as it thinks proper. The last diet of the Free Swiss Union assembled at Aarau in January, 1798; and all the deputies, that of Bâle 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, 12 incorporated territories, and 21 dependent lordships. The cantons are Zurich, Berne, Lucerne, Uri, Schwyz, Unterwalden, Zug, Glarus, Baden, Fribourg, Solothurn, Sankt-Gallen, Schwyz, and Appenzel, which fee respectively. The number of inhabitants in the 13 cantons is said not to exceed 9,532,000. The alliances may be divided into "associated" and "confederated" states; or the former are the abbot and town of St. Gallen, Bienne, and Mulhausen; and of the latter are the Grisons, the republic of the Vallais, Geneva, Neuchâtel, and the bishop of Bâle. The following lordships, bailiwicks, districts, and towns, belong, as joint property, to certain cantons. As subjects of the cantons, we may enumerate Thurgau; Rheintal, containing Rheinneck the capital, the market-towns of Altfallen and Berneck, and several villages; Sargans; Galtur or Galtel, a mountainous territory, bounded on the W. by Glarus, on the N. by Utzschach and Topgenburg, on the E. and S. by Topgenburg and Sargans, lying in N. lat. 47° 10', watered by the Linth, and now belonging to the cantons of Schwytz and Glarus, the inhabitants of which principally subsist by spinning, and the principal town of which is Schars (which see); Utzschach; Rapperichweil; Baden; the territory of the Free Alps, called the county of Rohr, or Rohr; and Waggenthal, bounded on the E. by Baden and Zurich, on the S. by Lucerne and Sargans, and on the W. by Lucerne and Berne, lying in 47° 20' N. lat., 20 miles long and 6 broad, containing 20,000 inhabitants, the upper division of which belongs to the 8 cantons, and the lower to Berne, Zurich, and Glarus. The Italian territories are those which lie beyond mount St. Gothard, in Italy, bounded by the canton of Uri, the Grisons, and the duchy of Milan: the three first belong to Schwytz, 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', abounding in pastures; Riviére or Polofer, 12 miles long, and 4 broad, watered by the Téfin and the Blegna; Val di Blegna, or Val Brenna, a fertile valley, enlivened by lofty mountains, and watered by the Blegna, all which contain 33,000 inhabitants; Louis or Lugano, a fertile district, 8 leagues long, and 5 broad, in N. lat. 46°, containing 53,000 inhabitants; Luggerus or Locarno, a territory in N. lat. 46° 8', 6 leagues long, and 5 broad, containing 30,000 inhabitants; Mayrath, or Val Maggia, about 28 miles long, bounded by high mountains, watered by the river Maggia, or Mayn, yielding some grain and much pasture, containing 24,000 inhabitants; Mendris, a small district between the lakes of Como and Lugano, very fertile, and containing 16,000 inhabitants. The allies of Switzerland are Gerfaw, or Gerflan; the Benedictine abbey of St. Gall, and its territories lying in Brigau, Savbia, 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 town of Biel or Bienne, having about 5500 inhabitants; the three united districts of the Grisons; the free communities in this country, composed of three bodies, called Dond or leagues, viz. the Grey or Upper League, the League of God's Hounds, and the league of the districts of which were united A.D. 1471, and now form one republic, consisting of 135 parishes, and 98,000 inhabitants. The valleys of the Grisons occupy a valley upwards of 50 miles from W. to E., watered by the Adda, at the foot of the Rhartian Alps, containing three counties, and 87,000 inhabitants. This valley comprehends the county of Bormio or Worms; the Valdeline; the county of Chiavenna, (which see;) the western part of the valley, 20 miles long, and 15 broad; and the barony of Haldenstein, in N. lat. 46° 50', containing a semicircular plain, about five miles long, and scarcely one broad, with a population not exceeding 400 persons.

For an account of the Valtellin, Neufchâtel, Pallong or Gémeen, and the Glaciers, see the respective articles.

Confederation and Government.—Under the former head we have already given some account of the government of Switzerland. The cantons of Berne, Zurich, Lucern, and Fribourg were arichocratic; those of Uri, Schwytz, Unterwalden, Zug, Glarus, and Appenzel, were democratical. The aristocracies were composed of a great council and 2 senates; the latter, in some cantons, enjoying exclusive authority,
SWITZERLAND.

thorough, 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 suprême power was vested in the people itself, 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 Helvetia 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 jurisdiction, and other circumstances, are specified. Thirteen of the cantons fend 13 deputies, and six of the most populous cantons fend 12 deputies, to form a general assembly, called a diet, to meet succedingly at Frifburg, Berne, Soleure, Balle, Zurich, and Lucern. Contributions in men and money, for the defence of the states, are levied in proportion to the population of every canton. What may be the future constitution of Switzerland, since the expulsion of Bonaparte from France, and the reformation 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 29. By the constitution, 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 florins, 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 equalled the expenditure.

Population and Manners.—The population of this interesting country has been generally computed at 2,000,000, or about 130 to a square mile. But so large a proportion is uninhospitable, that on a subtraction of such parts, the number might be about 200 to a square mile. Zimmermann reckons the inhabitants at 1,800,000 men; Berenger at 1,200,000. The enumeration of 1801 only gave 1,499,000. Including the subjects and valids of the cantons prior to the revolution, 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 citizens in the capital of their respective cantons; the second class consists of the inhabitants of the villages and countryside, 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 bestow one-half of his property to any one of his sons, as he please; so that no 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 the people. Jealous of their privileges, and tenacious of their liberty, they are enamoured of their country, the mild government and sublime scenery of which prevent them irrefrangible attractions. They are honest, sober, industrious, brave, and remarkable for their fidelity. Religious in principle, they are addicted neither to superstition nor fanatic 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 dress and manners of the inferior classes are plain and simple, not subject to the laws of fashion. Their houses, except in some secluded valleys, are chiefly constructed of wood, and costly furnished in the least expensive style. They indulge in no delicacy of fare, their ordinary food being the fruit of their labour and the produce of the soil. The original simplicity of the pastoral life is everywhere preserved; 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 belles lettres. In the most southern parts, bordering on Italy, the common tongue is the Italian. Among the Grisons the Romansh prevails. In Valais 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 we find the names of Bodmer, denominated the father of German literature; John and James Bernoulli, eminent mathematicians; Bonnet, a natural historian; Bullinger, a theologian; Buxtorf, celebrated for his rabbinical learning; Euler, a famous mathematician; Fussi, a classical scholar; J. Gefer, an antiquary and philosopher; Conrad Gfener, styled the German Plutus; Haller, an eminent botanist; Latzer, a phychiogitologist; J. Mallet, distinguished for his polite literature; H. Mallet, an antiquary; Necker, a statesman and financier; Otterwald, a theologian; Paracelsus, an alchemist; Rousellou, a well-known writer; Sauffre, a philosopher and natural historian; Scheuchzer, distinguished in natural history; the Turrellins, theologians; Weitzen, a learned critic and divine; Zimmermann, a physician; and Zuungel, 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 Balle, the Calvinists more especially have public schools and academies at Zurich, Berne and Laufanne, 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 Lucern, Uri, Schweiz, Unterwalden, Zug, Frifburg, Solochurn, part of Glarus, and the interior part of Appenzell. The Calvinists or reformed cantons are Zurich, Berne, Balle, Schaffhausen, great part of Glarus, and the exterior communities of Appenzell. The lordship of Haldendein, and the town of Neulad, are Lutheran. Every town and canton have their particular legislation for the management of their churches, 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 horses, cattle, butter, cheese, raw hides, flax, flax manufactures, dye-stuff and tilled 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 generally mountainous; and though Thurgau, and part of the cantons of Balde, Berne, Zurich, Schaffhausen, Soleure, and Fribourg, are the most level districts, yet these present eminences which may be called mountains, as they are from 2000 to 2500 feet above the level of the sea. No country exhibits so diversified an appearance as Switzerland; the vast chain of Alps, with enormous precipices, extensive regions of perpetual snow, and glaciers that resemble seas of ice, are contrived by the vineyard, and cultivated field, the richly wooded bow, and the verdant and tranquil vale, with its happy cottages and crystal streams. Although in such a country agriculture cannot be expected to flourish, yet the industry of the inhabitants affords a supply of grain 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. Flax is cultivated in considerable quantity, and tobacco has been lately introduced. The belt vines are those of the Pays de Vaud, the cantons of Berne and Schaffhausen, the Valteline, and the Vallais, which latter also produces hemp. The country affords an abundance of fruits, apples, pears, plums, cherries, strawberries, raspberries, and mulberries. Peaches, figs, pomegranates, lemons, and other productions 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 "Benners” 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 fowls, 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 sources 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 Limmat, the Rhone, and the Thur, which run 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 Maggiore, 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 Neuchâtel and Zurich are each about 25 miles long, and about four broad. That of Lucern is about 15 in length, and its greatest breadth not exceeding three. Next to these are the lakes of Thou and Brienz; of Joux and Roufs, 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 its 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 resemblance 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, from its southern climate and its elevated situation, may be considered, with regard to its botany, as an epitome of all Europe.

The horset России Switzerland are esteemed for vigour and spirit, and its cattle often attain great size. Among the animals peculiar to the Alps are the ibex, bouquetin, or 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 turdus cernulus. The lakes of Switzerland have few peculiar fish. As to the mineralogy of Switzerland, we may observe that the streams wash 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 grand lodes of minerals are in Piedmont, and the southern sides of the Alps. Rock-crystal is thought to be the chief export of Switzerland, pieces having been found that weigh from seven to eight hundred-weight. The calcareous parts of the Alps present beautiful marbles, and good fluorites are not uncommon.

The country is said to contain of granite and porphyry. Among the Alps are found serpentine, sericites, albite, and andalusite, as well as phyllites, schists, and gneisses. Near Chiavenna is a quarry of grey lapis ollaries, which has been long wrought into pots of various dimensions, and which will stand the fiercest heat. Among the mineralogical curiosities may be named the adularia or glassy 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 Pfieffer; to the south-east are the sulphureous baths of Alvaneus. 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 batzen being divided into 10 rappen. The franc is equal to 1½ franc of the new money of France. The money coined from 1798 to 1803 bore the stamp of the "Helvetic Republic," and consisted of gold pieces of 32 and 16 francs, silver pieces of 40 and 20 batzen, or 4 and 2 francs, and baile silver pieces of 10 and 5 batzen. In 1803 Switzerland became
became again a federative republic; each canton was allowed the right of coining; but the standard of the pieces was to be uniform, and the coins of each canton were to be current through the whole country. These coin of silver pieces of 1, 2, and 4 francs; and base silver pieces of 5, 10, and 50 batzen and 1 rappen. The coinage of all the cantons has been abolished, by a law of the diet of 1804, as follows: the franc is to contain 127.2975 Swiss grams (or 104.6 English grains) of fine silver, and the price of the mark of fine silver is to be 20 francs. The pieces of 1 franc are to be at the rate of 32.25 to the mark; and the pieces of 2 and 4 francs in proportion; the silver is to be 100 deniers 193 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 franc pieces, 12 grains; and in the 4 franc pieces, 8 grains per mark. The 5 batzen pieces are to be at the rate of 54 to the mark; 8 deniers fine; the remedy 2nd of a piece per mark, and 1 grain in the alloy: 90 batzen, 120 half batzen, and 360 rappen, are to weigh a mark; the batzen are to contain 1 part of silver in 6; the half batzen, 3 parts in 32; and the rappen, 1 part in 24. No law has been made for gold coins, except that such of the cantons as may wish to have them, must regulate the coinage in such a manner, that the franc may contain 8; Swiss grams of fine gold.

The franc, according to the above law of the diet, is worth 145,493 d. Herling, or 164 d. Herling = 16 francs 4 batzen 7 rappen, in new Swiss money. Kelly's Cambist.

SWITZER. See Schweizetz.

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 bridles are bent, that the ships may swing round to the tide; also in tenders for cattle, that they may turn round without unwarping the tender.

SWIVEL-Cannon, is 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, flern, or bow, and also in her tops. The trunnions of this piece are contained in a sort 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 caberel, 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 fpa, &c. for the ready taking out the turns of a tackle.

SWIVEL-Headed Churn-Spout, in Rural Economy, that kind of spout of this sort which turns upon a swivel. See STAFF-Churn.

SWOJANOW, in Geography, a town of Bohemia, in the circle of Crumulj; 9 miles S.E. of Politizka.

SWOONING. See Syncope.

SWORD, an offensive weapon, worn at the side, serving either to prick, or cut, or both.

Its parts are the blade, guard, hilt or grasp, and pommel; to which may be added, the bow, lichard, hook, and chape. The matters of defence divide the sword into the upper, middle, and lower part; or the fore, middle, and back, and small and weak part.

Anciently, there was a kind of two-handed swords, called spadas, which were to be managed with both hands; and which in those days they accustomed themselves to brandish to nimly, as to cover the whole body with them.

The favagyes of Mexico, when first visited by the Spaniards, had a kind of pincers, which would do as much execution as ours. In Spain, swords are only allowed of such a length, determined by authority. The ancient cavaliers gave names to their swords: Joyeuse was that of Charles Magne; Durandal that of Orlandu, &c.

Before the discovery of metals, swords were fashioned probably, like those of the Mexican favagyes already mentioned, of some heavy wood, hardened by fire; next to thee brazen, or rather copper swords were introduced, of which fort many have been found in Ireland. (See Archaeologia, vol. ii. p. 555.) And after the art of tempering steel was underflood 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 forged qualities, or alluding to their destructive powers; a method of distinction borrowed from the Persians and Arabia, and practised by Mahomet. Swords were also of various forms, and used with one or with both hands, for thrashing or cutting, or for both purposes. The swords used by the Roman legumary troops were very short and strong, the blade rarely exceeding nineteen inches in length, two-edged, and made for either flabbing or cutting. Thole of the Britons, called sphaera, 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 braidarics. Among modern swords we read of a braquemart or short sword, the foccato or long sword, the espadon or two-handed sword, the Swiss or basket-hilted sword, a Spanish sword or toledo, a tuck inclined in a walking-flick, a poniard, dagger, which seems to have been a constant companion of the sword, at least since the days of Edward I., fabre, and fycimitar, to which may be added the flable, a broad sword with only one edge.

Sword, Broath, sometimes called the back-sword, has only one edge, and is basket-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 armoursy, that the bearer must carry it upright, the hilt being held under his back, and the blade directly up the middle of his breast, and between the sword-bearer's brows.

The sword is 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.

Sword-Bearers. See Port-glaive.

Sword-Belt. See Belt.

Sword-Blades, Mills for. See Mill.

Sword, Pleat of the. See Pleas and Jus Gladii.

Sword, St. James of the. See JAMES.

Sword-Fish, Xiphius, in Ichthyology, the name of a genus of fish of the order of Aporids.

The characters of this genus, according to Linneaus, 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 scale. There is only one species, viz. the xiphius gladius.
According to the Artedian systcm of ichthyology, the characters of this genus of fish are these: the branchiopete membrane on each side contains about eight bones; the fin 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 fin, which is extended in its form, that it has been called by all nations by a name expressive of that character. Its common name, xiphias, is from the Greek, κιφος, 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 silver white; its mouth is of a moderate size, and has no teeth; its fin runs out 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 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 (ib. i. p. 16.), and agrees exactly with that practiced by the moderns. A man ascends one of the cliffs that overhangs the sea; as soon as he spies it, he gives notice of the course he 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 wearying itself with its agitation, is seized and drawn into the boat. It is much esteemed by the Sicilians, who buy it eagerly for about 6d. per pound, at its first coming into season. The seafowl flies 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 the sword-fish as are the fight of a wolf. Ovid. Hahuet. 97.

Sword-Grass, or Sweet Rufs, in Botany. See ACORUS.

Sword-Hand, in the Manger. See Hand.

Sword-Shape Leaves, in Botany, Folia ensiformia. See LEAF and ENNATE.

SWORDS, in Geography, a port-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 parochialing. It is seven miles N. from Dublin.

SYA, a town of Sweden, in Well Gothland; 13 miles S.W. of Linkoping.

SYALCOLE, a town of Bengal; 20 miles N. of Puckuloc.

SYAMA, a name of the Hindoo goddes 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. 27° 1'. E. long. 130° 51'.

SYANPOUR, a town of Hindoostan, in Oude; 13 miles N. of Caneo.

SYASKUTAN, one of the Kurils or Kurillki islands, about 50 versts from another island, called Ark-Amakutan, between which the current is very rapid. This island, which is 80 versts long, and 5 broad, is uninhabited. 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, confines of nothing but rock and crumbling stone.

SYBARIS, in Ancient Geography, a town of Italy, at 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 assigning to 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 Phileotetes. 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 300,000 fighting men. The walls of the capital included a space of six miles and a half, and its suburbs extended near four miles along the Crathis. The natural richness of the adjacent land encouraged agriculture and furnished abundance of articles for commerce; and the convenience of its situation between two considerable rivers, the Sybaris and the Crathis, favored 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 the astonishment and indignation of all ancient writers; informing us that the term "Sybarite" became proverbial to denote a man devoted to pleasure. So enfeebling were the effects of this luxury, that 70 days, as Strabo says, sufficed to destroy all their grandeur and prosperity: 572 years B.C. the Crotomates, amounting to 100,000, under their famous commander, the athlete Milo, encountered them. The army was entirely defeated and the Sybaris burned down the dams that kept out the Crathis, they let the furious streams 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 reiterate their city, 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 30 years after its destruction, it was reoccupied by the Thessalians, who were afterwards expelled by the Crotomates; and that it was at that time that the Athenians came hither with ten veflks. After the destruction of Sybaris, Thurium became a considerable state, under the discipline of Charydas, who died a martyr to the spirit of his own laws. Having fixed the pain of death upon any citizen that should enter the senate-house armed, and being reminded that in his hurry he had brought a sword with him into the assembly, he immediately plunged it into his own breast, and sealed his decree with his own blood. Thurium flourished for a long time under the dominion of Rome; till falling into decay,
Sycamore or Sycosis, from σκοτία, a fig, an excrement like a fig.

Sycamantia, συκαμαντία, in antiquity, a species of divination performed with fig-leaves; for which see Potter, Archzol. Grac. lib. ii. cap. 18. tom. i. p. 353.

Sycophant, συκοφάντας, formed from συκοφάντω, a fig, and κέφαλας, a head, I defover, a Greek term originally used at Athens, for perons who made it their business to inform against those who soked figs, to the owners, or against those who, contrary to the law, which prohibited the exportation of figs, practised the things, 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.

Sycophantine Plants. See Parasites.

Sure, or Sycosis, in Medicine, συκοσία, from σκοτί, a fig, an eruption of inflamed and hardish tubercles, affecting principally the bearded part of the face, and forming a granulated prominent ulceration, which somewhat resembles the soft inside pulp of a fig.

This cutaneous malady was mentioned by Celsus as occurring at Rome. "Eft etiam ulcus, quod à scutū limitudine scutō à Graeci nominatur, quia caro in eo extraiet." (Celsus, De Med. lib. vi. cap. 3.) The later
SYC

Greek writers are not at all agreed in their use of the term; but Paul of Egina properly describes it as an eruption on the face of "round, red, somewhat hard, painful, and ulcerating tubercles." (Lib. iii. cap. 22.) And Aetius mentions the disease as "one of the affections of the chin, which," he julily observes, "differs from Acne in the nature of the humour which it discharges, and in its greater tendency to ulceration." (Petrarchii. ii. Serm. 4. cap. 14.) Dr. Wilton 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 it when it occurs on the chin, syfocos menti; and another, when it occupies the hairy scalp, S. capillitis. See that work, p. 291.

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 succedent clusters, spreading along the course of the jaw up to the cars, 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 size of a pea. Their progress towards suppuration is slow, 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 encrustled 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 syfocos necerally 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, syfocos capillitis, appears chiefly about the margin of the hairy scalp, and the tubercles are arranged in clusters of an irregular 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 humid; for there is a considerable discharge of a thin ichorous fluid, which emits an unpleasant rancid smell. "Ex duro egresso sedat et glutinosum est: sed humido plus et multo odoris." Celsus, De Med. lib. vi. cap. 3.

The syfocos, under its former species, may be mistaken for the violent kinds of acne, which is situated chiefly upon the face; 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 feated on the scalp, as in the second species, the syfocos may be confounded with the porrigo, or pustules and ulcers, called "Oxid." But an attentive observer will mark the tuberculated hard, and elevated base of the suppurring tumours in the disease in question, which does not occur in the soft, scabbing pustules of porrigo. The latter, too, is a contagious disease; the former not.

The cure of the syfocos is sometimes flow, 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 subsituted. 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 tautine ointment. At the same time it is useful to prescribe antimonials, with alternative doses of mercury, followed by cinchona, or mercuraria, and the fixed alkalies, 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, 30 edit.

SYD

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 Afin, in the interior of the territory of the Periade. Ptolem. Sycurium, a town of Thessaly, in Magnesia, situated at the foot of mount Offa. Livy.

SYCUSSA, an island situated in the vicinity of Ionia. Pliny.

SYDABAD, in Geography, a town of Hindostan, in the fubah of Agra: 14 miles N. of Agra.—Alfo, a town of Hindostan; 50 miles W. of Benares.

SYDAPOUR, a town of Bengal: 28 miles S.S.E. of Boghpur.—Alfo, a town of Hindostan, in the Carnatic; 23 miles S.W. of Nellore.

SYDBY, a town of Sweden, in Ealt Bothnia: 10 miles S. of Christianhab.

SYDENHAM, Thomas, in Biography, a physician of extraordinary genius, was born at Winford-Eagle, in Dorsetshire, about the year 1624. He was the son of a gentleman of independent fortune, and was sent to Oxford in 1642, where he was admitted a commoner of Magdalen-hall. But on the occupation of that city as a garrison for Charles I. in the civil war, Sydenham, whose connections were with the parliamentary party, (his eldest brother being a colonel in their service,) quitted it, and went to London. While here, as he informs us himself, an accidental illness of his brother brought him into an acquaintance with Dr. Thomas Cole, 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 acutenes, persuaded him to commence the study of medicine, on his return to Oxford. Sydenham adopted this fuggelian, 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, 1648, he took the degree of bachelor of phyfic. 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 opinion. After pursuing his studies a few years, he quitted Oxford without any farther degree, and subsequently obtained that of doctor of phyfic 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 1679, is perhaps only to be accounted for by the greater success which his superiority of skill in the discrimination and treatment of diseascs 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 reformation, his opinions and political
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 censure and calumny which is usually excited by innovation; yet he appears, from his dedications to Drs. Mapleton, Brady, Paman, Cole, &c. to have prof- felled 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 minute attention to the phenomena of diseases, by giving up his whole mind to the investigation of the changes and products 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 canto 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 obser- vations on these subjects, in a work entitled "Methodus curandi Febrarum, propria Observationibus superna,' which he afterwards republished, with remarks tuggled by subsequent experience, under the new title of "Observationes Medicinae circa Morborum Acutiorum Historiam et Curationem," 8vo. 1675. In this work, however, as in some of his other writings, we find hypothetical language pretty largely inter- mixed with found practical observation. He commences with a definition of "fever" after the Hippocratic doctrine, even 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, perforation, or varous erup- tions; 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 rapi- dity 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 hypo- thesis; but to have regulated his views by his own experience, and of the "febrarum et raditae;" 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 subfequent 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 doctrines which he had himself refuted. 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 dis- eases. The sagacity and sound observation of Sydenham were also particularly manifested in the correct histories of some diseases which he has left. His descriptions of the small-pox, measles, and gout, have been deemed models of medical history; and his detail of the singular variety of deceptive appearances, which hysteria afflicts in females, is a display of extraordinary acuteness. He was extremely attentive also to the varieties which occurred in diseases, especially of the febrile class, in different seasons, 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 Reponentia dux; primis, De Morbis Epidemicis ab Anno 1675 ad 1680, ad R. Brady; secundis, De Lucis Venenae Historia et Cura- tione, ad H. Paman," 1680: "Diftellatio Epilolaris ad G. Cole, De Observationibus nuperis circa Curationem Variolarum confidentium; necnon de Affectione Hyperi- real," 1682: "Diftellatio de Febre putrida Variolae con- fluentibus superferviente; et de Mixta Sanguineae, a Calculo Renis impressa," 1682: "Tractatus de Podagra et Hydro- dropia," 1673: "Schedula Monitoria de Nova Febris in- grellia," 1686. On the subjects 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 con- signed the MS., under the title of "Procefsusintegrif Morbis fecern omnibus Curandis," 1693, which contains a very brief notice of the symptoms of many diseases, both acute and chronic, with some familiar formulas.

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 author- ity, 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 sub- fequently placed his bull in their hall, near that of Harvey. Halle gave his name to the age of medical history, in which experiment and observation began to be substituted for hypothetical doctrines; and Bihrnac, who never mentioned him but with a fort of veneration, thus expressed his praises in a public discriit. "Srnnum extremum ibabo, Thomam Sydenham, Anglum lumen; Artis Phrnon: cujus ego nomem hinc hominum praebens, memorare crudeliter; quem quosque contemplator, occurrat animo vera Hippocratiei viris species, de cujus erga Rempublicam Me- dicum meritis nonquam ut magnificae decem, quin ejus id fit superaturar dignitatis." See Eloy. Dict. Hilt. de la Mé- décine.
SYE


SYDENHAM, FLOWER, was born in 1710, and educated at Wadham college, Oxford, where he took the degree of M.A. in 1734. In 1759 he issued proposals for printing an English translation of Plato’s works; and from that time to 1767, he successively produced versions of the "Laws," the "Greater and Lesser Hippocratis," and the "Banquet," parts 1 and 2. He afterwards lived in indigence, and died in 1787 or 1788, in consequence of being imprisoned for debt to a victualler.

He was generally beloved for the candour of his temper and the gentleness of his manners; and he was reckoned a good Greek scholar. His circumstances excited sympathetically among the friends of literature in England, and are said to have occasioned the institution of the benevolent Literary Fund.

SYDERIS, in Ancient Geography, a river which had its mouth in the Caspian sea, in the place where it assumed the name of the Hyrcanian sea. Pliny.

SYDEROPECILUS, in Natural History, the name of a flower mentioned by the ancients. It was found in Arabia, and seems to have obtained this name from its being spotted with a ferruginous colour. The descriptions of the ancients are, however, in this, as in many other instances, too short to suffer us to guess what flower they meant. This might possibly be a granite with spots of this peculiar colour.

SYDERVELT, in Geography, a town of Guelderland; 6 miles W. of Culemburg.

SYDNEY. See Sidney.

SYDEN, Bay, a bay on the S. coast of Norfolk island, in the South Pacific ocean. Lat. 29° 5', E. long. 168° 3'.

SYDNEY Cove, a creek or harbour within Port Jackson, on the E. coast of New Holland; in which creek is the settlement for transported convicts. A town is erected here, with houses for the governor and deputy-governor. Metals of various kinds abound on the spot and in the neighbouring foil. The soil lies open to the N.E. and is continued in a S.W. direction for nearly 1000 yards, gradually decreasing from the breadth of 1400 feet, till it terminates in a point, where it receives a small stream of fresh water. The anchorage extends 2000 feet up the cove, and has foundings in general of four fathoms near the shore, and five, six, or seven near the middle of the channel. It is perfectly secure from all winds; and for a considerable interval on both sides, slips can lie close to the shore; nor are there any rocks or sandbanks to render the navigation dangerous. S. lat. 32° 57', E. long. 159° 20'.

SYDONAIA, a town of Syria, situated on the south side of a hill, on the top of which is a celebrated Greek nunnery, founded by the emperor Justinian, who endowed it with a considerable revenue, and gave them three hundred Georgian slaves for vassals, whose descendants are the inhabitants of the town, and professed the Greek communion; 12 miles N.E. of Damascas.

SYDOPTA, in Ancient Geography, a town of Ethiopia, near Egypt. Pliny.

SYDRACI, a people of India, who inhabited the territory which was the limit of the expeditions of Alexander on that side. Pliny.

SYDRI, a people of Afa, in Arcachon. Pliny.

SYDRUS, a town of India, on this side of the Ganges, on the banks of the river Indus, between Parabati and Epistaufa. Pliny.

SYEDRA, a town of Cilicia, according to Ptolemy. Strabo calls it Sydra, and places it in the vicinity of Coracaum.

SYIKE, in Geography, a town of Germany, in the county of Hoya; 16 miles N.W. of Hoya.

SYENA, in Botany, named by Schreber in memory of Arnold Syen, superintendent of the garden at Leyden, an ardent botanist, frequently mentioned in the Hortus Mala


Gen. Ch. Cal. Perianth 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. Pist. Germin superior, roundish; style thread-shaped; stigma trifid. Peric. Capsule globular, crowned with the style, of one cell and three valves. Seeds fix, globular, flattened, two attached to each valve, one above the other.

Obt. Syena is nearly allied to Comonyma.


SYENE, or ASSUAN, in Geography, a city of Egypt, situated on the east side of the Nile. This town was celebrated for the first attempt to ascertain the measure of the circumference of the earth, by Eratothenes, a native of Cyrene, who, about the year 276 before Christ, was invited from Athens to Alexandria by Ptolemy Euergetes. Near it, on a small island on the Nile, anciently called Elephantina, (see Elephantina,) is a temple of Champhill (standing), very little injured; here was likewise a Nilometer, but this is not to be discovered. In this town, which was situated under the tropic, according to the report of Strabo, a well sunk which marked the summer solstice, and the day was known when the style of the funereal cist 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 ages 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 situation. Here is an ancient building, perhaps the observatory of the ancient Egyptians; 375 miles S. of Cairo. See Assouan.

Juvencus was exiled at Syene, under a pretext of command ing a cohort there.

Pliny says that the name of Syene was also given to a pen ninsula 1000 paces in circuit, upon the confines of Ethiopia, on the Arabian coast, in which was a Roman garrison.

SYENITE, in Mineralogy. See Sienite.

SYER, in Geography, a river of France, which rises above two leagues to the N. of Thionville, and runs into the Molle near Walleribille.

SYESSA, in Ancient Geography, a town of Italy, in Tyrrhenia.

SYFERT, in Cairnige, a copper coin of Embdan. As a money of account, 2 fierys = a river. 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,
SYKE, in Rural Economy, a hill 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 Bensle 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 alfihants 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 Galtonham in Kent. In answer to a remon- 
dation of Dr. Thomas Beete, 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 Dillenius, this circumstance did not prevent his obtaining from the duchess dowager of Bedford a presentation to the rectory of Dry-Drayton, in Cambridgshire, on which he resigned his vicarage. In 1715 he published a tract, intitled "The Inocency of Error affected 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 life; no felicity so damnable as a course of sin;" and the ground of his refuting 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-resistant, and 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 Hoadleian in the church; always avowing himself the ally and advocate 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 Uniformity of Opinion," he argued, "that a latitude of opinion is intended and allowed by the legislature to subscribers, 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 Cambridgshire; and in the same year he was nominated by Dr. Clarke, as rector of St. James's, to be afternoon preacher at King-Street 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 Whiffin's letter to him on the eternity of the Son and the Holy Ghost, for which his lordship was thanked by the university of Oxford, had advanced some intolerance maxims. In 1721 he published a pamphlet, intitled "The Case of Subscription to the XXXIX Articles considered, occasioned by Dr. Waterland's Censure of Ancient Subcription," 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 1724, Sykes published a reply in 1725, intitled "An Essay on the Truth of the Christian Religion, wherein its real Foundation upon the Old Testament is shewn." 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 "died like the flurried 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 Whiffin, Chapman, and Doughlas, on Phlegmon's Eclipse. In 1736 he wrote in favour of the Dillenius tract, intitled "The Reasonableness of applying for the Repeal or Explanation of the Corporation and Test Acts impartially considered," and another, intitled "The Corporation and Test Acts shewn to be of no Importance to the Church of England." In 1737 he published "An Inquiry into the Meaning of the Mormonites in the New Testament." In 1739 he was promoted to the deanship of St. Bar- rien's, in Cornwall, in the patronage of the crown; and in 1750, by the interest of bishop Headley, he was collated to a prebend in the church of Winchester. In 1740 he published one of his most elaborate works, under the title of "The Principles and Consequences of Natural and Revealed Religion distinctly considered," which was regarded as an able defence of Christianity. His other works were, "A brief Discourse on Miracles," "A Rational Com- munication," &c., "Examination of Mr. Warburton's Account of the ancient Legislators; of the double Doctrine of the old Philosophers; of the Theocracy 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 sixty-three in 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 fezzed 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 manner, says his biographer, "he was mild and obliging, cheerful in temper, and unfoured 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. Difcray, D.D.

SYL, in Geography, a river of Walachia, which runs into the Danube; 16 miles S. of Krajova.—Albo, a town of Walachia; 28 miles S.S.W. of Brancovani.

SYLÉUS, in Ancient Geography, a town of Asia Minor, in Pamphylia.

SYLAX, a name anciently given to the Tigis.

SYLBURGUS, Frederic, in Biography, a learned philologist, was born near Marpurg, in Harle, in 1546. He passed his early years in the instruction of youth, and afterwards became a corrector and reviser of the editions of ancient authors, printed by Wechel and Commelin. 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 Vellius; and he had a con- siderable share in Stephens's Greek Thesaurus. He also composed Greek poems, and some other works, which manifest learning and judgment. He died at Heidelberg in 1596, worn out by his literary labours. Morei.

SYLEUM, in Ancient Geography, a town of Asia Minor, situated...
SYLLA.

situated towards the confines of Phrygia, Caria, Lycia, and Phœlia. 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 Cornelian 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 he bequeathed her whole property. He also was a favourite of his mother-in-law to such a degree, that at her death the 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 quinquerem 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 that of his younger days; contenting himself with the diet of the soldiers, 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 packed 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 debt which Sylla had acquired excited the jealousy of Marius, which was further aggravated by his causing a signet to be engraved, on which he was exhibited in the act of receiving the illustrious captive. Marius, however, disguised or suppressed his jealousy so far as to avail himself of his services; for when he was appointed to the command against the Cilician Gauls and Cimbriana, B.C. 104, Sylla acted as his lieutenant-general. In this office he was sigñally successful; and conceiving himself entitled to civic honours, he went to Rome, and declared himself a candidate for the praetorship. Failing in his first application, he accomplished his purpose in the following year by bribery. When the time of his magistracy expired, he was sent into Cappadocia, B.C. 89, to seize Ariobarzanes on the throne, and having soon effected 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 leaving himself in the middle, whilft those on each side were aligned to Ariobarzanes and the Parthian ambassador. In the Social war, B.C. 91, Sylla had a command in Samium, and distinguishing himself above all other commanders, he was elected to the consulship B.C. 88, and now commenced the rivalry and hostility 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 aspirant Romans was the command in the Mithridatic war. Sylla having gained the soldiers, succeeded in this attainment of his object; but the measures that were adopted by the partisans of both competitors were violent and sanguinary. 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 conclave; 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 Thessaly, he immediately received the submission of the Greek 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 feized the treasures of several temples, and violated the sanctity of the Delphian 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 devious of halting to Rome, he manifested an inclination to negotiate a peace with Mithridates, with whom he held a conference in person; and they agreed on articles for this purpose. The king consented 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 80 of his ships; and thus terminated the first Mithridatic war. Sylla pollexed uncontrolled 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 who 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 Aristotle, which belonged to Apollonius, the Telian, a wealthy person, 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 conclave, with Carbo, a man equally violent and sanguinary, for his colleague. At Dyrrhachium, the deputies of the senate had an interview with Sylla, who was entreated by them not to suffer his refentments to plunge the country in a civil war; but the answer they received led them to conclude that he 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 Junius Norbanus were elected consuls. An army was raised and commanders appointed, to refit the attempts of Sylla. This army was, in the mean time, taken a voluntary oath of fidelity and obedience to him. He then embarked, and landed 40,000 men without opposition at Brundusium and Tarentum. As he advanced, he defeated the army of Norbanus, and was joined by several perons of distinction. Scipio's army was so formidable, that Sylla thought it prudent to propose terms of accommodation. Scipio agreed to an armistice; but by the communication which ensued, the whole confular army was induced to join Sylla's party. Scipio and his son were brought prisoners to Sylla, who dinned them with a late-conduct. Young Pompey, though invetted with no public character, assembled his friends and dependants, and declared for Sylla: and his forces daily increasing, he was soon at the head of a confiderable army, with which he reduced several cities. Rome was now greatly alarmed: and Carbo hastened thither with fierce forces as he could raise. The senate was compelled to declare Sylla and his adherents enemies to their country: and each party was active in their endeavours, by negotiations and by bribes, for gaining allies. Carbo and young Marius were chosen consuls for the ensuing year. Sylla, as he approached Rome, met Marius at Frannele with a large army, which was defeated with great slaughter. Frannele was taken possession of by Sylla, and in the mean time his generals
S Y L

Seals were successful in various parts of Italy, and Carbo was obliged to withdraw to Africa. Sylla’s proconsul, however, was checked by a new enemy: this was Pontius Telefinus, a noble Samnite, who, with an army of 40,000 men, joined the Marian party, which had been always favourable to the rights of the Italian states, and advanced to the relief of Prenelle, but being surrounded by the armies of Sylla and Pompey, he decamped in the night, and hastened towards Rome. Sylla marched speedily to its relief, and rashly attacking Telefinus, exoped himself to danger, and was obliged to fly to his camp. Marcus Crassus, however, falling unexpectedly upon the victors, put them to flight, and Telefinus 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 Samnites 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 soldiers rushed into the circus, and indiscriminately 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 proceeded merely from some offenders whom he had ordered to be chastised. Prenelle soon after surrendered, and Marius, the confidant, 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 fanatical 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 affianced.

Rome was by these measures made to flow with blood, till at length Sylla was reproached for its cruelties by his best friends. After the murder of about 9000 persons of different ranks, he told the people that he had done no more as many as he could think of; but if he recollected 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 multitudes, and in some instances confiscations of the effects of the inhabitants. Sylla’s tyranny produced such terror, that no one could venture to refit it, or even to complain, if we except Cato, when a boy. See his article.

After the death of the confidants Marius and Carbo, an interval 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 ceased to be encased a number of laws, some of which must be acknowledged, were wise and fatal, and continued to be part of the Roman laws 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 felled the whole Roman people. Declining the consulate 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 his 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 listeners, descended from the rostra, and before the assembled multitude walked for some time in the forum, conversing familiarly with his friends. After his retreat from power to private life, he disfigured himself by the most dilapidate company and manners. Having lost his wife Metella, he again married Valeria, sister to the orator Hortensius; but she could not refrain him from indulging in low and scandalous amours. His intemperance occasioned a leathen 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, 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 “Fortunate.” Fortune was the goddess to whom he attributed all his successes, and with the superlition common among the heathens, he would not offend her by affixing 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 all 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. Ut. Hist. Geograph. Biog.

SYLLABA, Lat. a name given by some of the ancient, and among others by Nichomachus, to the confluence of the fourth, which they commonly call diatessaron; 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 singers-masters call olfomization by the hexachords, syllabizing; and adhering and defending the facts by the vowels, vocalizing; which might differ.

SYLLABIC, in the Greek Grammar. There are two kinds of augment; the first called syllable, 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 found, consisting of one or more letters, which are pronounced together; or which of itself conveys either no idea, or part only of what is denoted by the word. The word is derived from the Greek ΣΟΛΑΒΟΣ, which literally denotes comprehension or alleglance.

Or, a syllable is a complete found, uttered in one breath, consisting either of a vowel alone, or of a vowel and one or more consonants, not exceeding seven.

Seager defines a syllable to be an element under one tone or accent, that is, which can be pronounced at once.

Frison, 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 found, 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
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 pectoral muscles. Thus, a, a, a, make three syllables, formed by many motions, distinguished by small ropes between each expiration.

In the Hebrew, all the syllables begin with consonants, allowing aleph to be one; nor has any syllable more than a single vowel.

From the number of syllables in words, they become denominated monosyllables, disyllables, trisyllables, and polysyllables. e. g. words of one syllable, two syllables, three syllables, and many syllables.

As it is the number of syllables that constitutes the measure 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 dudious in that respect; and there are even some which have more syllables in verse than in prose. Many of the words ending in 

It is seen occasion great embarrassment to such as pique themselves on exactness: as adores, precios, &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 perfect sound, as a monosyllable 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 found 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 a, 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 univocal in spelling. A mute generally unites with a liquid following; and a liquid, or a mute, generally separates from a mute following: le and re are never separated from a preceding mute, e. g. ma-nis-fe, ex-e-cre-bis, an-e-qual, mis-as-ply, dis-in-quiè, cor-ri-pon-ding. But the belt 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 Effays upon the English Language, p. 44, &c. See also Lowth's Introduction to English Grammar, p. 23; and Murray's Grammar, vol. ii. ch. 2.

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 left syllable in Greek, but none in Latin, except a few compounds of fe, as malef, &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 penultima. No word in the Latin or Greek language is accented farther from the end than the antepenultima.

English words are not only accented upon each of the three last syllables, but several upon the fourth, and some 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 evincing the voice, and modulating the sound. Many English nouns and verbs written alike, are distinguished from each other, by pronouncing the former with an acute accent on the penultima, and the latter on the last syllable; as absent and abstent, carot, and contour, &c. In the inflection of verbs, the accent always remains on the root, as love, loveth, loved, &c. In derivatives, the accent is always on the theme, except substantives from the French, ending in eer and air, where it is carried to the termination, as volunteer, &c. Most compound words have their accent on the former part, unless that be a preposition, and then oftener on the latter. But the exceptions from either are more easily known from observation than reduced to any certain rules. If the accent be on the vowel, a syllable or syllable is long, as fall; a syllable is short, when the accent is on the consonant, which occasions the vowel to be quickly joined to the succeeding letter, as ans, hunger. Unaccented syllables are generally short, as admire, but this rule has many exceptions, as anime, firelight. 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 sadly, persif. When the accent is on a semi-vowel, the time of the syllable may be protracted, by dwelling upon the semi-vowel, as end, can; but when the accent falls on a mute, the syllable cannot be lengthened in the same manner, as bitte. Words with a mixture of long and short syllables are the most melodious. Ward, ubi supra, p. 32, &c. Murray's Grammar, vol. i.

SYLLABUB, Quantity of. See Quantity.

SYLLABUB, a kind of compound drink, most affected in the summer season; ordinarily made of white wine and sugar, into which is quirked new milk with a yering, or wooden cow.

Sometimes it is made of canary, in lieu of white wine; in which case the sugar is spared, and a little lemon and nutmeg are added in lieu of it.

To prepare it the belt way, the wine and other ingredient excepting the milk, are to be mixed over night, and the milk or cream added in the morning. The proportion is, a pint of wine to three of milk. For

SYLLABUB, Whipt, to half a pint of white wine or Rheiniu, is put a pint of cream, with the whites of three eggs. This they seafon with sugar, and beat with birchen rods, or work with a yering. The froth is taken off as it rifes, and put into a pot; where, after standing to glittle two or three hours, it is fit to eat. Ruf. 

SYLLABICUM, in Ancient Geography, a maritime town of Africa Preria, a league from Cartagene, according to Ptolemaus.

SYLLABUS, in Grammar, a figure by which we conceive the fene of words otherwise than the words import; and thus make our construction, not according to the words, but the intention of the author. See Substitution.

The syllabus, says an ingenious author, is a figurative construction, which agrees rather with our ideas than with the words; and expresses rather the fene of our mind than the fene of the terms themselves. SYLLABUS
S Y L

SYLLEPSIS is also used for the agreement of a verb, or

The predicate of the conclusion is called the major term,

SYLLOGISM, συλλογισμός, in Logic, an argument, or

The predicate of the conclusion is called the major term,

for, if they be certain, apodictical; if falfe, under an appearance of truth, sophileic or

SYLLOGISM is 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 syllogism and compound. Single syllogisms are made up of three propositions, and may be divided into simple, complex, and conjunctive.

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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 conjunctive; relative, requiring the major proposition to be relative; and conjunctive, or copulative, which require that two or more ideas be connected either in the compound subject, or predicate of the major, that if one of them be affirmed or denied in the minor, common sense will flow 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 epichirion, dilemma, profyllogism, and sorites. Watts's Logic, part 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 the proposition, "man is an animal," is understood.

The demonstration of mathematicians, it is observed, are only series 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 SOPHISM.) There are two general methods of reducing all syllogisms 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 this, as the terms in every syllogism are usually repeated twice, they must be taken precisely in the same sense in both places. Watts, u. s. 1.

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,

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the perceiving of their connection, and the making of a right conclusion; syllogism only afflicts 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, may perhaps better, without it. We fee men reason very lyncingly who do not know how to make a syllogism.

Indeed syllogism, the same author adds, may serve to discover a fallacy in a rhetorical flourish, or by stripping an absurdity of the cover of wit and good language, shew it in its natural deformity. But it only shews the weakest or fallacy 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 certainly conclude right and which not, and upon what grounds the one do so.

The mind is not taught to reaon 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, that to shew the weakest of an argument, there needs no more, than to strip it of the superficial 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 appeal to common observation; which has always eluded 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 fallacy can be couched in a syllogism, as nobody will deny but it may, it must be something else, and not a syllogism, that must discover it.

The same author proceeds to shew, that this way of reasoning discovers no new proofs, nor makes any discoveries; but is wholly convervant in the marshalling and ranging of those we already have: a man must know, before he be able to prove syllogistically; for that the syllogism comes after knowledge, when we have but little need of it. To the fame purpose it is oberved by Dr. Campbell, in his "Philosophy of Rhetoric," that the method of proving by syllogism appears, even on a superficial review, both unnatural and prolix. The rules laid down for distinguishing the conclusive from the inconclusive forms of argument, the true syllogism from the various kinds of sophism, are at once cumbrous to the memory, and unnecessary in practice. No person, one may venture to pronounce, will ever be made a reasoner, who hands 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.

SYLLUK, the principal of the Hebrew accents, used to cloe a period, and called king and pause. 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 Slewich, of an irregular form, about 40 miles in circumference, and no where more than two miles from the sea. N. lat. 54° 55'. E. long. 8° 20'.

SYLVA, among the Romans, a ludicrous kind of hunting 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 fixed to large beams, after which earth being thrown upon their roots, the circus actually resembled a wood; then being filled with all sorts of herculeous animals, the people were let loose upon them, and carried all clear off.

SYLVA, or Silwa, in Poetry, a poetical piece composed, as it were, at a flart; or in a kind of rapture or transport, and without much thought or meditation. Such are the Silvae of Statius, which, he allures us, were all composed after this manner.

Quintilian extends the use of the word silva to any writing done in haste, and on the spot.

The word is Latin, and literally signifies forest; whence its chief use in our language is metaphorically to express certain collections of poetical pieces of various kinds, and on various subjects; as a forest is an assemblage of trees of different sorts.

SYLVANS, in Mythology. See Fauns, Satyrs, and Sileni.

SYLVES, in Geography. See Silvies.

SYLVUS, Francis De Le Boe, in Biography, a distinguished physician, and founder of a leit in medicine, was born at Hanau in 1614, and was defended of a good family. After the usual grammatical education, he was sent to the university of Basle, where he commenced the study of physic, and received the degree of doctor in that faculty in 1677. In order to obtain the various information of different schools, 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 practice 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 physicians of that capital, which he continued to enjoy several years, until he was called to Leyden, in 1688, to assume the office of first proflidor of the practice of medicine in that university. This situation was well calculated for the exercise of his genius and eloquence, and he soon attracted a numerous audience from all parts of Europe. He was one of the earliest advocates for Harvey's doctrine of the circulation of the blood, and was the principal cause of its reception into that medical school. In other respects, however, he was instrumental in retribing the progress of medical science, by the invention of an hypothesifs respecting the cause of diætes, which contributed much to excite the attention of the medical world, and to extend his own fame. He ascribed all the morbid actions of the vital system to certain chemical operations, to fermentations, and ebulitions, which he believed gave origion to an excess of acid or of alkali, to the neutralization of which all the efforts of the medical art were of course to be directed. Whence he administered volatile alkali, absorbent earths, and cordials largely, paying little regard to the different iages of a disease, or the character of prevailing epidemics. The extent to which this doctrine was received and defended in most parts of Europe, and as it was upon a gratuitous hypothesis, and therefore productive in many cases of much mischief, is surprising, and the interruption which it occasioned to the improvement of medicine was considerate. It was in fact one of the great benefits which Sydenham conferred
Sylvestre, James, Du Bois, a learned physician, was one of the fifteen children of a camel manufacturer at Amiens, where he was born in 1578. 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. He was not less assiduous 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 private 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 1528, 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 Tresquet, while Ferrel taught in that of Corneubie; 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 Ferrel, were probably the principal cause of this preference. He was appointed professor of medicine at the royal college in 1538, which he continued to hold till his death, which took place in 1555, in the seventy-seventh year of his age.

This physician was never married, and is said to have flown an aversion to the other sex. His manners were rude, and his temper fallen; and his parsimony so extraordinary, that he is reported to have had no fire in the winter, but to have kicked a foot-ball, and carried a bag 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 Victoris ratione facili et falsi Paupereum, sive, Avariciarum," in which he published the life 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 "Inligege Anatomica," and in his "Observata in variis Corporibus feminis." 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 Meline, with a translation and comments. He wrote with great violence against Velius, who had been his pupil, and became his rival in anatomy; but especially on account of his preconception in correcting Galen, whose errors he was led to detest by his bigotted attachment to the ancients. Syllerus 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. Medecins.

SYLUSURUS, in Ichthyology. See Sylurus.

SYMA, or SYME, in Ancient Geography, an island north of Rhodes, at the entrance of a small gulf of the Dore. The ancients represent it as having been inhabited by Chthonian, the son of Neptune and Symé, and as having been polishe'd by the Carions after the war of Troy; and when abandoned by them, as having been occupied by a colony of Lacedemonians and Argians. See Symi.

SYMBACA, a town of Asia, in Media, according to Strabo.

SYMBACCHI, συμβακχια, in Antiquity, a designation given to the two men, who purified the city of Athens at the festival Thargeha.

SYMBARD, or SYMMARD, in Geography, a town of France, in the department of the Saone and Loire; 4 miles N. of Loubans.

SYMBOL, Symbolum, formed from σύμβολον, a mark, sign, or badge, of συμβάλλειν, to compare, a sign or representation of any moral thing, by the images or properties of natural things. Thus we say, 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 mythology; being used not only to represent moral things by natural, but even natural by natural.

Symbols are of various kinds, as types, enigmas, parables, fables, allegories, emblems, hieroglyphics, &c., each of which is under its respective article, Type, Enigma, Parable, Fable, &c.

The Chiefe letters are most of them absolute symbol, or figurative. The symbols in algebra, &c., are arbitrary. Medallia also apply the term symbol to certain marks or attributes peculiar to certain persons or deities. The thunder-bolt, 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 a urn, of a river, &c. See Medall.

SYMBOL, among Chriftians, is particularly ufed for the creed, or the articles of religion, which every Chriftian is to know and believe. See Apoftles' Creed.

In the emperor's library is a Greek MS. of the symbol of the apolilhes, 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, Thaddeus, and Matthias.

But the testimony of that MS. does not much confirm the opinion, that each apolilhe composed an article of the symbol;
SYM

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 profusion 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 this purpose Rufinus says, that the Greek word συμβολά, may be rendered in Latin by indicium. Others derive it from an assembly or conference of the apostles, where each expressing his faith of the soul, and what each had chiefly preached, the creed was framed, and called by the Greek word συμβολή, which signifies collaboration or conference.

Lord King derives the significancy of the word with greater probability from the σαυρος, 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 fluidously 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, Freeze. See the Index.
SYMBOLICAL Philosophy. See HIEROCLYPHIC.
SYMBOLICAL Physick. See PHYSIC.

Clemens Alexandrinus, Eusebius, &c. observe, that the Egyptians had two ways of representing their sibylistical 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 signify a collection of parts.
SYMOLOGOICE, 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 Philippi; 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 Lydia, according to Ptolemy.
SYME. See SYMA.

SYMI, in Geography, anciently Syme or Smya, an island of the Grecian Archipelago, situated near Cape Volpe, on the coast of Caramania, 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 Paulo, 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 Symi, 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 fishers, and the majority of them engage in the fisheries, which cover the rocks at the bottom of the sea that surround their island. They are reckoned the boldest and most experienced divers in the world, descending into the sea to the depth of 150 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 esteemed 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 fishery, they carry thither the fruits of their activity, which affords a small traffic, adequate to the wants and ambition of a nation of divers. They are a robust race of men, of a hardy stature. The life of these islanders is simple; and tyranny has spared, or, more properly speaking, disdained a tribe, which, in lieu of opulence, profess only austere habits and laborious occupations, the most certain pledges of independence. N. lat. 36° 38’. E. long. 27° 34’.

SYMITHA, in Ancient Geography, a town of Africa, in the interior of Mauritania Cazariensi. Ptolemy.

SYMMACHUS, Q. Aurelius Avianus, in Biography, a Roman senator of the fourth century, became prefect of Rome, pontiff and augur, and proconsul 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 Valentinian II., requesting the re-establishment of public rites and festivals of the altar of victory. This application was refuted by St. Ambrose, bishop of Milan, who composed an answer to the petition of Symmachus, as did also the poet Prudentius. Symmachus left 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 consulship A.D. 391. The petition above-mentioned is preserved in the ten books of Symmachus’s Epistles, still extant. Its oratory was of that kind which characterized the decline of Roman literature. “The luxuriancy of Symmachus,” says Gibbon, “conflicts of barren leaves, without fruits, and even without flowers. Few facts, and few sentiments, can be extracted from the verbose correspondence of the elegant sylph with his illustrious patron.” His works were inserted in the best edition, as far as the text is concerned, in that of Schioppis, 4to. Mogunt. 1668. Moreri. Gibbon.

SYMMACHUS, Pope, a Sardinian, and deacon of the Roman church, whose elevation to the pontifical chair terminated a schism that took place in the church at the decease of pope Anacletus 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 case upon the spot. The emperor submitted the pope; and the tumults at Rome, which had hitherto raged, were unheeded. Theodoric visited the city, and pacified its disturbances. He summoned a council, which assembled at Rome in July 501; and Symmachus, being summoned to appear, proceeded from the church of St. Peter, 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 position...
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 502, Symmachus held a council at Rome, in which the live of Odoacer, declaring that the election of a pope could not be made without the concurrence of the forefathers, was annulled; and another council, held in 503, confirmed the acts of the council which had abolished Symmachus; and another was convened in 509, which passed a decree, anathematizing all who should seize 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 restoring 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. Moret. Bower.

SYMMETRY, συμμετρία, formed from συμ-, with, and μετρόν, measure, the relation of parity, both in respect of height, length, and breadth of the parts necessary to compose a beautiful whole.

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 analogia, 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 ordinance reigns throughout the whole.

Symmetry, Represented, is that where only the opposite sides are equal to each other.

Under the article Veterinary Anatomy, it was proposed to diffuse 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 BREATHING.

SYMPARATAxis, a word used by Hippocrates to express the conflict between nature and a disease, and the aliments or medicines given in it.

SYMPASMA, a word used by many authors to signify a cataplasma.

SYMPATHETIC, συμπάθετικός, 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 idiospathic.

Thus, an epilepsy is said to be sympathetic, when produced by a remote cause; i.e. when the disorder in the brain, embarrased with blood, is preceded and produced by some other diseased.

There is a sympathetic palpitation of the heart, and an idiospathic one. There is but one idiospathic cause of the palpitation; but there are several sympathtic ones.

Among chemists and alchemists, the term sympathetic is principally applied to a kind of powder and of ink.

SYMPATHETIC Ink. See Ink.

SYMPATHETIC Powder, a powder once very much famed; supposed to have this wonderful property, that if spread on a cloth dip in the blood of a wound, the wound would be cured, though the patient be any number of miles off.

This powder, M. Lemery tells us, is nothing but Roman vitriol, opened by the sun-beams penetrating it, and imperfectly calcining it, in the middle of summer.

But it is now generally allowed a mere piece of charlatanery, whatever for Kenelm Digby, and others before him, and after him, pleads in its favour.

The composition of the famous sympathetic powder, used at Goffeater by the miners in all their wounds, is this. Take of green vitriol eight ounces, of gum tragacanth, reduced to an impalpable powder, one ounce; mix these together, and let a small quantity of the powder be sprinkled on the wound, and it immediately stops the bleeding. The vitriol is to be calcined to whiteness; the fun, before it is mixed with the gum.

SYMPATHETIC, συμπάθετικά, formed from συμ-, with, and πάθος, passion, q. d. compassion, fellow-feeling; an agreement of affections and inclinations, or a conformity of natural qualities, humours, temperaments, &c. which makes two persons pleased and delighted with each other.

A late ingenious writer has endeavoured to account for the origin of our moral sentiments from sympathy, denoting our fellow-feeling with any passion whatever. When we approve of any character or action, the sentiments which we feel are, according to this system, derived from four sources, which are in some respects different from one another. First, we sympathize with the motives of the agent; secondly, we enter into the gratitude of those who receive the benefit of his actions; thirdly, we observe, that his conduct has been agreeable to the general rules by which those two sympathies generally act; and, last of all, when we consider such actions as making a part of a system of behaviour, which tends to promote the happiness of the individual or of the society, they appear to derive a beauty from this utility, not unlike that which we ascribe to any well-contrived machine. There is another system that traces our moral sentiments to sympathy, different from the former. It is that which places virtue in utility, and accounts for the pleasure with which the spectator surveys the utility of any quality from sympathy, with the happiness of those who are affected by it. This sympathy, however, is different both from that by which we enter into the motives of the agent, and from that by which we go along with the gratitude of the persons who are benefited by his actions. It is the same principle with that by which we approve of a well-contrived machine. But no machine can be the object of either of those two last mentioned sympathies. Smith's Theory of Moral Sentiments, 3d ed. 1797. See Virtue.

SYMPATHETIC is also used with regard to inanimate things; intimating some proportion they have to unite, or to act on one another.

In this sense, naturalists say, there is a sympathy between the vine and the elm; between the loadstone and iron; the two poles of a loadstone, &c.

The alchemists talk much of the powder of sympathy. See SYMPATHETIC Powder.

SYMPATHY, in Physiology, the affection of the whole body, or of any part, consequent on injury, disorder, or disease of any other part. Thus the fever which follows a local injury, is called sympathetic. When, on the introduction of a bougie into the urethra, a person faints, the heart is said to sympathize. A stone in the bladder produces itching of the end of the penis; tickling of the fauces produces vomiting; the strain of a joint will cause fick-
mels, &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 Edinburg., vol. v. part 2. art. 45.

For the force and effect of sympathy, in the production of monsters, see *Monster*.

**SYMPESIS**, a word used by the old Greek writers to signify concord or disunion.


A genus of humble shrubs, or herbs, either smooth, or bearing a few scattered glandular hairs. *Leaves* in three deep, divided segments; the lower ones opposite. *Sepals* simple, terminal, and partly from the Bowman of the upper part; *petals* oblong. *Fowers* yellow, alternate, sessile, with solitary, hooded, permanent *bracteas*. Mr. Brown considers his *Symphonia* as not particularly allied to any other, except perhaps to his *Asystachys*, which has separate filaments, and an unilateral stigma. Two species only are known.


2. *S. montanum*. Mountain Symphoniae. Br. n. 2.—Segments of the leaves flat, linear, single-ribbed. Bracteas and flower-flask downy, with very short glandular hairs.—Gathered by the fame botanist, on moat rocks, in the fame neighbourhood.


Gen. Ch. Cal. Perianth inferior, of five roundish, spreading, imbricated leaves, permanent. Cor. Petals five, roundish, rather coriaceous, concave, much larger than the calyx, fanding obliquity over each other, and converging, fol to form a slightly depressed globe. Stam. Filaments united into a close, even, cylindrical tube, the length of the petals, slightly inflated at the bottom, fleathering the style; anthers five, ovate, acute, sessile on the margin of the tube, spreading. Pfyl. Germian superior, ovate; style cylindrical, rather longer than the corolla; stigmas five, oblong, acute, spreading, alternate with the anthers. Pfyl. Berry globose, of five cells. Seeds solitary, nearly globuliar, smooth, fatter on the inner fide.

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. 302. (Moronobea cocccina; Aubl. Guian. 789. t. 313. f. a-j?)—Native of Surinam, from whence Dalberg lent fpecimens, preferred in spirits, to Linnaeus. This is a flout and lofty tree; the smaller branches rather quadrangular, smooth, leafy, flitely fcarred. *Leaves* crowded about the ends of the branches, flaked, oppofite, croffing each other, elliptic-f lanceolate, pointed, entire, very smooth, three or four inches long, with one rib, and many fine tranfverfle parallel veins. *Fowers* channelled, half an inch long. *Fowers* four or five, red, forming a fort of terminal, fimple umbel, whole falks are angular, smooth, above an inch long. The berry has a coriceous coat, enclosing a very yellow fliny pulp, in which are lodged the parti-coloured *feeds*. The latter are faid to be a favourite food of parrots.

Such is the plant of Dalberg, preferred in the Linnaean herbarium. Neither the figure, nor the original fpecimen, of Aublet agrees with it as to inference. But his separate representations of the fructification, fig. a to j, undoubtly agree with the Linnaean fpecimen, and are of the fame size; while his fig. 1 to 8, reprefented larger, though defcribed as smaller, are certainly very different, particularly the *flamen*. Aublet appears to have confounded two diftinte fpecies, at leat. The trees he defcribes yield a resin, which serves the natives of Guiana as a strong and ufeful cement.

**SYMPHONIACA**, a name given by fome authors to the common *bysfeyamus*, or henbane.

SYMPHONICA STILIO. See *Stilo*.

**SYMPHONIALE**, in the Italian Magie, is fometimes prefixed to a canon, or fugue, to shew that it is at unifon, i.e. that the fsecond part is to follow, or imitate the firft in the fame intervals, fonats, notes, &c., the third to obferve the fame with regard to the fsecond, and fo on.

**SYMPHONY**, the name of a musical instrument often mentioned in the Fabliaux and old French poetry. It is fometimes called *Chiphonie*, fometimes *Cyfiane*, but more frequently *Simphonie*. Some of the quotations given by Du-Cange referbe it as a wind-instrument, and others as a species of drum, pierced with holes like a fieve.

"Je fai juglere de vielle;
Je fai de mufe et de fafide,
Et de harpe et de chifphonie
De la gigue, de Pharmone."

Here are feven instruments mentioned in the compafs of four lines.

"All the miniftrel art I know,
On the vielle I well can play;
I the pipe and lyrixus blow,
Harp and jug my hand obey,
Pifalty, symphony, and rote."

Zarlino speaks of a Tucan instrument, which he fays was very ancient, and which was called *Sinfonia*. According to his defcription, it was a kind of cleft, upon which the ftrings were tuned, 4th, 5th, and 8th. The three ftrings were per- fectually funding in the fabe, while an air was played on the moft acute ftring.

Zarlino adds, that fome authors, among whom was Otto- marus Liciunus, imagine that this instrument was the true ancient
It should be observed in Zarlino's account of this instrument, that he waspersuaded the ancients had harmony, or music in parts, and such instruments as he 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 four 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 above 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. ii. 7. If it was in the shape of a long chisel, or a trigon, flung 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, συμφωνία, formed from συμ, with, and ων, found, properly denotes a consonance, or concert of several sounds agreeable to the ear; whether be vocal or instrumental, or both; called also harmony; which see.

Some authors refrain from calling the sole music of instruments: this term, say they, the recitatives in such an opera were inconsiderable, but the symphonies excellent.

The symphony of the ancients went no farther than to two or more voices or instruments set to uniform; for they had no such thing as music in parts; as is very 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 Arcine, about the year 1022, that most writers agree in attributing the invention of composition: it was he, they say, who first joined in one harmony several distinct melodies; and brought it to the length of four parts, i.e. 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 success of efforts of ingenious men during several centuries, must have been trivial and inconsiderable in its infancy; and the first attempts at its use necessarily circumscribed 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 hint and analysis of the writings of Guido, in order to ascertain how much modern music has been indebted to this celebrated monk of Arezzo. Hist. Music, vol. i. p. 112, &c. vol. ii. p. 72, &c.

The word symphony is now applied to instrumental music, both 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, viz. tenor and fifth of the violon.

Before the above was written, symphony had been highly cultivated in Germany, particularly at the Mannheim school, by Stamitz, Hoeltzreeder, Cavaliere, Vermeh, and Pfitz; by Vahal, Ditters, and Rosetti, 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 muse interesting and sublime: invention, science, knowledge of instruments, melody, fire, grace, and pathos by turns, with new modulation, and new harmonies, without rudeness or affectation. And 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 shortness of his vital course.

Beethoven (pronounced Baythoven), a disciple of Mozart, is now (1847) 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 promise inexhaustible resources.

SYMPHORICARPOS, in Botany, a genus founded by Dillenius, in his Hortus Elisionus, 371., 278, and named by him from φυόμον, to classify, or accumulate, and φοιτητη, fruits, alluding to its copiously clustered berries. Jussieu has retained this genus, Gen. 21, 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 Honeyluckles called Lonicera; but seems to have had no idea of any affinity to them in its fruitification, which he compares to Cefenta! We may remark that the Lonicera connect Symphoricarpos with the genuine Honeyluckles, (Carpesium and Persicumus,) however unlike, at first sight, 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 fection of a natural order, into which fection Jussieu has well introduced Linneus and Triejeum, though he has now wisely removed Osieda from hence to his Vitice.

SYMPHYSIS, in Anatomy, a general term for those connections of bones, in which they are immediately joined together, without forming a moveable joint. See Joint.


Gen. Ch. Cal. Perianth inferior, permanent, eréct, five-fidged, clavous into five, acute segments. Car. of one petal, bell-shaped. Tube very short. Limb tubular, ventricose, a little thicker than the tube; mouth five-toothed, obtuse, reflexed; throat fenced 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, eréct, concealed. P. Germens superior, four; style thread-shaped, the length of the corolla; stigma simple. Peric. none, except the enlarged, widened calyx. Seeds four, gibbous, pointed, converging at the tips.

Effl. Ch. Limb of the corolla tubular, swelling; its orifice cloched with awl-shaped rays. Calyx in five deep segments. Seeds four, naked.

SYMPLOCE, sycok, in Rhetoric, a figure, where the same word is repeated several times in the beginning and end of a sentence, including the anaphora and epistrophe: thus, *Quis legem tuam? Rullus. Quis majorem populi partem supplices proovisit? Rullus. Quis coitus profuit? Idem Rullus.*

SYMPLOCOS, in Botany, from *symplokos,* a connection, because of the unusual union of the claws of the petals—


Gen. Ch. Cal. Perianth superius, bell-shaped, in five deep, roundish-ovate, concave, permanent segments. Cor. 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. Stam. Filaments numerous, linear, flat, erect, attached to the tube of the corolla in several imbricated rows, and combined unequally at their base into one; anthers roundish, two-celled, erect. Fil. German inferior, turbinate; style thread-shaped, the length of the flanks; stigma capitate, obliquely five-lobed. Peric. Drupa elliptic-oblong, dry, of one cell, crowned with the calyx. Seed. Nut of the same form, oblong, 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. marticinensis. Marticino Symplocos. Linn. Sp. Pl. 747. Willd. n. 1. Jacq. Amer. 166. t. 175. f. 68. Swartz Obsf. 293. t. 7. f. 1.—Stalks somewhat racemose. Leaves crenate, very smooth on both sides.—Found by Jacquin in the woods of the island of Martinico, flowering in November. A branching tree, twenty feet high. Leaves scattered, flaked. ovate, acute, two or three inches long, shining, somewhat coriaceous. Flowers flaked, axillary, solitary or slightly racemose, white, smelling like hawthorn, and about the same size.

2. S. Ciponima. Guiana Symplocos. Willd. n. 2. (Ciponima guianensis; Aubl. Guian. 567, t. 226. Cavan. Diff. 371. t. 217.)—Stalks many-flowered, the length of the footstalks. Leaves nearly entire; villous at the back. —Native of woods and wadg ground in Guiana, flowering and fruit in September. A middle-sized tree; its trunk seven feet high, and seven inches in diameter, with a grey bark. Leaves flaked, about three inches long, elliptical, pointed; smooth above; clothed when young, as well as the branches, with flesh-coloured hairs. Flowers in little axillary tufts; their corolla white, edged with yellow. Fruit black. Aublet.

flowered. Leaves serrated, nearly naked."—Gathered by
Dombey in the woods of Peru. L'Heritier considered this
as intermediate between the two forms, and supposes
they might all possibly be varieties of one species.
Occ. 1287. Wildl. n. 4.—Petals eight, slightly connected.
Stalks single-flowered. Leaves bluntly serrated, smooth
on both sides. Native of lofty mountains, in the south
part of Jamaica, flowering in July and August. A tree
20 or 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. *Sturtevant.*
Wildl. n. 5. Art. n. 1. (Hopea linctoria; Linn. Mant.
195. Pursh 451. Arbor laurifolia, floribus ex foliorum
alis; Caesb. Carol. v. i. 54. with a plste.) Flowers
nearly sessile, axillary, crowded. Leaves slenderly, serrated,
rather glaucous. In the low woods of Virginia and Caro-
lina, flowering in April and May, when its scent is very
agreeable. Dr. Garden sent it to Linnaeus, and called it
Hopea, after Dr. Hope, professor at Edinburgh. (See our
Home.) We believe it was also sent alive to Dr. Fothergill
by the same person. This is a *furbib or small tree.* The
leaves are oblong-lanceolate, occasionally downy beneath,
with a sweet taste, and dye a fine yellow. Flowers yellow,
small, very fragrant.
6. S. Althoria. Mexican Symposclos. L'Herit. as
above. Wildl. n. 6. (Altonia theaformis; Linn. Suppl.
265.4.)—Petals about ten, slightly connected. Flowers
axillary, sessile, about three together. Leaves elliptical,
obtuse, slightly serrated, smooth. Gathered by Mutis in
New Granada. A smooth rigid *furbib, with coriaceous,
veiny, shining leaves, hardly an inch and half long, on
short thick ilafs. Flowers white, nearly the size of a
hawthorn. The younger Linnaeus thought the leaves tailed
like these, and might serve as a substitute for that plant, but
they would be even more out of our reach. It is singular
that the genus dedicated to two Edinburgh professors,
should thus coincide under another previously established.

SYMPSONIAC, *Συμποσιακος,* formed from *Συμποσιος,*
feast; a conference or convocation of philosophers at a
banquet.

Plutarch has nine books, which he calls Symposiacs; or
symposiac questions, *q. d.* disputations at table.

SYMPOSIARCH, *Συμποσιαρχος,* in Antiquity, the direc-
tor, or manager of an entertainment. This office was some-
times performed by the person 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
*biosis, rex,* and moderator, &c.; he determined the laws
of good fellowship, and observed whether every man drank
his proportion, whence he was called *obphalbus, occlus,* 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
cognizance of our senses, as when an external part has re-
ceived a mechanical injury. But in the great majority of
causes, the effecual morbid 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 diversified sensations which the
patient may experience. There are these 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 ammel-
blage constitutes a sort 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 reaonings in regard to the lences of changes
which have preceded the observed effects, are liable to a
peculiar source of fallacy, from the disjointed nature of the
phenomena on which they must be founded. The more
important internal changes are removed from our
sight, 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 refult of the primary, or, as it
has been termed, the proximate cause. A long and labori-
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 insufficiency of
many organs, even of those concerned in the vital functions;
the sympathies which prevail between contiguous and dif-
ferent parts; the subtle organisation and obscure nature of
the functions of others, introduce much ambiguity in a variety
of cases. But in the determination of diseases, we gene-
 rally 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, 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 fame object; or may, in other cases, be altogether dis-
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
verse 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-
flation 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 part originated; and which, if suffered
to continue, would reproduce them in an aggravated degree,
even had we succeded in obtaining a temporary alleviation.

See Enteritis.

A general classification of the symptoms of diseases, and
a view of the principal kinds, has been already given
under the article Disease.

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 idiosomatic; which see.
SYNAGOGUE. Synagogy, συναγωγή, literally importing assembly, congregation; a particular assembly of Jews, met to perform the office of their religion. Also the place in which they met.

The Jews use 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 instituted originally by Moses, and the members of which they afterwards increased to one hundred and twenty. See SABREDS.

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 Babylonian 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. xxviii. 3, 4. Deut. xxxi. 11, 12. Psa. lxxiv. 4, 8.) but be this as it will, no allusions 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 beth 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 themselves.

They were not allowed to build any synagogue in a town, unless there were in it ten persons of leisure; 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 attend the synagogue. 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, 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 on 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 great 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 by confinements, excommunication, fines, and lashing; they took care of the alms, called by the sacred writers, as well as the rabbins, "righteousness," (Matt. xix. 18. Mark, v. 22. Acts, xviii. 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 present synagogue, as it was first established by Ezra, the priests and Levites delivered their discourse 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 rulers of the synagogue. (Acts, xiii. 15.) Some persons have expressed their surmise, 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 free observers of the law; that they were well versed in it, and even were rabbins and doctors, (Acts, xiii. 1. Matt. xxvi. 55. Acts, xiii. 14. 1 Cor. xiv. 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 "rabbir, or angel of the synagogue," (philarch zibbor,) who stood before the ark in which the scriptures were kept, and repeated the prayer "Cadiich," before and after reading of the law; another, called "minister of the synagogue," who, from the pulpit, gave notice to the Levites when they were to sound the trumpet; this minister sometimes read the law; and another minister, called "guardian or keeper," (chabam,) 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 lection 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 to 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 these were ended, the minister, standing up, began the public prayers, the people likewise standing, and bowing the knee and body at the performance of some particular psalms; and their service began and ended with the prayer "Cadiich," similar to our Lord's prayer. When prayers were ended, the
the chafan took out of the chaf 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
evellun, fitched or glued very neatly together, and fastened
at one end to flinks very neatly turned. For an account of
the manner of reading the pentateuch, see Pentateuch
and Parashie. 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 chaf, the next part
of the service was some thanksgiving or adoration, ending
always with the prayer Cadich. 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
Thursdays they read only the law; but on the sabbaths, as
well as on fast-days and festivals, they read the prophets
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 clafs Itafiah, Jeremiah, and Ezekiel,
with the 12 leffer 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 prophetical writings above
mentioned. The same ceremonies occurred before and after
the reading of the prophets as at the reading of the law, ex-
cept that there were some additional thanksgivings then
repeated. Portions of the prophetical writings were selec-
ted, 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 estabhhsed by Ezra; others, with greater probabili-
ity, fix the commencement of it to the time of the Mac-
cabees. The mode of interpreting was as follows: the
minister, or any other 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 les honourable than
the reader, from respect to the original text: and very
young persons were admitted into this office. Some pa-
fages were not lawful to interpret: such were the incant
of Reuhen, of Thamar, and Ammon, the bleffing which used
to be given by the priest (Numb. xii. 23—26.), and the lat-
ter part of the history of the golden cull (Exod. xxxiv.
21—25.) The reading of the prophets, according to the
rabbins, was closet with the priest's bleffing: after which
the congregation was diffmufed, unless somebody was ap-
pointed to preach.

The afternoon service concluded in singing the 84th
psalm, from v. 5, to the end, and the whole 145th, in
rehearsing the prayer Cadich; 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 Cadich, which
concluded the service.

The evening service was almost the fame. One of the
principal ceremonies performed in the synagoge was cir-
cumcision; though this was performed sometimes in private
houses.
SYN

Anthers as four, with finge cells. It seems to us at last that they must be either 4 or 2, not 3.

The Synapheae are New Holland shrubs, of humble stature. Their leaves are scattered, flat, most elegantly reticulated, wedge-shaped in their general outline, lobed, except the lower ones, which are mostly undivided. Footstalks dilated, and half sheathing at the base. Spikes either axillary or terminal, simple or branched. Flowers alternate, solitary, sepaliferous, with a solitary, hooded, permanent bract at each. Corolla yellow, deciduous.


2. S. dilatata. Dilated Synapheae. Br. n. 2. Bot. of Terra Austral. 74. t. 7. (Consolpernum reticulatum; Sm. in Rees's Cyclop.; see Conospermum, n. 5.)—Leaves dilated and three-lobed at the end; their lobes deeply toothed. Footstalks and spikes hairy. Stigma with two horns.—Gathered by Mr. Menzies, at King George's Sound. Mr. Brown found it there, bearing flowers and seed, in December 1829. It is growing in exposed barren situations, near the shore. This author describes it as a "spiny, small procumbent shrub, whose stem is round, the thickest of a crow's quill, somewhat branched, hoary with soft spreading hairs, and cloiep-prefld down. Leaves scented, three-ribbed, tapering very much at the base into a long, round footstalk, which has a membranous dilatation, on each side, at the bottom; their beautiful minute reticulations most conspicuous at the back; when young they are villous, but at length become smooth. Spikes axillary, simple, shorter than the leaves, being three or four inches in length. Flowers yellow. Pollen triangular. Nut fribled, hairy, crowned with a circle of thicker club-shaped bristles.

3. S. petiolata. Long-stalked Synapheae. Br. n. 3. (Polypodium spinulosum; Burm. Ind. 233. t. 67. f. 1.)—"Leaves of the branches about the length of their footstalks; in three deep, flat, divided lobes; the lower ones either three-lobed or undivided. Spikes elongated, branched. Stigma with a simple point."—Native of rocky hills in Lewin's land. Mr. Brown has well observed that Burman's plant, above cited, must be either this species, or at least one of the same genus, and was probably gathered by some Dutch navigator on the coast of New Holland, and carried to Batavia, instead of being really a native of Java. Burman seems to have had no reason for supposing it a fern, except its rigid texture, and none whatever for making it a Polypodium.

4. S. polymorpha. Various-leaved Synapheae. Br. n. 4.—"Leaves of the branches with very short footstalks, channelled, in three deep subdivided lobes; the lower ones either undivided or three-lobed. Spikes simple, longer than their stalks. Stigma with a simple point."—Gathered by Mr. Brown, along with the last, in rocky situations at Lewin's land.

We have seen no specimens, except of the second species. This is admirably illustrated by Mr. Brown, in his General Remarks, geographical and systematic, on the Botany of Terra Australis, subjoined to Captain Flinders's Voyage, published in 1814. The genus of Synapheae is confeciously very nearly allied to Consolpernum, but differs in the union of its barren filament to the Rigme. Mr. Brown also observes that these two genera, to nearly related, differ never theless in the position of their abortive and perfect flowers with respect to the corolla, which is a very unusual circumstance in any natural order, though not without example; "Drypetes, for instance, having its flowers alternate with the divisions of its calyx, though in the reit of the Thymelea they are opposite when only equal in number to those divisions.

SYNARTHROISMUS, exspexitus, in Rhetoric, a figure which, in order to magnify a thing, whether good or bad, enumerates a great many different kinds of actions, &c. to which it relates: thus Cicero, "qui mihi fratrem optatifsimum, me fratri amantissimo, liberis nostris parentes, nobis liberos; qui dignitatem, qui ordinem, qui fortunas, qui amphilam rem publicam, qui patriam, qui nihil potest effe iucundus; qui denique nonset ipotes nobis reddiditis." See Vol. Rhet. lib. vi. p. 372.

SYNARTHROISIS, 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 antiphonal manner, anfwering each other alternately, without any mixture of voices. Roufeane observes that, Malcolm, who doubted whether the ancients had any music composed expressly for instruments, yet has cited from Athenaeus this account of the synaulia. He is, however, right in his first conjecture; for these synaulia were nothing more than vocal music played by instruments, in a concert of unison and octaves.

SYNBRANCHUS, in Ichthyology, a genus of fishes of the order Apodes, established by naturalists since the time of Linnaeus. The body is eel-shaped; it has no pectoral fins, and the spiracle is finge beneath the neck. This genus differs from the Muranaea, (which see) in the circumstance of the spiracles or branchial orifice being finge, and situated beneath the throat. There are but two species.

Maromatrus; Olive-brown Synbranchus, marbled with blackish spots; the body is yellowish beneath. The general species of this animal is that of a murana; it is about 80 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, nutfles fimple, fteated near the eyes, which are blue; the fkin of the body is thick and loofe; the back is of a deep olive-colour, with fudky spots; the belly and fides are of a yellowish faw, and the spots on those parts have a tinge of violet. The doraf or rather the caudal fin is extremely remote from the head, and surrounding the tail, unites with the vent-fin; the vent being fitated at the distance of fome inches from the end of the tail, which terminates acutely. It is a native of the frefh waters of Surinam.

Immaculatus. This is of a plain unvariegated brown colour; it is much allied in general form to the preceding, but is considerably smaller, and very different in colour, being nearly of an uniform brown throughout, with the exception of a few very obscure sub-transverse dullfey fhedes, across the body, and a few whitifh marblings on the fins. This, like the former, is a native of Surinam.

Dr. Shaw has mentioned another genus, designated Spagæbranchus, which is fo much allied to the one here noticed, that it may be described in this place. It has an eel-shaped body, and no pectoral fins; it has two spiracles beneath the neck.

Rostratus, with the upper lip produced into a fownt. This fih, as described by Dr. Bloch, measures about nine inches, and is of a cylindric form, diftinctly both of fins and scales. The upper jaw is considerably longer than the lower, being indeed sharpened into a fownt; the eyes are small; the teeth numerous; and the two spiracles or branchial orifices are situated at about an inch beyond the month, immediately beneath the neck or fore part of the body. The colour
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 margravate of Anpsch; 6 miles S. of Fuschwang.

SYNCAME, formed of κολες and κακός, burning; 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.

SYNCATEGOREMA, ναυάρα, ναύαρα, 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 κατα and κύκειον, 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 Synceles, an ancient officer in the family of the patriarchs, and other prelates of the eastern church.

The word in the corrupt Greek, κατακυκλοφορούς, signifies a person who lives in the chamber with another; a chamber fellow, or chum.

The synceles was an ecclesiastic, who lived with the patriarch of Constantinople, to be a witness of his conduct; whence it is, that the synceles was also called the patriarch's eye, because his business was to observe and watch.

The other prelates also were their synceles, who were clerks living in the house 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 synceles of churches. At last it became a title of honour, and was bellowed by the emperor on the prelates themselves; whom they called pontifical synceles, and synceles Augusitales.

There were also synceles in the western church, particularly in France. The fifth council of Paris speaks with a great deal of indignation of some bishops who abolished the office of synceles, and lay alone; and strictly enjoins them, that for the future, to take away all occasion of scandal, they made the office of synceles inexpressable from that of bishops.

SYNCELES, George, in Biography, a Greek historian and chroniquer, derived his name from his being synceles, or confess rider with Tarafias, patriarch of Constantinople. He wrote a "Chronograph," in which he transfers the whole chronicles of Eusebius, subjoining censure and corrections of that author, though he himself often errs both in history and chronology. Synceles 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 ulla pubis, the bodies of the vertebræ, &c.

SYNCHORESIS, κολαπεσιον, in Rhetoric, the fame with permission.

SYNCHRONISM, κολλοειπος, formed from κολλω, and ειπος, time; the being or happening of several things together, 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, κολαπεσιον, in Rhetoric, a confused manner of expression, where the natural order of the words is preserved. Horace affects it much; thus, lib. i. sat. 5:

"Pene maecenas aris tomod furto verit in igne."

SYNCHYSIS, in Surgery, a confusion of the humours of the eye, from blows, or violent inflammation.

SYNCOMISTERIA, συνκομιστηρια, in Antiquity, the fame with that, i.e., a place for the treatment of wounds.

SYNCREMENTUM, formed of κρενωτας, I nourish, a name given by Athenæus, and some other authors, to the corner fort of bread eaten by the poor in many countries, and made of unifted 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 Synconopation, in Music, the prolonging of a note begun on the accented part of a bar, to the accented part of the next bar. Thus every syncopated note is what the French call à contre temps, against time; and every incidence of syncopes 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 syncopes in the harmony, as if they were united by a ligature.

Syncopation has its use in melody for title and the expression of words; but its principal effect is in harmony, for the treatment of discords. 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 syncopation, by Rameau and Roussette, does not satisfy us, the first thought it came from the shock or clash of sounds, in the diffionance; and the citizen of Geneva derived it from κολαπεσιον, and κολαπεσιον, I cut, or beat. But by the fanciation it excites, we rather think it resembles in music the effect of a syncope in medicine, in which faculty the word implies a swoon, or fainting away.

Syncopation is used for a driving note, that is, when some shorter note at the beginning of a bar, or half a bar, is followed 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 minims, or an odd quaver before two or three crotchets, &c.

To describe all the effects of syncopation in melody, and all its use in harmony, would require a book, instead of an article for a dictionary. In quick movements, syncopation or driving notes express passion and impatience; in slow, languor and sorrow, sighs and despair. In harmony, all regular discords are prepared, struck, and resolved in syncopation. In the 2d, the syncope is in the base; in the 4th, 5th, and 6th, in the treble. But in melody, the syncope so much resembles what the French call défaillance, fainting, fainting, and swooning, that it seems to confirm the etymology to which we incline; as a tone in syncopation, however forcible and loud in the beginning, grows more and more feeble and faint to the end; particularly on flinged instruments incapable of sustaining a sound.

In our Music plates examples may be observed in the preparation of all regular discords.

SYNCPE, in Grammar, denotes an elision, or retraction of one or more letters, or syllables, from a word.

As when we say, virum for virorum, and manus alta mente repitum, for repitum.

SYNCPE, in Physiology and Medicine, fainting; a con-
SYNCOPE.

Considerable 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, and pain or fenefe of fulness in the stomach, giddiness, singing 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. Palpitation 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 circulatory 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 participating 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 continues dry, or becomes moistened with a cold and clammy sweat, 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, fenefation, 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 pernicious 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 it is to be wished it was possible. It is usually attended with an anxiety about the heart is often extremely distressing; there is usually some nausea, discharge of flatus, 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 fenefation, thought, and voluntary motion.

The various degrees in which this affection may occur, have given rise to a number of distinctions among medical men, which do not, however, appear to be founded on any real difference in the nature of the disease. Dr. Cullen has, therefore, with great propriety, placed the lipothyemia, aphthia, and delirium of former authors, under the same head of syncope: but it may, after all, perhaps, be doubted, whether fainting, which is to constantly a secondary affection, arising from a disorder of the state 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 depressmg nature. It is a symptom familiar to hypochondriacal and hysterical persons; and may be brought on in all those who have much mobility of nerves, by any sudden or violent emotion, paffion, or even strong fenefation. It is a very usual confluence 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 lusceptibility to prelusions made on the nervous system. But we find, even among men, frequent peculiarities of constitution, which, in spite of general strength of frame, dips them to faint from causes which appear to be of slight, and would be inadequate to produce any effect of the kind in others. The fight of blood, of a wound or sore, certain odours, or the presence of objects, such as a cat, a mouse, or a spider, for which a person has conceived an unaccountable antipathy, may give rise to every degree of this affection. The cause is sometimes to be sought for in the alimentary canal, disturbed digestion, worms, and other irritations acting upon the nerves of the stomach and intestines, which sympathize so extensively with the whole system, often produce a state of syncope in children and paralytic patients. Other causes act more directly on the circulation: as the sudden deplition of the blood-vessels by hemorrhage; or by large evacuations of any kind, such as purging, vomiting, or even sweating. 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. Causes which suddenly diminish the supply of blood to the head tend peculiarly to produce it in those who are disposed to it; 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 invasian of acute diffeites, such as fever, hooping-cough, the influenza, or the exanthemata; it prevails frequently during the progress of typhus, and is sometimes reduced to an alarming degree by atomic poison. 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 its vicinity. See Cardiacus.

This latter class of cases has been distinguished by Dr. Cullen as a dilatet species, under the title of syncope cardiae, while the rest are included under the general head of syncope occulans.

The pathlogy 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 shew that it begins with an affection of the brain, and must refer our readers to what has 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 chaming the temples with fumilant amonialical liquids, which may also be held to the nostrils when the breathing is not entirely suspended. If the fit were to continue any time, however, it would be proper to rub the body with hot cloths, to administer ephesers, and to employ, in a word, all the other means.
SYNCRETISTS, formed of συνεργός, I compare, or reconcile, 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 indifference or contempt; and they proposed to reconcile the jarring doctrines of these two famous Grecian sages, 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 faction, of which Ammonius was the original founder. Their feat 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 fables: they fell into the most childish superlatives, and followed, without either reflection or restraint, the extravagant dictates 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 principle of this pacific and uniting plan was founded on.

SYNCRITICA, a name given by some writers to such medicines as are of a coercive and alluring quality, whether used externally, or given internally.

SYNCRISMA, a sort of ointment of the nature of the acopa, in use among the ancients.

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second day; and by this kind of synecdoche, the plural number is sometimes put for the singular, as Mat. xxvii. 44; compared with Luke, xiii. 39: by the sixth 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 Ort. vol. ii. p. 2, &c.

SYNECHES, in Medicines, is the name of a fever of the next degree to the intermittent; it also seems to be something akin to thefe, and is called the continual 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 Synopis, p. 3.

SYNECHPHONESIS, or Sympheonesis, in Grammar, a coalition, by which two syllables are pronounced as one.

It is much the same thing as the synaloepha, or fenereis.

SYNECTICON, a word used by the old writers to express the proximate cause of a difcase: called also the causa contiones, and always remaining closely united with the difcase.

SYNEDRELLA, in Botany, a genus of Gartnër's, whose name appears to be a diminutive of synepha, a military flation, or camp, but we do not perceive its application. This genus is separated from Verbesina, 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 feed of these florets are fringed with teeth. But Swartz, who gathered the plant wild, describes a single calyx, without noticing any fuch peculiar formation of the radius, which he fays consists of four or five florets; see his Obf. Bot. 312. Whatever errors, therefore, may be laid on the naked receptacle, we feel scarcely authorized to follow Gartnër, who perhaps saw an imperfect or anomalous fpecimen 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 reembling Galepea Tribulata, is indeed unlike that of the genuine Verbesina.

SYNEDRIN, or Synedrio. See Sanhedrin.

SYNENMENON Tetrachord, in the Greek Music. See Greek Music, and Netē.

SYNERGASMA, formed of συν, and εργαζομαι, 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 fuch bodies as are of power to act on others as mendrumus, to cure difeafes, and the like; and the others producing no fuch things, but being necessfary preparatives to them.

SYNERGISTS, formed of συνεργος, co-operation, in Ecclesiographical History, a name given to those whole doctrine was almost the fame with that of the Semipelagians, and who denied that God was the only agent in the conversion of finful man, and affirmed, that man co-operated with divine grace, in the accomplishment of this falutary purpofe. The friends and disciples of Melancthon adopted expressions of this kind, in defcribing the nature of the divine agency in man's conversion; but the Lutherans confidered this representation as subfervive of the true and genuine doctrine of their matter, relating to the absolute fervitude 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 fyllen

of Melancthon, and Flacius maintained the ancient doctrine of Luther. Molheim Eccl. Hist.

SYNEUSIS, in Biography, was a native of Cyrene, in Africa, of noble extrac tion, who united the characters of a Christian bishop and heathen philosopher. He studied philosophy under the famous Hypatia of Alexandria; passed the early period of his life in secular employments; and from the year 397 to 410, refided at Constantinople as deputy from his native city to the emperor Arcadius. After his conversion to Christianity, he was elected bishop of the fee of Ptolemia in 410, though he was not then in orders, and thought himself unfit for undertaking such an office. He very honestly stated his objections in a letter to his brother; nevertheless, he was consecrated by Theophilus, primate of Egypt, who thought that a man whole 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 prebident Andronicus, who invented new modes of rapine and torture, and added facrilege to robbery. Syneusis had tried in vain mild and pious admonition, inflamed against him a sentence of excommunication, involving his associates and their families, and at the same time asked his intervift with the Byzantin court to bring the offender to submiflion; and this was at length effected. It is not known when this bishop died.

Several writings on different topics, and 155 epistles of Syneusis, all in Greek, are still extant. One of which is a free and liberal discourse, entitled "An Oration concerning Government, or the Art of Reigning?" another singular and ingenious piece is entitled "The Praise of Baldnefs." In his "Dion Praeclarus," to the praises of that eminent perfon, he adds an account of his own studies, and a defence of philologifical learning. He wrote "Homilies" and "Hymns," and a book on "Dreams," which is said to contain some curious remarks on the nature and fignification of fome phenomena. In his "Letters" are many historical paffages, fublime notions, and moral fentiments. The style of Syneusis is characterized as lofty and dignified, inclining to the poetical and rhetorical. The latter edition of all his works is that of Petau, Gr. and Lat. fol. Paris, 1612. Morei. Dupin. Lardner.

SYNESTIC, formed of συνεργος, I render confluent, is sometimes applied by physicians to express the tools when firm, and of a confidence; such as to make them remain in their shape, in opposition to liquid ones.

SYNGE, Edward, in Biography, an Irish prelate, fon of Edward, bishop of Cork, was born in 1659 at Inhono, near Cork, and from the diocefe-school at Cork, was removed to Chrift-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 precented, in 1714, to the fee of Raphoe; and as he had displayed much zeal in his attachment to the house of Hanover, he was transfefted, in 1716, to the arch-bifhopric of Tuam; on which occasion he generously surrendered the quarter-archiepiscopal parts of his fee, and procured an act for fettling them on the refident clergy of the diocefe. He was made a privy-counfeilor; and, in the abfence 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 evinced his piety and his attention to the concerns of his clerical functions.
functions. Some of these traits were very popular, and particularly his "Anwer to the Excuses Men make for not coming to the Holy Communion," which had reached the 211th edition in 1712. This prelate died at Tuam in 1741, having been the son and the nephew of a bishop, and the father of two bishops. B. G. Brit.

SYNGENESIA, in Botany, from κοσμοκρατες, together, and γενεσις, generation, alluding to the combination of the male organs, or anthers, is the appellation given by Linnaeus to the 11th class of his artificial system. This great class is, now, according to its general acceptation, one of the most natural possible; conferring on the compound flowers of preceding writers, whose anthers are united into a tube. It is equivalent to Jussieu's 10th class, comprising his three orders of Chloracacea, CinarocepbaU, and Cymbidifera.

The essential character of the Synge-nesia 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, confiding of several florets in one common calyx; each floret having flaments and a pilil of its own, or one of those parts, or neither; in other words, being perfect, male, female, or neuter. Linnaeus indeed admitted simple 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 subdivide the Linnean order of Syngenesia Monogama, and to conf its genera simply by their number of flaments.

The following are the natural characters of the Syn-genesis.

Common Calyx, in fact a perianthium, 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 row of leaves; or imbricate, 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 thinly, or more lax, and of a different form or aspect.

Common Receptacle, enclosed by the common calyx, supports several fertile florets. Its disk is either concave, flat, convex, conical, or globose: the surface being either naked, merely marked with flight dots; or villous, covered with upright hairs; or stuffy, 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 of the following parts.

Calyx crowning the germin, in the form of a simple, sometimes obsolete, border, or a series of five teeth, bifurcet, or hairs, becoming the pappus, or seed-down.

Corolla of one petal, with a long narrow tube, seated on the germin; and either tubular, with a bell-shaped five-cleft limb, whose segments are spreading or reflexed; or ligulatet, with a linear flat limb, directed outwards, entire, abrupt, three-toothed, or five-toothed, at the extremity; or deficient, being delimitate of a limb, and often of a tube.

Stamen. Filaments five, capillary, very short, inferted 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.

Pilil. Germin oblong, below the partial calyx and corolla, but above the common receptacle, erect; ifycle thread-shaped, erect, the length of the flaments, running through the cylinder formed by the anthers; filga in two revolute and divaricated segments or lobes.

Pericarp really none, though in some infirmes the seed has a corneous crust, with the Osphoroonum and Strennpse. 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 infirmes felisile, in others falked: or with five or more small scales or leaflets, originating from the partial calyxt. Sometimes there is no more than a feebly 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 confine 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 first, and they are all capable of varying into each other. The fame is the case with the fourth, fifth, and sixth, all closely allied to each other, though distinct from the first, 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.

On these differences, however, the Linnean Orders of the class Synge-nesia arc found. See Polygama.

1. Polygama equalis consists of sect. 9, 11, and 4.
2. Superflua of 2, 5, and 7.
5. Segregata has no exclusive character of any, being distinguished by its doubly compound flowers.

However natural the clas now under our consideration may be, it is not without exceptions or irregularities. Kulina, though a true compound flower in every part of its structure, has distinct anthers; which circumstance occurs, more partially, in Tuffillo. A few infirmes are found of genera in which the florets are, or more or less, univertically, four-cleft, with four flaments, and in one species of Siegesbeckia, they are three-cleft, with only three flaments; see that article and Echites. In the generic character of the latter, line 5th, for nearly, read "male on the outside." A still more paradologic exception occurs in our fifth species of Staphelina, see that article, which has solitary florets.

Linnaeus remarks, that Plumier has not founded one new genus of compound flowers; that Tournefort sought 4
out the most natural genera, though he wanted the information which has been supplied by later botanists; and that Vaillant has furnished more of this than any other perfon.

Jussieu 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 Jussieu 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 receptacles, with their appendages, has by that means been led, if we mistake not, to form unnatural and unuitable 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 florihouse 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 syngnathus is of Grecian origin, and is formed of the word syn, which in composition signifies the same as the Latin aequalis, equal; and gathos, a girdle. 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 moveable; gill-covers are large, flat, and closed; the spiracle on the nape is tubular; the body is jointed, and mailed with many-fid ed plates: it has no ventral fins.

The fish of this genus inhabit the ocean, near the shores; they feed on leffer worms and insects, and the spawn 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-fid ed 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 variegated with red 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 decussate bands; the fins are yellowish; the tail is composed of 45 plates.

*TYPHLE; the shorter Pipe-fish. Caudal, anal, and pectoral fins radiate; body fix-fid ed. This, by some writers, is considered as a variety of the tetragonus. 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 flender, sub-compressed; iris yellow; trunk with 18 plates; tail with 36; the vent is nearer the head; the fins are cincereous.

*ACUS; Needle-fish. This is also called the Great Pipe-fish, and the Heptagonal whitish Pipe-fish, with brown bands and plain-tailed. The caudal, anal, and pectoral fins radiate; the body is seven-fid ed. 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 flender form, gradually tapering towards the extremity, and is of a pale yellowish-brown colour, variegated throughout its whole length with broad alternate zones of a deeper or olive-brown, with a few smaller variegations intermixed; the cheeks or 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, hollow, and of no great extent; the pectoral fins are small, and slightly rounded, and the tail of similar shape and size. The eye are found lying in a longitudinal channel or divition 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 no anal fin; the body is seven-fid ed. There is a variety, the plates of whose trunk are 25, of the tail 32; the dorsal fin has 33 rays. It is found on the coast of the Cape of Good Hope, and in the Cufian sea; the body is of a yellow-brown, marked with transverse brown lines; it is generally found swimming among weed-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 dorsal and caudal are yellow.

AQUOREUS. Caudal fin radiate; it has no pectoral nor anal fin; the body is angular. It is found in different parts of the ocean.

*OPHIDION; Little Pipe-fish, or Pipe-fish with roundish body and finlets tail. This differs from the typhe, and the acus, in having the body nearly round, or at least ob Regulatory cornered as to appear round; it is also entirely detiute 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, finot short, vent nearly the head.

*BARBARUS; Longer Pipe-fish. This has neither caudal nor anal fins; the body is fix-fid ed. 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.

HIPOCAMUS. This species has no caudal fin; the body is seven-fid ed, tuberculate; the tail is square. This fish has a very angular appearance; it is generally from fix to ten inches in length; the body is much compressed; it is of a greenish-brown, varied with darker and lighter specks; the head is large and rather thick, and bifet on 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 flender, 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 finlets tip. In its dry or contracted state, this animal exhibits the fancied resemblance from which it takes its name, but in the living fish this appearance is somewhat lefs striking; the head and tail being carried nearly strait. It is a native of the Mediterranean, Northern, and Atlantic seas. Such
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Such are the species given by Gmelin. Dr. Shaw mentions two others; viz.

BIAULUS. This is named the Ferrugineus Pipe-fish, with quadrangular body, and two fins above the head. It is about six inches long; the body is somewhat broader in proportion to its length than most of the species; the dorsal fin is placed low on the back; the tail is hexagonal at its origin, gradually becoming tetragonal in its progress, and terminating in a fulcrid point or tip; the colour of the whole animal is rufous brown. It is a native of the Indian seas, and is often seen in the Baltic.

FOLIATUS; Foliated Pipe-fish. This is a most extraordinary species, far exceeding all the others in the singularity of its appearance, which at first view rather suggests the idea of some production of fancy, than of any real existence. It is longer in proportion, or of a more slender habit, than the other pipe-fish. Its great peculiarity consists in the large leaf-shaped appendages with which the back, tail, and abdomen are furnished; these appendages are situated on very long rough square spines or processes; and, were it not for the perfect regularity of their respective proportions, might be mistaken for the leaves of some kind of fucus adhering to the spines. The colour of the whole animal is of a dull or blackish-olive, thickly sprinkled on all parts, except on the appendages, with small round whitish specks; and accompanied by a kind of metallic gloss on the abdomen; the fins are soft, tender, and transparent. This curious species is a native of the Indian seas.

SYNOME, Συνομή, in Rhetoric, the same with concileion.

SYNGRAPH. See Chirograph.

SYNIZE, synizesis, blindness from a closure of the pupil. See Pupil, Closure of.

SYNNAS, or SYNADIMUS Marmor, 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 documenium marmor, with which the temple of Jupiter, erected by Adrian, was built; but this is erroneous, since that elegant marble was always characterized as perfectly white, without blemish; and this was always spotted and clouded with black, infomuch that some writers have called it by an epithet expressing those variegations, maculosa 

SYNNEUROSIS, in Anatomy, the connexion of parts by means of tendons.

SYNCHA, 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 synochus 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 συνοικία, convention, assembly, compounded of συν, with, and οικία, house, in Architecture, a conjunction, or concourse, of two or more houses or planets, in the same optical place of the heavens.

SYNOD, Synod, in Church History, a council, or a meeting, or an 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 prefixed 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 Samosataeaus; 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 673, and the last that was held by cardinal Pole, in 1555.

Provincial, where they of one province only meet, now called the convention 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. Those were not wholly laid aside, till by the act of submersion, 25 Hen. VIII. c. 19, it was made unlawful for any synod to meet, but by royal authority. See Council and Convocation.

SYNODS, Provincial, in the Government of the Church of Scotland, are composed of several adjacent presbyteries, 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 prolocutor. 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 consents of commissioners from presbyteries, royal burghs, and universities. A presbytery of twelve ministers, sends two ministers and one ruling elder; a presbytery of between twelve and eighteen, sends three and one ruling elder; of between eighteen and twenty-four, sends four and two ruling elders; of twenty-four, sends five and two elders; every royal burgh sends one elder, and Edin.

bury two; every university sends 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 representative, or commissioner appointed for that purpose.

SYNODALS, or SYNODORI, were pecuniary rents (commonly of 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 dio-

cesan synods at once.—For the same reason, they are sometimes also denominated synodalia; but, more usually, procurationes.

In all probability, this payment is the same with that which was anciently called "cathedriculum," as paid by the parochial clergy, in honour of the episcopal chair, and in token of obedience and submission 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 cathedriculum, that is two shillings," at the most, says the gloss, for sometimes less is given. Synodals 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. Gibbon.

Constitutions made in the provincial or diocesan synods, were sometimes called by the name of Synodals, which was required in many cases to be published in the parish churches.

SYNODALIS TITLES was an appellation anciently given to the
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the urban and rural deans; from their informing against, and attesting, the disorders of the clergy and people in the episcopal synod.

When these sunk in their authority, in their flend rote another fort of synodal witnesses, who were a kind of impunned jury, confulting of a priest, and two or three laymen, for every parish; though, at length, two for every diocefe were annually chosen; till, at last, the office came to be devolved on the churchwardens.

Some think our quedmen, who are affiliats to the churchwardens, were called feldmen, quasi fynodmen. See Sides-Men, and Quest-Men.

SYNODALE Inflammatum, a solemn oath, or engagement, that these synodal witnesses took; as our churchwardens now are sworn to make just preffentments.

SYNODENDRON, in Entomology, a genus of infects of the order Coleoptera. The generic character is as follows: Antenne clavate, the club lamellate; thorax gibbosus, muricate or unequal; lip fuliform, 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 unarmad.*

*MURICATUM. Thorax muricate, gibbosus; shells two- spined before the tip. It inhabits Europe and America, in wood. The shells are dull tectaceous, retuse behind, with a long hooked tooth at the future, and another ledge one at the margin; the antennae are tectaceous.*

*CAPRIFICUS. Shells entire, black; thorax rough before. It inhabits Coromandel. The thorax has numerous raised denticles before; the shells are naked, retuse at the tip.*

*DOMINICANUM. Smooth, black, dusky; shells lirate; legs pitchy. It inhabits South America, and is a very small infect. The head is black, bent under the thorax; the thorax is prominent before; shells entire, lirate.*

*SYNODICAL, Syncodem, something belonging to a synod.*

SYNODICAL Epifles, are circular letters written byynods to the abfent prelates and churches; or even those general ones directed to all the faithful, to inform them of what had pafled in the synod.

In the collection of councils are abundance of these synodical epifles.

SYNODICAL Month is the period or interval of time, in which the moon, departing from the fun 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 lunation; because, in the course of it, the moon puts on all her plafes, or appearances.

SYNODIES. See Synodals.

SYNODON, or CYNODON, in Ichthyology, a name given by several authors to fish caught in the Mediterranean, and more commonly known by the name of denex. It is a species of *ferra* in the Linnean Sytem.

SYNODONTIDES, in Natural History, the name of a fjonoe defcribed by the ancients, and faiid to be taken out of the head of the fish, called by them synodontes, the denex of the moderns.


SYNOECA, Syncem, in Antiquity, a feast celebrated at Athens, in memory of Thefeus’s having united all the petty communities of Attica into one single commonwealth, the feast of which was Athens; where all the assemblies were to be held.

The feast was dedicated to Minerva; and, according to the feholfift of Thucydides, it was held in the month Metaginition.

SYNONYMOUS, Synonymus, is applied to a word or term that has the fame import, or signification, with another. Accordingly, fynonymous words agree in expressing one principal idea; but generally, if not always, they express it with fome diversity in the circumfiances. They are varied by fome neceffary idea which every word introduces, and which forms the diftinction between them. Hardly in any language are there two words that convey precisely the fame idea. A perfon thoroughly converfant in the propriety of the language, will always be able to obferve fomething that diftinguifhes them. In the Latin language, no two words feem to be more decidedly fynonymous than amare and diligere; and yet Cicero, in his Epifles, has marked a very obvious diftinction between them. "Quid ergo tibi commendam cum quem tu ipife diligis? fed tamen ut flere cum non am diligi folunt, verum etiam amari, ob rem tibi hae feribo." Thus also tutus and fecurus, apparently fynonymous and liable to be confounded as fuch, have neverture a diferent meaning; tutus fignifying out of danger, and fecurus free from the dread of it. Seneca (Epift. 97.) has marked the difference, "Tuta fedeera ef a poont, fecura non poont." In our own language, many inferences occur in which there is a difference of meaning among words reputed fynonymous.

Dr. Blair has pointed out many of these. We may select a few: e.g. affertery, relating to the manner of living; fervenfy, to that of thinking; rigour, to that of punifhing. To the firit is oppofed eflemency, to the second, relaxation, to the third, clemency. Cufion refpects the action, habit; by cufion, we mean the frequent repetition of the fame act; by habit, the effect which that repetition produces on the mind or body. Pride makes us efteem ourfelves; vanity makes us defire the efteem of others: fo that it is juft to fay with dean Swift, that a man is too proud to be vain. Haughtiness is founded on the high opinion we have of ourfelves; disdain on the low opinion we have of others. We invent things that are new; we difcover what was before hidden; e.g. Galileo invented the telecope; Harvey difcovered the circulation of the blood. A difficulty embarraffes us; an obftacle fops us; we remove the one and furmount the other. Wifdom leads us to fpake and act what is moft proper; prudence prevents our fpaking or acting improperiy. A wise man employs the moft proper means for fuccefs; a prudent man, the fafest means for not being brought into danger. See other inferences in Blair's Lectures, vol. i.

Some fevere critics condemn all use of fynonymous terms in the fame period; but this is to condemn all antiquity: fo far is the ufe of them from being vicious, that it is frequently neceffary; as fynonmys contribute both to the force and clearnefs of the expreflion. If the firit word fletch out the refeemance of the thing it reprefents, the fynonym that follows is, as it were, a second touch of the pencil, and finifhes the image.

Indeed they must be used with great difcretion and economy. The fyllle muft be raised and brightened, not fuffed or loaded, with fynonymous terms. They muft be ufed as ornaments, and to render the expreflion the more forcible, without making a show of the riches of them, or heaping fynonmys on fynonmys.

But though fynonymous words in fome cafes may be laudable,
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landable, synonymous phrases are incurable; the reason is, that two synonymous phrases keep the mind at rest, and let it flag and languish.

The perplexity in the writings of the ancients, arising from the use of synonymous, as well as homonymous terms, is very great, when they use the same word as the name of two different things. The whole value of the accounts they have left us is lost, by our not being able to distinguish which of the two they mean.

The great source of this confusion has been in the love of secrets in medicine, which prevailed as strongly among the ancients as it does among the moderns. In order to conceal the remedies they used, they often gave them new names, and often (which was worse) used them for the names of other things.

Thus, they called the pine-tree _Pinus_ the universally received name of the willow, and so in many other instances; from which we have, at this time, the same word in use in different authors, as the name of different things.

Galen gives a prescription for baldness, in which almost all the ingredients are called by names wholly different from those that the rest of the world knew them by at that time, and by that means profited upon the vulgar for new-discovered medicines. The bay-tree is there called _Laodis_ the bear, _amophon brevis_, from the story of its young cubs being shaped with till kicked into form by the mother bear: the _la-danum_, or _labdanum_, is called _apatragopagan_, because of being gathered from the beards of goats; and the adare is called _pericaramitae_, from its being found concreted about a reed.

The composition of Philo, called _eboliz_ given in the fame author, is thus given in the enigmatical manner by the fame means. The more learned and ingenious people of these ages detected this idle practice, and gave all things their common names; but as the abridgments of one man will generally find followers in others of the fame famp, though the physicians defcarded the practice, the fucceeding race of chemifls, famous for their love of fecrets, continue and improved it to fo great a degree, that were their writings of any value, it would be wholly impoffible, in many of them, ever to arrive at the author's meaning.

The Arabian writers have fallen more into the use of _fynonyms_, and that in a more erroneous manner, than any other authors.

SYNONYMISTS, among the Botanical Writers, such as have employed their care in collecting the different names, or _fynonyms_, used by different authors, and reducing them to one another.

SYNONYMY, _Synonymia_, formed from _sva_ with, and _svs_, name, in _Rhetoric_, a figure by which synonyms, or synonymous terms, that is, various words of the fame, or nearly similar signification, are made use of, to amplify the discourse.

Such is that passage in Cicero. _Alii_, _curso_, _effugio_, _erupit_.

He went off, he escaped, he ran away, &c.

This figure sometimes adds force to an expression by enhancing the idea; and it often promotes the harmony and just cadence of a fentence, which otherwise would drop too soon, and disaffoxt the ear.

SYNOVIA, in _Anatomy_, the fluid sequestered in the cavities of joints, for the purpose of lubricating them. See _Membrane_, _Synovial_, and _Synovial Gland and Membrane_.

SYNSKAR, in _Geography_, a small island on the W. side of the gulf of Bothnia. N. lat. 60° 59'. E. long. 17° 3'.

SYNTAGMA, _Synvyanph_, the disposing, or placing, of things in an orderly manner.

SYNTAX, _Συντακτικ_, in _Grammar_, the construction, or connexion, of the words of a language into sentences or phrases. See _Sentence_.

F. Bufler more accurately defines syntax, the manner of constructing one word with another, with regard to the different terminations of them, prescribed by the rules of grammar.

Some authors, as M. Vanlegas, &c., confound syntax with _style_; but there is a real difference.

The office of syntax is, to confider the natural fuitableness of words with respect to one another; in order to make them agree in gender, number, perfon, mood, &c.

To offend in any of these points, is called to offend against syntax: and fuch kind of offence, when grotes, is called _fabulism_; and when more flight, a _barbarism_.

The feveral parts of speech are, with regard to language, what materials are with regard to a building. How well prepared forever they may be, they will never make a house, unless they be placed conformably to the rules of architecture.

It is, properly, the syntax that gives the form to language; and it is that on which turns the most effential part of grammar.

There are two kinds of syntax; the one of _concord_, in which the words are to agree in gender, number, cafe, and perfon: the other of _regimes_, or _government_; in which one word governs another, and occasions some variation in them. (See _Concord_ and _Regimes_.) The most comprehensive rule of syntax is that which we have numbered 20 under _Regimes_. 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 expreffion, which other rules, less general, cannot at all, or at leaft cannot so readily, determine. See this rule exemplified in a great variety of appropriate cafes, as in Murray's _Grammar_, vols. i. and ii.

SYNTENOSIS, a word used by anatomists to express an articulation of the bones when they are connected, as the offa feminooides of the toe, only by a tendon.

SYNTERICE, denotes that branch of medicine which is concerned in preserving of health.

SYNTEXIS, _Συντεχνις_, in _Medicine_, an attenuation, or colligation, of the fluids of the body; such as frequently happens in atrophies, inflammations of the bowels, colligative fevers, &c., in which a fatty and uliginous matter is voided with the excrements by froud. See _Colligation_.

SYNTHENA, a term used by Paracelsus to express an applectic 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 _exvulgo_, to make a crop, or harrefc, of itself; in allusion to its abundant produce, as well as its popular name of Cquip-grafs. This supposed genus, however, is the identical _Digitaria_ of Hiller, under which appellation it stands in Puriils _Flora America Septentriohnis_. We have followed Linnaeus in considering it as a section of the genus _Panicum_. See that article.

SYNTHESEE, _Συνθες_, formed from _sva_ with, and _vzis_, _politis_, _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.

F. Bufler, by his _synthesis_, or synthetic method, we purfue the truth by reafons drawn from principles before established or allumed, and propositions formerly proved; thus proceeding by a regular chain, till we come to the conclusion.

Such
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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 allo call composition, in opposition to analysis or reduction.

SYNTHESIS, in Grammar. See SYLLABLES.

SYNTHESIS, in Surgery, an operation by which divided parts are re-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 the lepated principles, either recompose 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 brandy, seck, glazi, 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 fome, 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 Lectures, p. 169.

Synthetic Method. See SYNTHESIS and METHOD.

SYNTHETISMUS, in Surgery, the reduction of a fracture.

SYNTONO, or DURUM, is the epithet by which Arit-roxenus expresses one of the two common diatonic genera of which the tetrachord is divided into a femi-tone and two equi-tones; whereas in the molte diatonic, after the femi-tone, the first interval is three-fourths of a tone, and the second two. See GENERA and TETRACHORD.

Besides the syntonic genus of Aritroxenus, called allo Diatono-Diaticone, Ptolemy has established another, by which he divides the tetrachord into three intervals: the first is a femi-tone major; the second, a tone major; and the third, a tone minor. This durum diatonic, or syntonic of Pto-lemy, 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 soon with a fingle glance, by the ratios of the intervals of which both the tetrachords are composed.

Syntono of Aritroxenus, \( \frac{c}{4} + \frac{c}{4} + \frac{c}{4} = \frac{3}{4} \)

Syntono of Ptolemy, \( \frac{c}{4} + \frac{c}{4} + \frac{c}{4} = \frac{3}{4} \)

“There were still other syntonicities,” says Roullèan, “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.”

SYNTONO-Lydian, in Greek Mufic, the name of one of the ancient modes. Plato says, that the mixo-lydian mode and the syntono-lydian, are plaintive, and proper to excite tears. Arifides Quintilianus gives a hint, in his first book, of the different Greek modes, which we must not confound with the ecclesiastical tones 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 confounded 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 fenfe that we must understand the fynotono-lydian mode mentioned by Plato, and of which we are unable to give any explanation. See PTOLEMY, and TEMPESTMENT.

SYNTONUM DIATONUM. See GENUS.

SYNTROPHIC, formed of \( \text{synt-} \), and \( \text{trophi-} \), I nourish, an epithet used to certain diseases, which grow up with the patient. Of this kind is the epilepsy, which often first excites the person in infancy, and continues growing up with him, and increasing in strength as he grows.

SYNULOTICA, medicines for healing of wounds.

SYNUSIASTES, SYNUSIASTES, SYNUSIITY, formed from \( \text{syn-} \), with, and \( \text{usia-} \), substance, a fect of heretics, who maintained that there was but one nature, and one fingle substance, in Jesus Christ.

The Synulists 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 reft, was there changed into blood and blood. Thus they taught that Jesus Christ was confubstantial to the Father, not only as to his divinity, but even as to his humanity, and very body.

SYNVMENISI, a word used by some chirurgical writers to express a conjunction of two bones by means of a membrane, as the bones of the fapcint are connected to those of the fore-head in young children.

SYPHAR, a word used by some naturalists in the fame fenfe as cæsvius, to express the fkins which many reptiles caft off at certain times. Thus the snake, the water-newt, and all the caterpillar tribe, part with their fkins during the time they remain in that fiate.

SYPHAX, in Biography, king of Mafcsylla, on the western part of Numidia, was engaged in the fcond Punic war on the part of the Romans against the Carthaginians, when he was defeated by Maffinilla, 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. Afdrubal, 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 fon as he found that his rival Maffinilla 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 Afdrubal, both camps were in the night furprized and burned by Scipio. Afterwards, in general engagement, the united Carthaginian and Numidian armies were defeated by Scipio; and Syphax, with the remnant of his forces, hafened back to his own country; but being pursed by Lælius and Maffinilla, he, together with his fon Vermina, was taken prifoner. Maffi-nilla then made a captive of Sophoniba, and married her, which was the occasion of a tragedy. Syphax was sent to Rome; and we learn from Polybius, that he was led in Scipio’s triumph, and died a few days afterwards in prison; but other historians fay that he was removed from Alba, his firft place of confinement, to Tibrus, where he died of grief before the return of Scipio from Africa. Univ. Hist. For other particulars, see CARTHAGINIANS and MAS-IFICATION.

SYPHILI. See LUES VENEREA.

SYPHON. See SYPHON.

SYPOBMA, in Geography, an island on the coaf 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 Amanzirifdin.

SYRA,
SYRA, the ancient Syra, an island in the Grecian Archipelago, which, though mountaneous, 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 salubrity, and in its fertility. It is thus extolled by Homer:

Euboe, omyki, omiklile, oteigor —

There is not a Turk upon the island: its inhabitants are all Greeks, and profess the Catholic religion. — Also, a town in this island, built upon the summit of a lofty hill, so remarkable for its conical form, that it may be compared to a vassugar-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. Near the port 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: 12 miles S. of Andros. N. lat. 37° 29'. E. long. 24° 52'.

SYRA, a town of Japan, in the island of Ximo; 12 miles N. of Uxama.

SYRACUSE, a sea-port town of Sicily, in the valley of Nota, formerly a superb 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 place, 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 2000 sail, and armies of 400,000 men; and to have contained within its own walls, what no city ever did 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 moll ignominious burgh.

Syracuse was built, according to Thucydides and Strabo, by Archias, one of the Heraclides, 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 marish, called Syraco. This flatly city contained within its walls, which were 18 miles in compass, four very considerable cities, as Strabo calls them, united into one, viz. Acradina, Tyche, Neapolis, and the island of Ortigia.

Acradina, for an account of which, see ACHRADINA, 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 Acradina and the hill Epipolae, 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 Ortigia, was joined to Acradina, Tyche, and Neapolis, by a bridge. The most remarkable buildings in this part were the palace of Hiero, which afterwards became the habitation of the Roman praetors; and two magnificent temples, 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 last 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 Libera or Pothina. The statue of Apollo Temnites, which was afterwards carried to Rome, is celebrated by Tully as the most valuable monument in Neapolis. Of these four cities, Ortigia 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 porticoes, temples, and palaces. The famous fountain of Arethusa rots in this island; but its spring is now dried up. (See ARUBHUS.) Near the city stood a hill, called Epipolae, (see Epipolae) exceedingly steep, and of very difficult access. When the Athenians besieged Syracuse, this hill was not included by a wall, and was not taken in after-ages, but defended by a fort called Labadalon. On Epipolae was the famous prison called Latium, which word properly signifies a "quarry." (See Labadalon.) Cicero has particularly described this dreadful prison, which was a cave 125 paces long, and 20 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 flung up in it, who had the misfortune to incur his displeasure. It now forms a noble subterraneous garden.

The whole city was encompassed 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 Lucia; both were surrounded by flatly edifices. The great harbour was above 5000 paces in circumference; and the entrance of it 500 paces wide; being formed on one side by a point of the island Ortigia, and on the other by the little island and Cape Plemmyrion, 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 Ortigia, 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 Ortigia, 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 galleys with his burning-glares. 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 refresh and of admiration to those who have visited Syracuse. Above Acradina was a third port, called the harbour of Troglitius. The river Anapias ran about one mile and a half distant from the city, and discharged itself into the...
great harbour. Near the mouth of the river, and about 500 paces from the city, stood a casle, called Olympia, from the temple of Jupiter Olympius, 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, Acerrina, 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, their successors, were become equally formidable to the Greeks, Africans, and Athenians. Dionysius the younger, who governed this city, kept in constant pay 100,000 foot, and 10,000 horse, besides a fleet of 400 sail.

The principal epochs of the history of Syracuse are as follow; though allowance should be made for the variations in the statements of differentchronologers.


It is not ascertained what kind of government first prevailed in the city of Syracuse. Athenians and Elion mention a person named Poliz, who reigned 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 Thrafulbulus, 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 tyrant. 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 fize of a colossus; and that, on the anniversary of the happy day on which they had regained their liberty, solemn games should be exhibited, and 450 bulls sacrificed, by way of thanksgiving to the gods, and all the people entertained and feated 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 any 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 intermeding 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 successes and defeats, 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 Cartha-ginians.

When Hamilcar gained the city of Agrigentum, after a siege of eight months, the whole island of Sicily was struck with terror; and many of the inhabitants forfaking their native cities, fled to Syracuse, where they were treated with great kindness, and the chief men among them made free. However, many of these refugees were Agrigentians, and they filled the city with their complaints against the Syracusan commanders, and they had betrayed Agrigentum into the enemy's hands. These accusations caused disturbances in Syracuse, which gave Dionysius a favourable opportunity for feizing on the sovereign power, and depriving the inhabitants of that liberty which they had long abused, 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 from Corinth and other cities of Greece a population amounting to above 10,000 persons. At the same time, great multitudes of people from Italy, and other parts of Sicily, joined Timoleon, who distributed lands among them gratis, 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, whom the Syracusans called the Amphipolus of Jupiter Olympius; the first who sustained this name and office being Calimenes. Hence arose the custom among the Syracusans of computing their years by the respective governments of these magistrates, which custom continued in the time of Diodorus Siculus, that is, in the reign of Augustus, above 500 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 new 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 a design of abolishing monarchy, and restoring the Syracusans to their ancient form of government, but was diverted from the execution of his purpose by one of his daughters, and at her instigation bequeathed the crown to his grandson Hieronymus, whose vices and cruelty gained occasion to the Syracusans very much to regret the death of his grandfather. Besides their hatred, which he incurred by his misconduct, the
he provoked the Romans by his contemptuous treatment of their ambassadours. The Romans commenced hostilities, and Hieronymus fell a sacrifice to a conspiracy among his subjects. Marcellus, who commanded the Roman army, besieged Syracuse 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 enforced the lating gratitude of the Syracusans to him and to his polleties. (See Marcellus.)

The conquest of Syracuse was soon followed by the reduction of the whole island. See Sicily.

The diocese of Syracuse is said to produce above forty different sorts of wine; 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 marathes 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 Dryden with respect to the climate, derived by tradition from the ancients, but the traveller does not vouch for the truth of it; that at no season the sun has ever been invisible during a whole day at Syracuse; 71 miles S. of Melfina, and 115 S.E. of Palermo. N. lat. 35° 51'. E. long. 15° 14'.

Syracuse, in Geography, a town of Saxony, in the Vogtland; 4 miles N.W. of Plauen.

Syré, a town of Norway, in the province of Christiania; 24 miles N.W. of Christiania.—Lady, a lake of Norway, in the province of Christiania; 50 miles N.N.W. of Christiania.—Alfo, a river of Norway, which rises near the mountain Lang, runs through the vale of Syre into the lake of Lunde, in the diocese of Christiania, and afterwards discharges itself into the sea, shooting like an arrow through a very contracted strait, between rocks; 20 miles W. of Syre.

SYRENS, SIRENES, in Antiquity. See Siren.

SYRENUSSE INSULAE, in Ancient Geography, Isles of the Syrens, islands of the Mediterranean, E. of the isle of Caprea, and S. of the promontory of Minerva. They are three rocks, said to be inhabited by the Syrens.

Syrja, a 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 Ararat; 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 those 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 Seleucid, 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 called Amanus Mons, inclining from the N.E. to the S.W. On this side, and near the sea-coast, is the strait or passage called Pylyc Syrie. Near Antioch, to the S., is a chain of mountains, which separates the course of the Orontes 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 Celso-Syria; the latter including a space of about 25 leagues in one direction, and 25 in another. The most considerable river of Syria is the Orontes, now called El-Afi. The Leontes we have already mentioned. The four ancient kingdoms comprehended in Syria, and distinguished by the Orientals, were those which had for their capitals Damascus, Zobah, Hamath, and Gehur. After the death of Alexander, Syria was divided into five large provinces, viz. Comagene, the Seleucidae, Celso-Syria, Phoenicia, and Judea. Adhering partly to this division, Strabo says that Syria comprehended four large nations, the Hebrews (or Jews), the Idumeans, the Gazzarens, and the Azotiters. The partitions under the kings of Syria gave occasion to a great number of provinces. Thoese belonging to Syria Proper, mentioned by Ptolemy, are the Comagene, Pieria, Cyrrhelaica, the Seleucidae, the Caffitodite, the Chaldeonic, the Chaldeic, the Apamaic, the Laodicene, the Mediterranean Phoentic, Celso-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 Euphratensis. Comagene was the most northern part of Syria, extending N.E. between mount Amanus, from the S.W. to the N.E., and mount Taurus to the N., and the Euphrates to the E. and S. The Euphratensis extended along the Euphrates, 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 fee. Celso-Syria formed the southern part of Syria, between the Libanes and Anti-Libanus. Its principal towns were Damascus, Abyla Lyfania, Soana, Paneas, Heliopolis or Baalbek, &c. Phoenicia of Libanus formed a part of Syria. The part called Lofdicene, or Laodicene, lay towards the N. Here were situated Laodiceas of Libanus; to the E. Emesa, where was a celebrated temple of the sun; to the N. Epiphania, called Hannah; to the W. Raphana or Rafehn; to the S., between the mountains, Lybium; N. of Lybium, and W. of Raphana, Demetrias or Acker; N.E. of this last place, Carion; and N.W. upon the Eleutherus, or Nahal-Rhibin, Mazara. The town of Andoa lay to the N. of Laodicene, and was traversed by the Orontes from S.E. to N.W.; here were situated Larilia or Shizar, on the Orontes; Apamea or Famiich, on the bank of a lake to the S., and surrounded by a lake; to the N.E. of Apamea were Marra and Androna; to the E. Caparae and Theleda. The Seleucidae comprehended the towns that lay on the sea-coast; such were Marathus or Maraka, Balatins or Belmias, Patmus, Gabala or Gebileh, and to the N.W., on a small promontory, Laodies ad mar, or Laodike. The tongue of land which advanced to the N.W. was called Cheroneus, having at its extremity Cape Ziret, and upon the northern coast a small fortress called Heraclea, or Monteburg; and at a small distance towards the E. a small place called Cathela. At a small distance towards the N., on the sea-coast, at the northern extremity of a small peninsula, was Pafodius. On the S.E. was the isle of Melibaza. 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 Scopus, and upon the northern coast of the peninsula was the town of Rhofas or Rofoes. W. of Rhofas, and at the mouth of the Pyramus, was Aegae; and between the mountains and the sea, the strait called Calpe.
SYRIA.

Pyle. The gulf bore the name of Iliacus Sius, from the town of Ilius, situated on the northern coast, and belonging to Cilicia. On the eastern coast were Myrianthus, or Alexandria, Alexandria-Cata-Ilium, and Alexandria towards Ilius, or Alexandria. In the midst of a valley, near a lake N.E. of Antioch, and on the course of a river, was a town called Hieracon, and more to the S., on a mountain, the fortress of Gindarus; to the W. was Gephyra, on a small river, and S.W. Pagae or Bagras. At a small distance to the S. was Antioch on the Orontes; and further S. was the place called Daphne, now Bait-el-ma. Towards the E. was Imma or Harem; and in ascending along the Orontes was a fine valley, leading to the W. mount Calius, upon which was a temple, in which were situatedPlanus or Blatus, and a little further to the S. Baccala or Bakas, once called Seleuco-Belus (Shage), which took its name from mount Belus, which almost shut up the valley on the S.

The Cyrrhetic region lay to the E. of Antioch, and was watered by the Chalus or Koeic; to the N. were Deba or Aia tab, and Ciliza or Kilis. Here were also Chauonia, Abarara, on the N.E., to the S.E. Regla or Sejour, and near S. of Cyrrhus, the small town of Azza or Ezaz, and S.E. Thura, once Artas or Iterib. South of Cyrrhetic, and N. of Chalidic, was Chalybitis, also called from Chalybeus or Berera, now Aleppo. N. was Mafena, E. Bannis, and Thiltauri in the mountains. Chalidic lay to the S., and joined Apamene. It took its name from Chalce (Kinefrin), situated at the place where the Chalus discharges itself into a small lake. To the E. was another lake, which, from the saltiness of its waters, was called Lacus Salius, and on the bank of which, to the N.E., was Gabbala or Gebul, and S.W. Thelmenius or Sermin. Ceso-Syria, in its most extensive sense, comprehended the whole country which was subject to the kings of Syria, from Seleucia to Arabia and Egypt. Syria of Damasc extended to the E., along the Libanus, and had Damas for its capital. Syria of Emath had Emath on the Orontes for its capital. Syria of the two rivers, or Mesopotamia of Syria, in Hebrew Aram Nahzaim, was comprised between the Eufrates and the Tigris. Syria of Maacha extended on the side beyond Jordan, and was given to Manasshe. Paleftine was called Syria when it was subject to the kings of Syria. Syria of Rohole was that part of Syria of which Rohole was the capital. This town was at the northern extremity of Palestin, and formed for some time a small state. Syria of Soba, called also Sobal, constituted a portion of Syria, the situation and extent of which are not now known. Syria of Tob lay in the vicinity of the Libanus; but its precise limits are not ascertained.

Syria, according to Ptolemy's arrangement, was bounded on the N. by Cilicia and part of Cappadocia, and towards the W. by the Syrian sea.

The government of Syria was for a long time monarchical; but some of its towns, which formed separate states, were republics. With regard to religion, the Syrians were idolaters. The central place of their worship was Hieropolis, in which was a magnificent temple, and near the temple a lake, that was reputed sacred. In this temple was an oracle, the credit of which the priests used every method to support. The priests were distributed into various classes; and among them were those who were denominated Galli, and who voluntarily renounced the power of transmitting the succession in their own families. The Syrians had bloody sacrifices. Among the religious ceremonies of the Syrians, one was that any one who undertook a journey to Hieropolis began with shaving his head and eye-brows. He was not allowed to bathe, except in cold water, to drink any liquor, nor to lie on any but a hard bed, before the term of his pilgrimage was fulfilled. When the pilgrims arrived, they were maintained at the public expense, and lodged with those who engaged to instruct them in the sacred rites and ceremonies. All the pilgrims were marked on the neck and wrists; the youths consecrated to the goddess the first-fruits of their beard and hair, which were preferred in the temple, in a veil of gold or silver, on which was inscribed the name of the person who made the offering. The flight of a dead person rendered a person unfit to enter into the temple during the whole day.

The dynasties of Syria may be distributed into two classes; those that are made known to us in the sacred writings, or in the works of Josephus, acknowledged by the Orientals, and the Seleucidian kings, successors of Alexander, with whom we are made acquainted by Greek authors.

The first dynasty comprehends the kings of Zobah, viz. Reboobam, Hadadezer, and Adrazar; the kings of Damas, viz. Rejen, Adad I. and II., Hazzon or Adad III., Tabrmon or Adad IV., Benhadad I. or Adad V., Benhadad II. or Adad VI., Hazael or Adad VII., Benhadad III. or Adad VIII., Adad IX., and Rezin or Rafe, or Adad X.; the kings of Hamath, viz. Toi or Tobi and Joram; the kings of Gehur, viz. Ammihud and Talmi. The second dynasty comprehends the succession of Alexander's successors; viz. Seleucus Nicator, Antiochus Soter, Antiochus Theos, Seleucus II. or Callinicus, Seleucus III. or Cearausus, Antiochus III. or Megas, Seleucus IV. or Philopator, Antiochus IV. or Epiphanes, Antiochus V. or Eupator, Demetrius Soter, Alexander Balas, Demetrius II. or Nicator, Antiochus, son of Balas, Dyodotus Tryphon, Antiochus VII. or Sidetes, Demetrius Nicator, Alexander Zebina, Seleucus V., Antiochus VIII. or Grippus, Antiochus IX. or Cyzicenus, Seleucus VI., son of Grippus, Antiochus X., son of Cyzicenus, Antiochus XI., Philip, Demetrius III., Antiochus XII., Tigranes, Antiochus XII., Tigranes, subject to the Romans, and in the year 63 B.C. Syria became a Roman province. See the several biographical articles for a further account of most of these kings, and more especially of the Seleucide.

Syria, in Geography, called by the Arabsians Barr-el-Sham, a province of Aftian Turkey, comprehending the whole space contained between two lines, drawn, the one from Alexandretta to the Eufrates, and the other from Gazz to the desert of Arabia, bounded on the E. by that desert, and on the W. by the Mediterranean.

This country is, in some measure, only a chain of mountains, which distribute themselves, in various directions, from 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 firs, larches, oaks, box-trees, laurels, yews, and myrtles, give them an air of liveliness which delights the traveller. On some declivities he even meets with cottages, environed with fig-trees and vineyards. The inferior branches, which extend to the northward of Aleppo, on the contrary, present nothing but bare rocks, without verdure or earth. To the south of Antioch, and on the fex-coast, the hill-sides are proper for the cultivation of tobacco, olives, and vines (mount Caurus excepted); but on the side of the desert, the summits and declivities of this chain are almost one continued series of white rocks. To-
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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 insupportable. 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, orange-trees loaded with flowers and fruit, while the lofty head of Lebanon is seen 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 Antioch, Aleppo, and Damascus, there are several weeks of frost and snow every winter; which arises from the situation of the country, still 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 parching blasts of the north and north-west, and feeced from the humid winds of the south and south-west. Besides, Antioch and Aleppo receive from the mountains of Alexander, and detta, which are within sight, an air which the snow that covers them so long, mall 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 dispersed 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 variety this province affords. Besides 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. Palecline abounds in lefamum, and doura as good as that of Egypt. Maize thrives near Babec, and even rice is cultivated with success. They plant sugar-canes in the gardens of Saide and of Bairout, and they 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, the olive-tree of Provence grows at Antioch and Ramla to the height of the beech; the white mulberry-tree confutes 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 winding 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; Alepo enjoys the exclusive advantage of producing pitaehos; 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-lion."
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known. The jackals go in droves, and in unfrequented places there are also hyenas and ouches; 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 caHdward, the air is light, pure, and dry; while on the coasts, especially from Alexandria to Jaffa, it is moist 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 wish for it to fall what they call their winter crops; 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, dourra, 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 2500 years we may reckon ten invasions, which have introduced into that country a succession of foreign nations: first, the Assyrians of Niniveh, who pillaging the Egyptians about the year 750 before the Christian era, within 60 years, obtained possession of almost the whole country lying to the north of the Chaldeans of Babylon, who having destroyed the power on which they were dependent, succeeded, as by hereditary right, to its possessions, and completed the conquest of Syria, except only the isle of Tyre. The Chaldeans were followed by the Periains, under Cyrus; and the Periains 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, feeling 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 Constanine. Such was its situation, when in the year 622, the Arabian tribes, collected under the banners of Mahomet, feizied, or rather laded it waSte. Since that period, torn to pieces by the civil wars of the Fatimites and the Omniades, wrestled from the caliphs by their rebellious governors, taken from them by the Turkman soldiery, invaded by the European crusaders, retaken by the Mamlukes 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 nobility of the people conquered by the Arabs, that is, the Greeks of the lower empire; the nobility 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, vulgarly called Schifmatics, or separated from the Romish communion; Latin Greeks reunited 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; Mutuials, distingahed from the by their religion; the Drufes, distingahed from the name reason; the Anfarians, who are also descended from the Arabs. To these people, who are the cultivators and settled inhabitants of Syria, must still be added three other wandering tribes, or patrons, viz., the Turkmans, the Curds, and the Bedouin Arabs: such are the different races dispersed over the country, between the sea and the desert, from Gaza to Alexandria. In this enumeration, it is remarkable that the ancient inhabitants have no remaining representatives; their distinguishing 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 cities, some individuals whose whole 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 Arabian countries, the dialects vary at every place. The Syrian may be, therefore, regarded as a dead language; for the Maronites, who have preserved it in their liturgy, and in their schools, understand very little of it, while they recite it. The Turkish language is only used, in Syria, by the military, persons in office, and the Turkman hordes. The Arabic of Syria is much harsher than 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 former class, with this difference, that the Turks reside only in the towns where they are in possession of the military employments, and the offices of the magistracy, and where they exercise the arts. The Arabs and the Greeks inhabit the villages, and form the class of husbandmen in the country, and the inferior people in the towns. The part of the country which contains the most Greek villages is the pachial of Damascus.

The Greeks of the Romish communion, who are much less numerous than the schifmatics, are all retired within the towns, where they cultivate the arts and commerce. The protection of the Franks procured them, in the late war, a decided superiority in trade, wherever there are European settlements.

The Maronites form a national body, which occupies, almost exclusively, the whole country comprised between Nahor-el-kelb (the river of the Dog) and Nahor-el-bared (the cold river), from the summit of the mountains on the north, to the Mediterranean on the west. The Drufes border upon them, and extend from Nahor-el-kelb to the neighbourhood of Sour (Tyre), between the valley of Bekaa and the sea. The country of the Motuialis formerly included the valley of Bekaa, as far as Sour; but this people, of late years, have undergone a revolution, which has reduced them almost to nothing.

As for the Anfarians, they are dispersed throughout the mountains, from Nahor-akkar as far as Antakia; they are distingahed into different tribes, such as the Kelbia, the Kadmonia, the Shamha, &c.

The Turkmans, the Curds, and the Bedouins, have no fixed habitations, but are perpetually wandering with their tents and herds, in limited districts, of which they look upon themselves as the proprietors. The Turkman hordes generally encamp on the plain of Antioch; the Curda in
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the mountains between Alexandretta and the Emphrates; and the Arabs spread over the whole frontier of Syria, adjacent to their desert, and even the plains of the interior parts of the country, as those of Palæline, Bekaa, and Galilee.

Syria is divided into five governments, or pachalics, viz., the pachalics of Aleppo, Tripoli, Damascen, Acre, and Palæline; the whole of which is, by a modern traveller, computed to bring into the grand signior's treasury the sum of 312,500sterling, and the produce of Syria is estimated at 1,281,250l. All the troops of the five pachalics united amount to no more than 5700 men. Syria is ruled by the same writer to contain about 5550 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, 476 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 faction 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 polISTORY 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 may dispose of all as matter, he owes his captive nothing, and grants what he leaves him as a favour. Such was this law among the Greeks and Romans, and among all those 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 Turkey. See PALESTINE.

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 Kebrouan, 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 are not allowed to repair them, unless by a permission which costs them very dear. A Christian cannot strike 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 slippers, white javelins, and every sort of green colour. Red for the feet, and blue for the drets, 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 coarce blue muslin, with a single white border. When they travel, they are perpetually stopped at different places to pay "kafars," or tolls, from which the Mahometans are exempt. In judicial proceedings, the oath of two Christians is only reckoned for one; and such is the partiality of the cadis, that it is almost impossible for a Christian to gain a suit. In short, they alone are subject to the capitulation, called "karadji," the ticket of which bears these remarkable words: "Duazz-el-ras," that is, (redemption) from cutting off the heads; 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 intercours 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 polisfession. 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 less uncertain and less ruinous; but every where the preference is given to property in money, as more easy to hide from the rapine of the depôt. In the tributary countries, such as those of the Druces, the Maronites, Haféya, &c., there exists a real property, founded on customs, 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 an 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 "waqf," that is, an endowment or donation of an estate to a mosque. The proprietor then becomes the irremovable guardian of his property, on condition of a fine, and under the protection of the professors of the law; but this act has this inconvenience, that, instead of protecting, the men of the law frequently devour the property; and, in that case, to whom are they to look for redress, since the embezzlers of the property are at the same time the distrutory of justice? For this reason, these lawyers are almost the only landholders; nor do we see, 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, artificers, merchants, military men, and those who fill the different departments of the law and juridical offices. 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 lieutenants, a distinction has taken place between the spiritual and temporal power, which has left only the shadow of authority to the interpreters of the law. Such is that of the grand mufti, 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 prefers to profecutors of the law a credit, of which they almost always avail themselves, to form a party of opposition. The sultan is served by an intendant, and the pachas venture too openly to thwart it in their provinces. In each city this party
party is headed by the muti, who derives his authority from that of Constantinople: his employment is hereditary, and not venal; which single circumstance has preferred more energy in this body than in all the others. From the privileges they enjoy, the families which compose it bear a considerable resemblance to our nobility, although its true type be the army. They resemble also our magnificry, our clergy, and even our citizens, as they are the only persons in that country who live on their rents. From them to the peafrican, the artificers, and traders, the descent is sudden; yet, as the condition of these three classes form the true standard of the police and power of an empire, we shall select the particulars best calculated to enable the reader to form just ideas.

The peafants in Syria, and also throughout the Turkish empire, are deemed fletes of the sultan, i.e. as the term imports, they are his subjets. Although he is master of their lives and property, the sultan does not sell men; he does not limit them to a certain spot. If he beallows an apanage on some grandee, it is not faid, as in Russia and Poland, that he gives 500 or 1000 peafants; in a word, the peafants are opprefled by the tyranny of the government, but not degraded by feudal titles. In order to venefuce the collection of the revenue more easy, sultan Selim, after he had conquered Syria, established a fingle territorial tribute, called the "Miri," (which fec.) This he established at an invariable rate, but the pachas and their agents have introduced a variety of changes, which produce all the effects of an augmentation. Practising numerous modes of oppreflion and extortion, the poorer classes of inhabitants cannot pay the mifi, and leaving their villages fly into the cities; but the mifi being unalterable, the burthen on those who remain becomes infupportable. Nothing is more deftructive to Syria, than the shameful and eXceflive injury customary in that country. When the peafants 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 circumstances, which we cannot detail, the condition of the peafants is extremely wretched. They are very reduced to a little flat cake of barley or dourra, to onions, lentils, and water. They are so little acquainted with dainties, that they eflen frong oil and rancid fat as delicacies. In the mountains of Lebanon and Nablous, in time of dearth, they gather the acorns from the oaks, which they eat, after boiling or roasting them in the ashes. In these circumstances, agriculture is discouraged; the husbandman is deteflute of proper implements; his plough is often no more than the branch of a tree, cut below a bifurcation, and used without wheels. The ground is tilled by oxen or cows, rarely by oxen. In districts like Palestine, exposed to the Arabs, the countryman mutt low with a mufket in his hand. The corn, before it changes colour, is reaped, but concealed in subterraneous caverns. The whole industry of the peafant is limited to a supply of his immediate wants; and to procure a little bread, a few onions, a wretched blue firt, and a bit of woollen, much labour is not neceffary.

The artificians and traders, whole property is more capable of concealment than that of the peafants, 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 existed in barbarous ages and uncivilized countries. Along the coaft there is not a harbour capable of admitting a vessel 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 neceffary in winter. The communication between one town and another is maintained by carriers, 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 liable to be feized by the minions of government. Every thing is conveyed on the backs of mules, asses, or camels. The camel is chiefly used on the plains, because he consumes less and carries more; his usual burden being about 750 pounds, and his food, fraw, brambles, pounded dates, beans, barley, &c. or any thing, in a word, which you chufe to give him. With a fingle pound of food, and as much water in a day, he will travel for weeks in fucceffion.

Here are no ins for the accommodation of travellers; but the cities, and commonly the villages, have a large build- ing called a Kat, or Caravanerai, which serves as an an- lymum for all travellers. The weights and measures vary in different districts; but the value of the coin is more fixed; and you may travel over the whole empire, from Kothmus to Aflouan, without experiencing any change in its denomina- tion. In order to venefuce the collection of the revenue, the value of the para, called also medio, fadda, kata, or mefria: its fixed is that of an English silver three-pence, and its value somewhat more than a half-penny. Next to the para are pieces of 5, 10, and 20 paras; then the zolata or iilote, which is worth 30; the piaffe, called kerfaff-afadi, worth 40 paras, or two flinthills and a penny; and the abou-keli, or piaffe of the dog, which is worth 60 paras. All thes coins are filver, with a considerable alloy of copper. The gold coins are the fequin, called dahab, or piece of gold, and also zahr- mahaboub, or well-beloved flower; this is worth 3 piaffes of 40 paras, or 6s. 3d. The fequin, called fondoucii, is worth 170 paras, but it is very rare. Besides these coins, which belong to the whole Turkish empire, some of the Eu- ropean specie have as much currency; such are the silver dol- lars of Germany, and the gold fequins of Venice. The dollars are worth in Syria from 90 to 92 paras, and the sequis from 205 to 208. The Venetian sequins are much valued on account of the ftrms of their fan&ard, and because they are much used for women's trinkets. The practice of weighing money is general in Syria, Egypt, and the whole of Turkey. Almost the whole commerce of Syria is in the hands of the Franks, Greeks, and Armenians: formerly it was engrossed by the Jews. France is fatid to have had the greatest trade to Syria of any European nation. The imports confifled in five principal articles, viz. the cloths of Langedoc, cochimel from Cadiz, indigos, luggars, and Welt India coffee; to which may be added hardware, caft-iron, fheet-lead, tin, Lyons laces, foap, &c. The returns confif almost wholly in cottons, either fpun or raw, or manufac- tured into coarse fluffs, in some flinks of Tripoli, in gall-nuts, in copper, and wool. The factories ufed to be feven in number, viz. Aleppo, Scanderbon, Lutakia, Tripoli, Saide, Acre, and Ramla. The arts and trades in Syria depend on a variety of circumstances. In the villages, the inhabitants, limited to mere necessaries, have no arts but those without which they cannot subsist. Each family manufactures the coarse cottons necessary for clothing. Every house 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- turing fluffs at Aleppo was borrowed from the Greeks, and by them probably derived from the ancient Oriental. The dyes are as old as the times of the Syrians; and the cement they use is, without doubt, that of the Greeks and Romans; in
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, cisterns, 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 in the side of a deep declivity: the funnel is filled with wood, which is let fire to; the bellows is applied to the inferior mouth, and the iron ore poured from above; the metal falls to the bottom, and is taken out by the same mouth at which the fire is lighted. Their muffle 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, if it is, 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 Psalms, if Chaldeans; 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 paucity of books. There are but two libraries throughout Syria, that of Marhanna 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 ridicule 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 anomalous habits of deportment, and a ferous, and even fanatical 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, London.

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 Ephasis.

SYRIA SABUARI. Pompey conquered Syria in the year of Rome 689, B.C. 65; and during the reign of Theodosius the younger, it was divided into two parts, one of which, having Apamaea for its capital, was called Sabuari, 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 Chaldean, which the learned divide into three different dialects, viz. 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 Chaldeans of Comagene, 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, Mafcefl, 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 Sidnian, 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 preserved it in their liturgy, and in their meditations, understand it very little of it, while they recite them. The Syriac language bears a near affinity to the Hebrew and Chaldee 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, Mafcefl 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.

The Syriac version, a version of the Old Testament, 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 skilful 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 is very much affixed; for as it had been written in 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 Chaldeans dwelling about mount Libanus. (See MARONITES.) Their liturgy is also in this language. It is used also by the Nestorians (see NESTORIANS), and also by the Jacobites. (See JACOBITES.) There is also another Syriac version of the Old Testament, made from the Hexapla of Ongen'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 Syrians "Pehito," that is, the literal, though in fact it is much less so than the new Syriac version. It has neither the glory of the adulterers, in the eighth chapter of St. John's Gospel, nor the celebrated palliace, St John, v. 7. The epistle to the Hebrews, though contained in all the copies of the Pehito, 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 Michaels. The old Syriac translator made his version from the carthellection 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 canon,
canon, it was afterwards translated into Syriac by a different person: who this person 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 Mofe 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 Wide man, and printed at the expense of the emperor Ferdinand I., under the care of Mofe and Wid man, assisted by William Poth. It was printed at Vienna in 1557; and in this edition the two lepitelis of St. John, the second of St. Peter, the epistle of Jude, and the Revelation of St. John, are wanting. This edition princeps will ever retain its intrinsic value. Tremel lius's edition at Geneva, in 1599, fol., is a copy of the former in Hebrew, and not in Syriac letters. The Antwerp edition in the fifth volume of the Biblia Regia is referred to the year 1571. There is another Antwerp edition in 8vo., in Hebrew letters without points, which may be considered as a supplement to the Hebrew bible printed by Plantin in 1573 and 1574; and there are also an Antwerp edition in 1600, and two other Antwerp editions printed in Syriac letters, the one in 1567, 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 Cuthon edition by M. Trost, in 1621, 4to., is printed in Syriac letters, with a translation and a collection of various readings, printed by Walton in the sixth volume of the London Polyglot. L. de Dieu published the Revelation of St. John in 1627, at Leyden, and reprinted it in 1643, in Syriac and Hebrew letters. Pocceke published at Leyden, in 1636, the four epistles wanting in the Old Syriac.

All these parts of the Syriac New Testament were collected and published in the Paris Polyglot, in Syriac letters. The Latin translations by Gabriel Sionta, 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 MSS. in the possession of archbishop Uther, but 1 John, v. 7, is faithfully omitted. The edition of Egidius Gatter, which appeared at Hamburgh in 1664, is generally used in Germany. A Syriac New Testament was published in Hebrew letters without points at Sulzbach, in 1684, by Christian Knorre of Rotenroth, which Schaff says is only a reprint 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 Schaff in 1709, and reprinted in 1717. The last Syriac version of the New Testament which we shall mention, was published at Leipzig in 1713, fol. in "Christiani Reinccei Biblia quadringuia." 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 perhaps unknown. The Syriac version coincides very much with the Latin, called the Vulgate, and with those ancient Greek MSS. which were 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 north 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 our printed text, and the MSS. of what is called 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. Lef frequently, though not seldom, does the Syriac version agree with the Coptic, and with those ancient MSS. that belong to the Alexandrine edition, sometimes when these differ from those of the Western edition. This similarity must also be ascribed to the high antiquity of those MSS., whereas the copies of the Greek edition are of a later date. Hence it appears that a reading, supported by the unity of the Syriac, and the Anciente MSS., 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 as genuine.

The learned are much divided in their opinions respecting the antiquity of the Syriac version; some referring it 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 Christianity was propagated at an early period in Syria and Mesopotamia, as that in which Abraham, a convert to Christianity, was king of Edessa, or from the eighth year after the birth of Christ to the year 45, that the Christian communities in those countries should have been dititute 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 yet he is known to be ignorant of Greek, and could have read the New Testament only in Syriac; the version, therefore, is prior to the age of Manes. Besides, it appears from the testimonies of Jerome, that the Syriac bible was in his time read publicly in the churches, for he says, Epherem the Syrian is held in such veneration, that his writings are read in several churches immediately after the lessons from the Bible. A very convincing argument for the antiquity of the Peshito, 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 Syrian church was divided into parties. Another argument in its 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 Testament, affords also a presumption in favour of its antiquity. In the last place, Ephrem, who lived about the year 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 urged against this early date are examined and refuted by professor Michaelis. Dr.
The speculations of Mr. Marsh, the editor of Michaelis’s Introduction to the New Testament, have 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 necessity, says Marsh, of a Syriac translation in the first century is not so obvious as Michaelis contends; though far 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 Peshito rests on the authority of a scholiast, ascribed indeed to Melito, but probably spurious, and written many years after his death; and if it were genuine, it would only avail to prove, that the Syriac version of the Pentateuch existed before the close of the second century. Again, Marcæus appears, on the authority of Bezuofre, 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 Syriac 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 Smelser have shown, that the canon was not formed before the middle of the second century. Previously to that period, therefore, the Syriac version cannot possibly have existed.

It cannot with certainty, or even probability, be determined who was the author of the Syriac version, for though the Syriacs ascribe it sometimes to the evangelist St. Mark, and at other times to Thaddeus, called by them Adæus, 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 Syriac 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 still extant that the Syriac version was written at Edessa, 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 Syriac, but which during many ages was the eastern metropolis of the Christian world. Michaelis commends the Peshito as the best translation of the Greek Testament which he had ever read; its language being the most elegant and pure, not loaded with foreign words, like the Phænomenon version and other later writings; bearing no marks of the fustiness 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 writer who translated into Syriac the rest of the New Testament. These books are not found in any MSS. of the Syriac Peshito; neither Nellorian 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 Iberia on this side of the Ganges. Some have ascribed it to Maraba, or Mr. Abba, or Mafrejan, who was primate of the East between the years 535 and 552, and translated the Old Testament from the Greek, though a translation had been already made.

The New Syriac, or Phænomenon version, was so called from Phænomenon, otherwise denominated Xenayas, bishop of Hieropolis, or Mabug, from the year 488 to 518; but Phænomenon 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 confounded and uncertain. Thomas of Racaeus, 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 Peshito; and it is his accurate.

Besides the Peshito and Phænomenon versions, it is probable that there existed other Syriac versions, with which biblical critics are at present unacquainted. The Nellorian 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 Chaldee, have a peculiar version, which we call the Karaseus. Professor Adler found at Rome a valuable Syriac or rather Chaldee 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 Chaldee. Aflamen, Bib. Orient. Michaelis on the New Testament, by Marsh, vol. ii. vol. iii. ed. 2. 1802.

**SYRIAC TUR.** See Year.

**SYRIACUM MARIS**, in Ancient Geography, a part of the Mediterranean sea, which bathed the coasts of Syria, according to Ptolemy.

**SYRIACUS LAPIS**, in Natural History, a name given by Aetius, and many other authors, to the petrifed spines of the cebini ovarii, called by us the Jew-flores, and petrified olives, from their likeness to an olive in shape, and called by the ancients tecalibus.

It has been a common opinion that this stone was good against the gravel and stone; but Aetius limits its efficacy to a particular cafe, 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 gross for belief, is yet given us by Pliny. In most of the common editions, the words lapis thus, lingentium frangit calculos; but all the best copies have it ingleanium; and the word ingleanium is only made by dividing the two perpendicular lines in the letter V.

**SYRIE PVLX.,** in Ancient Geography, a διήθης at the eastern extremity of the Mediterranean sea, by which they
Syr

passed from the gulf of Iblis into Syria, situated at the extremity of one of the branches of mount Amanus.

SYRIANES, in Geography, a tribe of Finns, who inhabited the district of Uiting-Velcho, in the governments of Vologda, of Perme, and Tobolsk. These people call themselves, as well as the Pernians, among and near whom they dwell, Komi or Komi-mart. Their language, which they have still preferred, much resembles the Pernian, and is nearly related to that of the Finns; in religion, mode of life, and general manners, they have approached to near to the Russians, that they are scarcely any longer distinguishable. In the 14th century, they, together with the Pernians, were converted to Chirilians. Tooket'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 fens as famdyx. Pliny makes it a composition of equal parts of finopis and famdyx; and Aetius 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 syringes, syringas, 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 Bahun's edition of Matthiolus, p. 854, it is recorded, on the authority of Cortusus, that this tree is called in Barbary Syringa; which De Theis writes firius, and fuppofes to be the real source of the Linnaean 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 purpofes, as well as for the fimpler, more ancient, musical ftruments. 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 1570, though not in that with the large cuts, of 1583, which much valuable matter is omitted. The Philosophus 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 fame purpofes. See Syringa in Clusius and Gerard.—Linn. Gen. 11. Schreb. 14. Willd. Sp. Pl. v. 1. 48. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 23. Vahl Enum. v. 1. 38. Gerin. t. 49. (Lilac.—Tourn. t. 372. Jull. 105. Lamarck Illudr. t. 7.)—Clafs and order, Diandria Monogyna. Nat. Ord. Sperma, Linn. Junc. 3. 1713. Gen. Ch. Col. Perianth inferior, fmall, tubular, of one leaf, permanent, bordered with four erct teeth. Cor. 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 heart-shaped, obtuse, eret, enclosed within the tube. Pfl. Germin superior, oblong; style thread-shaped, rising as high as the flamina; stigma eleven, taward. 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. caerulea fere; Clus. Hill. v. 1. 56. S. caerulea; Ger. Em. 1399. Lilac; Matth. Valgr. v. 2. 576. L. vulgaris; Poteau et Turpin Pl. Parif. 7. t. 5.)—Leaves ovate-heart-shaped. Stem arborescent.—Said to be a native of Peria. Dr. Sib- throrp found this tree wild among the shady rocks of mount Hymus, but not in Greece, nor its immediate neighbour- hood. 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 Lilacs introduced into the gardens of Germany, Holland, and England, about the middle of the 16th century, appear to have come from Constantinople. At present nothing is 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, when they blossom together in May. The Lilac refers to the height of a middle-sized tree, with opposite, round, smooth branches. Leaves opposite, deciduous, italked, smooth, entire, pointed, veny, of a full opaque green, without stipules; their length from two to three inches; their base heart-shaped, somewhat decurrent along the linear channelled foot- stalk. Cludery terminal, a foot long, very dense, obtuse, repeatedly compound, 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 segments, as well as their hue, the narrower sort being of that peculiar pale purplish-blue, popularly denominated a lilac colour; the broader kind is more purple. A pure white variety is common. Matthiolus is charged with annexing the oriental seed, called Ben nut, to his figure of the Lilac above cited. That he confounded the two plants is certain, but it seems to us that his drawing might altogether have been taken from the Syringa. See Hyperanthera, n. 2.

2. S. chinesis. Chinese Lilac. Wild. n. 2. Baum. 378. Vahl n. 2. Ait. n. 2.—Leaves ovate. Stem shrubby.—Native of China. Hardy with us, flowering in May and June. Of a much humbler stature than the former, with oval, 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 that, bears forcing well.


Native of Peria. Introduced into our gardens before 1640; Parking. 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 flender habit, four or five feet high, with opposite, italked, lanceolate, pointed, entire leaves, an inch and half long; occasionally becoming deeply pineatifid, which variety is much increased by layers. The flowers are larger than the Common Lilac, and equally fragrant, but fewer in each panicle, and less crowded. Their white variety is peculiarly brilliant and elegant. This species scarcely ever forms syringes 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. pericarpa).

In the first fort 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 spring following they may be taken off and planted out, as in the suckers. The shrill form 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 shrub-beries.

**SYRINGA of Pan.** See **SYRINGA.**

**SYRINGE,** formed from συρίγη, or syrinx, πίπα, an instrument serving to imbibe, or suck in, a quantity of any fluid; and to squirt or expel the same with violence.

The syringe is made of a hollow cylinder, as A B C D (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 imbibles moisture; and if no matter 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 flocking-pump; whenever 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 veysels of the parts of animals, to chew the disposition, texture, ramifications, &c. of them.

The syringe is an instrument, that is used both in the rarefaction 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. A B C D (fig. 9.) represents a small cylinder of brass about one-fourth of an inch thick, and of such a diameter as just to move upon and within 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 syringe 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, to prevent any liquid from passing out the syringe. In order to pass through the valve D, to pass by, but to stop all that endeavours to pass from C to D. The end of the syringe is made and represented at R (fig. 10.), has a piece like a bell, P P P P, 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 d, there must be another cylindrical piece g g, whose diameter is about 4th of an inch smaller than the other fixed 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 stoped by the valve at C) forward through the hole in the syringe into any place where it is intended to be driven. But when the rod is drawn up, 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 e. 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 bottom of the syringe, 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 fill in the direction a b, 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 l 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 inverting 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. Deftag. Exp Phil. vol. ii. p. 391.

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 depreting 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 flint seed placed within it. Syringes of this kind are sold by most of the philosophical instrument makers in London. Since this contrivance has been thought of, it has been proposed to make walking-flicks, furnished with similar syringes, so adapted to them, that a single stroke of the walking-flick 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, Deco, in Gardening,** a fine sort of syringe, centred for the purpose of throwing the water in a dewy manner over different fine sorts of fruit-trees. In hole-bound peach and cherry trees, after being hard frozen, 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 house shut in; as by retaining the dewy moisture upon the bark and buds of the trees, it nourishes
nourishes them both, makes the flowers much stronger, the fruit fets 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 can confidently assert, that these forts of trees, when managed in this way with the syringae and paint, will seldom be either hide-bound or attacked by insects. The young syringae 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 forts of plants.

SYRINGITAE, a flute mentioned by Pliny, and described as being always full of cavities. Some have supposed this author meant the octoeocera by this name; but it is more probable that he meant the flume we now call syringoides, or the pipe-flute.

SYRINGOIDES LAPIS, the pipe-flute, in Natural History, the name of a very beautiful foible substance, of which there are several different kinds. The tubuli marini, or cafes of four kinds, lodged in any solid substance of the foible kind, constitute what is called the lapis syringoides.

The most frequent kind is made of the common matter of the lunas Helmontii, or septaria, with tubuli of different kinds and dimensions in it; but the most beautiful fort is that made of the bottoms of chips, old boards, or piles of wood; 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 flume. This is usually of a blackish colour, and the pipes being of a pale yellow, the whole makes a very elegant appearance.

Some 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 becomes a mass of pyrites, with these pipes lodged in it in different directions. This has been called by authors pyrites syringoides.

SYRIGOTOMUM, in Surgery, an old instrument for operating on fistula in ano.

SYRIGOTOMY, a term used for the cutting for the fistula.

SYRINX, Gr. ; Fistula Panis, Lat. ; Siringa, Ital. ; Pan's Pipes, Engil.; an instrument composed of reeds of different lengths, glued or fastened together with wax, faid by the poets to be invented by Pan; and with respect to the syringa Panis of the ancients, it is observed by the editors of the Supplement to the first folio edition of the Encyclopædia, that Bartholomus, De Tibii Vet. l. iii. c. 6. has related his having seen at Rome, on a monument in the Farnefe palace, a syrinx with eleven pipes; the five first are of equal length, and consequently produce the fame tone; with six others of equal diameter, but of different lengths from the first five. " I confefs," 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 found at once. Is it not possible that these five pipes were half tones, and differed from each other in length fo little, as to feem 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 fagacious conjecture to imagine that any ancient instrument had five femi-tones de fuite. The chromatic tetrachord confined only of one femitone major, one minor, and a minor third. We faw 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 feen that there is no truffing to painters or sculptors for accurate drawings of ancient instruments of music. We have seen the syrinx, which had a regular series of fongs, ascending or descending, repreffing four of one length, and three of another; which of course would furnish no more than two different founds. Now the reeds that were joined together decreafed in this proportion; at the top, where they received the breath, they were all of the fame 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 truck against each other, are placed in the hands of fome antique figures in fuch a manner, that it would be impoffible to bring them in contact with the neceffary degree of force, without amputating, or at least violently bruifing, the thumbs of the performer.

The manner of playing on the syrinx by the ancients; under the title of fistula panis, is accurately described in a fingle verse of Lucrétius, lib. iv.

—— " Et fupra calamos unco percurre labro."

Bianchini (De Tribus Gen. Infrum. Maf. Vet.) thinks the syrinx the origin of the organ.

Bonanni (Gabinetto Armonico) calls the syrinx cinfolti pastoriali, the shepherd's whifhles.

The two fets of admirable performers on Pan's pipes, here at prefent, (1803) exalted the syrinx into a confent 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 thofe rude instruments. They have extended the fame beyond the ancients fyfima profifium, maximum immutatum.

SYRIS, in Ancient Geography. See Siris.

SYRITES, in Natural History, a name used by fome for the fapphire; but by Pliny for a flume, which he fays was generated in the bladder of a wolf.

SYRITTA, in Geography, a town of Bengal; 8 miles S.W. of Goragot.

SYRUS, a word used by fome authors for a very ftrong purge, a preparation of fcammony; being no other than a reinf or magiftry of that drug.

SYRMA, among the Romans, a long garment, common to both sexes, that reached to the ground. It was used in tournaments, that the perfons of the heroes and heroines might appear the taller. Pitifc, in voc.

SYRMAEA, a name given by the ancients in general to a certain root, faid to be of the radifh-kind, and to be frequently used to promote vomiting.

Some have made it also the name of a fort of viand, prepared of honey, the fine fat of animals, and other ingredients, which was the prize forrowed at one of the Spartan games; others have used it to express a purging potion, made of falt and water, or plain brine. The Egyptians frequently purged themselves with this radifh-juice and falt, which operated gently both upwards and downwards, and these potions were called by the fame name syrma.

SYRMAES, in Antiquity, was used as a denomination of the games at Sparta, the prize in which was syrmaea, or a mixture of fat and honey.

SYRMAESMUS, a word used by the ancient medical writers to express a gentle purging of the fomach or bowels, either by fluid or vomit, it had its name from syrmaea, a word expressing a medicine that acted in this gentle manner.

SYROS,
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 Syrinx, which—also, a town of the same island.—Also, a town of Aiga Minor, in Cretan—Also, a river of the Peleponnesus, in Arcadia.

SYRTE, an island situated between Sicily and the coast of Africa.

SYRTES, the Syrtis, two gulfs on the northern coast of Africa, one called "Syrtis minor," on the coast of Byba-cene; the other called "Syrtis," or "Syrtis major," on the coast of Cyrenaica, near the gulf of Sydra. The appellation, if it has not a more ancient oriental etymology, seems to be derived from the Greek συρτος or σφικτος, 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.

Mela, in speaking of the lesser Syrtis, says, "Syrtis finus est caustum fere melha passum quia mare accipit patens: trecenta, qua cingit. Verum importuus atque aetos, et ob vadamum frequentiam brevia magique etiam ab alternos motus Pelagi ad fluentis et refuentis infernalis."

Of the Greater Syrtis he says, "Tum Leptis altera et Syrinx, nomine atque ingendo pariori: celerum altero fere itpasi quo desiderat quae flexum agit, amphiorn. Eius promontorium et Bryun ab eoque incipiens ora, quam Lopaphagi tanum dicuntur, utque ad Phycynta (et id promontorium et) importuovus littore pertinet.

SYRP, SYRUP, or Sirupas, 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 sugar or honey.

Menage derives the word from the Arabic, esherubah, portion: from the root shureb, to drink. Others derive it from the Greek συρτος, I draw; and σφικτος, juice. Ethlius, from σφικτος, and σφικτος; in regard these kinds of liquors were much in use among the Syrians, a very delicate people. According to D'Herbelot, the words sirup, and shereb, or forbe, come both from the Arabic sherebah, which signifies any kind of drink in the general.

There are various kinds of syrups, denominated from the various spirits, e.g. spirits, 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 sugar or honey.

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Syrup, 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 holifes, pills, and eletuaries. 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 seems 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 just 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 way else, because all faults 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 destructible 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, 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 bain marie, till the sugar is dissolved; which, to hasten the solution, should be reduced to powder.

Secondly, the decoctions of all such vegetable substancces 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 balsamic 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 rule 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; therefore they shall first stand a day or two, and then they will pass through a flannel; after which these are to be made into syrup with an eighth part less than twice 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 faccharine 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 mixture of sugar and water before boiling. The albumen coagulates as the syrup boils, and, involving the impurities which the sugar contained, rises to the surface in the form of a foam, which must be carefully removed. If too much sugar be used, or if the syrup be too long boiled, the sugar forms crystals; and if it be in too small proportion, the syrup quickly ferments, and becomes accecnt. The most certain test of the proper consistence of a syrup is its specific gravity, which, when cold, should be 1.355. 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 Londe. 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 foam, and if it has any facets, pouring off the clear part from them.

The simple or common syrup of the Edinb. Ph., is prepared by dissolving 15 parts of purifled sugar powdered in eight parts of water by a gentle heat, and boiling it a little fo as to form a syrup. Syrups, for neither the weight of sugar nor the mode of dissolving it is specified, are thus prepared:...
SYRUP.

prepared; add 29 oz. of refined sugar, finely powdered by
degrees, to one pint of the liquor preferred; and digest
with a moderate heat, in a clofe vessel, till it is diffolved,
frepeatedly stirring it; let the solution stand for 24 hours, take
off the scum, and pour off the syrup from the fæces, if there be
any. Simple syrup, properly prepared, should be inodorous,
sweet, thickflud, nearly colourled, and perfectly transparent.

**Syrupus Acidii Acetifii**, syrup of acetic acid, of Edinb.
Ph., is prepared by boiling 3½ lbs. of refined sugar in 2½ lbs.
of distilled vinegar, 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
gruel in fevers and inflammatory diseases.

**Syrupus Aiihs**, syrup of garlic, of the Dub. Ph., is ob-
tained by macerating one pound of garlic-root (bulb) in
two pints of boiling water, in a covered vessel, for 12 hours;
then adding the fæces to the strained liquor, and thus form-
ing a syrup. This, though disagreeable, contains the virtues
of garlic.

**Syrupus Altheae officinalis**, syrup of marsh-mallow, of
the Edinb. Ph., is procured by boiling 10 lbs. of water with
one pound of fresh root of marsh-mallow sliced, down to
one-half, and exprefling it strongly, and straining it: putting
aside the strained liquor, and when the fæces have fubfided,
adding it to the liquor; then boiling it fo as to form a syrup.
This syrup is fuppofed to pocfide demulcent properties,
which are trivial; and as it contains a small proportion of
fugar, it is foon spontaneously decomposed. The lubricating
virtues of this syrup may be fupplied by adding to the
common syrup a fufficient quantity of mucilage of gum
arabic.

**Syrupus Aurantii**, 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 pour-
ing off the liquor, and adding to it 3 lbs. of refined
fugar.

**Syrupus Citri Aurantii**, 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 fugar in powder to the strained liquor, and
exposing it to a gentle heat, fo as to form a syrup.

**Syrupus Aurantii**, syrup of orange, of the Dub. Ph., is
had by macerating 8 oz. of fresh peel of Seville oranges in
five pints of boiling water, for 12 hours, in a covered vessel,
and diffolving as much fugar in the filtered liquor as will
form a syrup.

A syrup equally agreeable and efficacious may be made by
adding 2½ oz. of tincture of orange-peel to a pint of simple
syrup.

**Syrupus Celosii 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 flices, in 16 oz.
of distilled vinegar, for two days, fhaeking the vehicle occa-
sionally; then exprefling and gently straining the liquor,
and adding to it 26 oz. of refined fugar in powder; and
then boiling a little, fo as to form a syrup. With the sub-
fitution of syrup for honey, this preparation is fimilar to
cymel; and the dose is 3½ oz. increased gradually to 7½ oz.
or more.

**Syrupus Cruci**, syrup of faffron. See Saffron.

**Syrupus Diasii 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
fugar in powder to the strained liquor; and diffolving it
with a gentle heat, fo 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 frefh petals, freed from the claws, in fix pints of
boiling water, in a glafs vessel; and diffolving a fufficient
quantity of fugar 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 teft of the genuinenefs of the syrup.

**Syrupus Limonis**, syrup of lemon, of the Lond. Ph., is
made by diffolving 2 lbs. of refined fugar in a pint of
strained lemon-juice.

**Syrupus Citri Medicae**, olim Syrupus Limonis, syrup
of lemons, of the Edinb. Ph., is prepared by diffolving five
parts of refined fugar in three parts of strained lemon-juice,
after the fæces have fubfided, fo as to form a syrup.

**Syrupus Limonis**, syrup of lemon, of the Dub. Ph., is
made by putting two pints of exprifed lemon-juice, after
the fæces have fubfided, into a maffraff, and immerfing it
in boiling water for a quarter of an hour; straining it
through a fieve when cold, and making it into a syrup.
This is an agreeable syrup for acidulating barley-water or
other drinks in febrile difeafes: it is also an ufeful adjunct
for gargles in inflammatory fore-throat.

**Syrupus Morii**, syrup of mulberry, of the Lond. Ph., is
made by diffolving 2 lbs. of refined fugar in a pint of
strained mulberry juice, as for syrup. This is used for the
fame purpofes as the syrup of lemons, and has a better
colour.

**Syrupus Opii**, syrup of opium, of the Dub. Ph., is ob-
tained by macerating 18 grains of the watery extract
of opium in 8 oz. of boiling water, till the opium be diffolved;
and then adding fugar, fo as to make a syrup. This is an
ufeful anodyne for allaying the irritation which occasions
 cough in catarrh after the inflammatory symptoms are
abated, and for procuring fleep, in the difeafes of children.

**Syrupus Papaveris**, syrup of poppy. See Poppy.

**Syrupus Pectoralis**, syrup pectoral, a form of medicine
prefcribed in the late Lond. Ph., and intended to fland in
the place of the syrup of maiden-hair, and some others of
that kind. It is to be made thus: take leaves of English
maiden-hair dried five ounces, liquorice four ounces, boiling
water five pints; steep the ingredients for some hours, and
afterwards strain off the liquor; and when it is made clear
by fettling, add to it the neceffary quantity of fugar to
make it a syrup in the common way.

**Syrupus Rubiadas.** See Poppy.

**Syrupus Rhamni**, syrup of buckthorn, of the Lond. Ph., is
prepared by letting apart four pints of the fresh juice of
buckthorn berries for three days, that the fæces may fub-
fide, and straining it: adding to the strained juice ginger-
root fliced, 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
3½ pint, mixing the liquor, and adding 3½ lbs. of refined
fugar, as for making syrup.

**Syrupus Rhamni Cathartici**, syrup of buckthorn, of
the Edinb. Ph., is made by boiling two parts of the clarified
juice of ripe buckthorn berries, and one part of refined
fugar, fo as to make a syrup. This is a brisk cathartic;
but on account of the roughnefs of its operation, it is
feldom ufed, except as a horfe medicine. The dose is from
2½ to 3½, drinking freely of tepid demulcent fluids
during its operation. See Rhannis.

**Syrupus Roje**, syrup of rose. See Rose.

**Syrup of Sapum**, is an ancient medicament, the bafe
of which is apples, with juices of buglefo, anife, faffron, &c.
Thus called from Sapor, king of Perfia, who overcame the
emperor.
emperor Valerian, and who was supposed to be the inventor of it.

SYRIPUS Saccharum. See Sugar.
SYRIPUS Scille Maritima. See Syrups.
SYRIPUS Sena. See Sena.
SYRIPUS Sulphur. See Sulphur.
SYRIPUS Tolbutan. Syrup of Tolu, of the Lend. Ph., is prepared by boiling 1 oz. of the balsam of Tolu, in a pint of boiling water, for half an hour in a close vell, frequently stirred it, and draining the liquor when it is cold; then adding 2 lbs. of refined sugar.
SYRIPUS Tolufera Balmaini, vulgo Syrups Balmainus, Syrup of Tolu, commonly called balmatic syrup, of the Edinb. Ph., is obtained by adding to 2 lbs. of common syrup, immediately after it is made, and before it is quite cold, 1 oz. of tincture of balsam of Tolu gradually, and with frequent stirring.
SYRIPUS Viole Odorate. Syrup of violet, of the Edinb. Ph., is made by macerating a pound of the flowers of the odorous violet in four pounds of boiling water for 24 hours, in a covered glass or glazed earthenware vessel; then draining without expression, and adding 7s. lbs. of refined sugar in powder, so as to make a syrup.
SYRIPUS Viole, syrup of violet, of the Dub. Ph., is prepared by macerating for 24 hours, 2 lbs. of the fresh petals of the violet, in five pints of boiling water; then draining the liquor through fine linen with expression, and adding a sufficient quantity of water to make a syrup. This syrup has a deep blue colour, and a very agreeable flavour; but the colour is injured by keeping, and hence the syrup is often counterfeited with materials which have a more permanent colour, and which are more easily obtained. The fraud is detected by adding a little acid or alkali to a portion of the suspected syrup; if it be genuine, the acid will change the blue colour to red, and the alkah to green; but if it be counterfeit, there will be no such changes. This syrup acts as a gentle laxative when given to infants; but it is chiefly used as a tinct of acids and alkalies.
SYRIPUS Zingiberis, syrup of ginger. See Ginger.
SYRTITES, in Natural History, is used by some authors as the name of a gem of a very beautiful appearance, in the substance of which are interperfed faint flars of a saffron colour.
SYRUS LAPIS, a name given by the writers of the middle ages to a foil, seeming to be the fame with the thyrous of Pliny.
SYSINA, in Geography, a town of Sweden, in Tavalland, on the Pajana lake; 25 miles E. of Jamfn.
SYSSEACOSIS, in Anatomy, the connection of parts by means of mucus.
SYSSEL, in Geography, the apellation by which a district is distinguished in Iceland. The island is divided into four large departments, called "amts": the northern, southern, eastern, and western amts. These are subdivided into districts, called "byllfe", and the byllfe into parishes. The southern amt contains 4 districts; the western amt contains 5; and the northern and eastern amts contain 6 districts or byllfe. In all these districts, the total of farms is 478; of families, 7401; of farmers, 5821; of hirings having grafs, 400; of those without grafs, 590; of priests, 231; of civil officers, 45; of males, 21,476; of females, 25,731; and of total inhabitants, 47,207. It appears from the general results of the estimates for the years 1804 and 1805, that the population is on the increase in Iceland. The excess of the female population is very considerable; and the average longevity of the women is greater than that of the men.
The population has varied little during the last 100 years.
VOL. XXXIV.
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 recovered, 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. Astron. 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. Astron. fig. 16.

System, Tychonic, 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 sun 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 embarrassed 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. Astron. 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 occupies 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 bear 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 arises a kind 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. Astronomy; and for another view of it, to Plate XXI. Astronomy, fig. 1. This last cited figure comprehends the orbits of all the primary planets, and of three of the comets. The parts of the orbits represented by entire lines are on the north of the ecliptic, and the dotted parts on the south; the letters A and P denote the apogee and perigee. The point in the centre, which ought to be only \( \text{\frac{3}{4}} \text{th} \) of an inch in diameter, represents the sun. The figures of the respective planets shew their comparative magnitudes, that of the sun being represented by the innermost of the graduated circles which inclose the whole: they are placed according to their actual situations on the 14th of June, 1806. The letters M D shew the mean distance of the comet of 1759, being placed at the extremity of the lesser axis of the ellipse in which it must be supposed to revolve.

The periodical times of the different planets are represented in Plate XXI. Astronomy, 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 in the lowest line: and the places of the ascending nodes of all the planets are marked in fig. 4, on one half of the ecliptic, supposed to be extended in a right line; together with the inclinations of their orbits. The line marked E E E E shews the situation of the fixed ecliptic.

The annexed table shews the elements of the solar system.

"Tabular"
### 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 distance 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 diameter, as seem from the Earth.</th>
<th>Mean diameter, that of water being 1.</th>
<th>Proportional quantities of matter.</th>
<th>Distant rotations round their own axes.</th>
<th>Inclinations of axes to the ecliptic in 1789.</th>
<th>Inclinations of orbits to the ecliptic in 1789.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Sun</td>
<td>88,3246</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mercury</td>
<td>3,124</td>
<td>3,700,000,000</td>
<td>38,710</td>
<td>10</td>
<td>16</td>
<td>94</td>
<td>0.1954</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Venus</td>
<td>10,857</td>
<td>68,000,000</td>
<td>72,333</td>
<td>58</td>
<td>30</td>
<td>54</td>
<td>0.8899</td>
<td>-</td>
<td>-</td>
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<tr>
<td>The Earth</td>
<td>79,117-73</td>
<td>95,000,000</td>
<td>100,000</td>
<td>-</td>
<td>17.2</td>
<td>-</td>
<td>1</td>
<td>1800</td>
<td>1802</td>
</tr>
<tr>
<td>The Moon</td>
<td>2,182</td>
<td>95,000,000</td>
<td>100,000</td>
<td>31.8</td>
<td>4.6</td>
<td>4.1</td>
<td>0.025</td>
<td>19.7</td>
<td>44.5</td>
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<tr>
<td>Mars</td>
<td>4,189</td>
<td>34,000,000,000</td>
<td>152,563</td>
<td>27</td>
<td>10</td>
<td>3.3</td>
<td>0.0875</td>
<td>24.3</td>
<td>29</td>
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<tr>
<td>Ceres</td>
<td>10'24</td>
<td>260,000,000</td>
<td>27,600</td>
<td>1</td>
<td>6.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pallas</td>
<td>80</td>
<td>266,000,000</td>
<td>279,100</td>
<td>0.5</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Juno</td>
<td>1425</td>
<td>275,000,000</td>
<td>26,700</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Vesta</td>
<td>238</td>
<td>225,000,000</td>
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<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Jupiter</td>
<td>89,170</td>
<td>450,000,000</td>
<td>52,079</td>
<td>39</td>
<td>37</td>
<td>1.4</td>
<td>312.1</td>
<td>90.5</td>
<td>390</td>
</tr>
<tr>
<td>Saturn</td>
<td>79,042</td>
<td>600,000,000</td>
<td>95,4072</td>
<td>18</td>
<td>16</td>
<td>0.4</td>
<td>97.7</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Georgium Sidus</td>
<td>351,12</td>
<td>1,800,000,000</td>
<td>190,8352</td>
<td>3.54</td>
<td>4</td>
<td>0.028</td>
<td>16.84</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table continued.**

<table>
<thead>
<tr>
<th>Names of the Planets</th>
<th>Tropical Revolutions.</th>
<th>Sidereal Revolutions.</th>
<th>Place of Aphelion in January 1800.</th>
<th>Motion of the Aphelion in 100 Years.</th>
<th>Longitude of the ascending Node in 1790.</th>
<th>Motion of Nodes in 100 Years.</th>
<th>Eccentricities, the mean Distances being 100,000.</th>
<th>Greatest Equation of Centre.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Sun</td>
<td>D. H. M. S.</td>
<td>D. H. M. S.</td>
<td>S. D. M. S.</td>
<td>D. M. S.</td>
<td>D. M. S.</td>
<td>D. M. S.</td>
<td>D. M. S.</td>
<td>D. M. S.</td>
</tr>
<tr>
<td>Mercury</td>
<td>87 23 14 32.7</td>
<td>87 23 15 34.6</td>
<td>8 14 20 50</td>
<td>10 7 59 11</td>
<td>9 8 40 12</td>
<td>0 19 35</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Venus</td>
<td>224 16 41 27.5</td>
<td>224 16 49 10.6</td>
<td>10 5 79 11</td>
<td>1 21 0</td>
<td>0 14 26 18</td>
<td>0 31 18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Earth</td>
<td>355 5 48 49</td>
<td>355 6 9 12</td>
<td>9 8 40 12</td>
<td>0 19 35</td>
<td>0 19 35</td>
<td>0 19 35</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Moon</td>
<td>686 22 18 27.4</td>
<td>686 23 30 35.6</td>
<td>5 2 24</td>
<td>4 51 15</td>
<td>1 17 38 38</td>
<td>2 20 58 40</td>
<td>0 46 40</td>
<td>14183.7</td>
</tr>
<tr>
<td>Mars</td>
<td>1681 12 9 0</td>
<td>-</td>
<td>4 25 57 15</td>
<td>in 1802.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ceres</td>
<td>1681 12 9 0</td>
<td>-</td>
<td>4 25 57 15</td>
<td>in 1802.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pallas</td>
<td>4° 210°, or 4° 77&quot;</td>
<td>1703 16 43 0</td>
<td>10 1 7 0</td>
<td>in 1802.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Juno</td>
<td>5° 182°</td>
<td>7 29 49 33</td>
<td>7 29 49 33</td>
<td>in 1804.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vesta</td>
<td>8° 60°</td>
<td>2 9 42 53</td>
<td>2 9 42 53</td>
<td>in 1804.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Jupiter</td>
<td>3° 182°</td>
<td>6 11 8 20</td>
<td>6 11 8 20</td>
<td>in 1800.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saturn</td>
<td>4332 14 39 2</td>
<td>4332 14 27 10.8</td>
<td>1 34 33</td>
<td>in 1800.</td>
<td>3 7 55 32</td>
<td>7 55 32</td>
<td>0 59 30</td>
<td>25013.3</td>
</tr>
<tr>
<td>Georgium Sidus</td>
<td>30637 4 0 0</td>
<td>30737 18 0 0</td>
<td>11 16 30 31</td>
<td>in 1800.</td>
<td>1 2 12 70</td>
<td>1 44 35</td>
<td>9 0840 4</td>
<td></td>
</tr>
</tbody>
</table>

Height of the Atmospheres of the New Planets, according to Schroetter.

- Ceres: 675 English miles
- Pallas: 468
### SYSTEM.

#### Elements of the solar system.

The sun, ʘ, revolves on his axis in 25° 10'. The inclination of his equator is 7° 23'. The place of its ascending node, ʘ, 2° 18', or 78° from the equinoctial point Aries. His diameter is 883,000 English miles, and his density, to that of the earth, 58. 255 to 1. His mean apparent diameter is 31° 57'; his mean parallax 8° 75.

<table>
<thead>
<tr>
<th>Mercury ʘ</th>
<th>Venus ʘ</th>
<th>Earth ☉</th>
<th>Mars ☉</th>
<th>Juno ☉</th>
<th>Pallas ☉</th>
<th>Ceres ☉</th>
<th>Jupiter ☉</th>
<th>Saturn ☉</th>
<th>Georgian Planet ☉</th>
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</thead>
<tbody>
<tr>
<td>1801.</td>
<td>1802.</td>
<td>1803.</td>
<td>1804.</td>
<td>1805.</td>
<td>1806.</td>
<td>1807.</td>
<td>1808.</td>
<td>1809.</td>
<td>1810.</td>
</tr>
</tbody>
</table>

#### Inclination of the orbit.

| 7°      | 10° 51' | 13° 4' | 34° 38' | 10° 38' | 1° 19' | 2° 30' | 46°      |

#### Place of the ascending node.

| 1° 15° 58' | 2° 14° 58' | 1° 18° 2' | 5° 21° 4' | 5° 22° 31' | 2° 21° 7' | 3° 8° 25' | 3° 15° 7' | 2° 12° 51' |

#### Mean distance.

| 3871    | 7233    | 10000  | 15237  | 26640  | 27650  | 27670  | 52028   | 95497   | 191536        |

#### Eccentricity.

| 795     | 50      | 168    | 1418   | 6770   | 6800   | 2170   | 2501    | 5364    | 8956.          |

#### Mean distance in millions of miles.

| 37      | 68      | 95     | 144    | 252    | 263    | 263    | 490     | 900     | 1800           |

#### Place of theaphelion.

| 8° 14° 22' | 15° 58° 37' | 9° 9° 30' | 5° 2° 25' | 7° 23° 11' | 10° 1° 3° | 10° 22° | 6° 11° 9' | 8° 29° 5' | 11° 17° 21' |

#### Mean place of the planet.

| 5° 11° 54' | 0° 9° 57' | 3° 9° 40' | 2° 3° 51' | 1° 13° 3° | 18° 13° | 1° 6° 12° | 3° 22° 9' | 4° 15° 18° | 5° 27° 47' |

#### Motion of the node in longitude in 100 years.

| 1° 12° | 52° | 47° | 4° | 5° 37° | 26° |

#### Motion of theaphelion in longitude in 100 years.

| 1° 34° | 1° 21° | 1° 44° | 1° 52° | 1° 35° | 1° 50° | 1° 28° |

#### Tropical revolution.

| 8° 42° 3° | 22° 46° 16° | 17° 5° | 17° 3° 21° | 4° 12° 4° | 4° 21° 4° | 4° 22° 4° | 11° 31° 4° | 29° 16° 4° | 8° 29° 4° |

#### Sidereal revolution.

| 8° 42° 15° | 22° 46° 16° | 17° 6° | 17° 3° 21° | 11° 31° 4° | 29° 16° 4° | 8° 29° 4° |

#### Diameter in miles.

| 3180 | 7600 | 7916 | 4120 | | | | 86000 | 79000 | 34200 |

#### Diurnal rotation.

| 23° 21° | 23° 56° 4° | 24° 39° 21° |

#### Proportion of diameters.

| 300.301 | 15.16 | | 12.13 | 10.11 |

#### Mass, that of the sun being unity.

| 1.000 | | | | |

#### Density.

| 258 | 104 | 220 |

#### Mean apparent diameter.

| 16½ | 9½ | 40½ | 18½ | 4½ |
SYSTE M.

The obliquity of the earth's equator to the ecliptic is \(23^\circ 28'\); its secular diminution \(50''\); its periodical change in a revolution of the moon's nodes, \(9''\) each way; the annual precession of the equinoxes is \(50''\); 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, \(d\), is \(5^2 6'\); the place of the ascending node \(13^\circ 56'\); the mean distance 248,000 miles; the eccentricity 13,700 miles; the place of the apogee \(21^\circ 26' 7'\); the moon's place \(3^1 15' 2'\); the diurnal motion of the node \(10''\); its tropical revolution \(18^\circ 28^\circ 4^\circ 52' 52''\); its sidereal revolution \(18^\circ 223^\circ 7^1 17''\); the tropical revolution of the apogee \(8^\circ 31^\circ 8^\circ 34' 57''\); its sidereal revolution \(8^\circ 312^1 11^h 11'\); the moon's tropical revolution \(27^\circ 7^1 43' 3''\); its synodical revolution with respect to \(\odot\), \(29^d 12^h 44' 3''\); its diameter 2163 miles; its mass \(742\); its apparent diameter \(29^d 22^h 10''\) to \(33^d 34''\); the horizontal parallax \(53^\circ 46''\) to \(61^\circ 26''\); at the mean distance \(37^\circ 1''\).

The sidereal periods of the satellites, and their distances in semi-diameters of the planets are: Jupiter's \(1^d 14^h 18^m 27^o 33''\). D. 5.67. II. \(3^d 13^h 13^m 42^o 34''\). D. 9. III. \(7^d 3^h 24^m 33''\). D. 11. 18. IV. \(16^d 15^m 32^o 8''\). D. 25. 5. The third, which is the largest, is about the size of the moon. Saturn's ring \(10^h 32^m 15''\). D. 2.33. I. or VII. \(22^h 37^m 23''\). D. 3. 27. II. or VI. \(8^h 51^m 8''\). D. 4. 2. III. or I. \(21^h 18^m 26''\). D. 4. 9. IV. or II. \(2^h 17^m 44^o 51''\). D. 6. 3. V. or II. \(4^h 12^m 25^h 11''\). D. 8. 75. VI. or IV. \(1^h 2^m 4^1 16''\). D. 20. 5. VII. or V. \(7^h 7^m 53^o 43''\). D. 59. 15. The longitude of the nodes of the ring \(5^1 17^o 1'-1\), retrograding about \(35^\circ\) in a century. The Geocentric planet's \(5^d\). D. 12. 7. II. 8. 16. 5. III. 10. D. 19. 5. IV. 13. 5. D. 22. V. 38. D. 44. VI. 108. D. 88.

A Table of the Chronology of Astronomers.

<table>
<thead>
<tr>
<th>HERMES 1140. B.C.</th>
<th>CHIRON 950.</th>
<th>BABYLONIAN OBSERVATIONS 716.</th>
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<tr>
<td>700 B.C.</td>
<td>600</td>
<td>500</td>
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<tr>
<td>THALES</td>
<td>PYTHAGORAS</td>
<td>MET US EPICTAS ARIS PHILOLAUS TIM RUS. TYLLUS OCHIRYS ARISTARCHUS APOLLONIUS P. ARCHIMEDES ERATOSTHENE</td>
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<tr>
<td>S. HIPPARCHUS.</td>
<td>CAESAR. SOSTHENES MANILUS</td>
<td>PTOLEMY</td>
</tr>
<tr>
<td>100</td>
<td>400</td>
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<tr>
<td>THEON</td>
<td></td>
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<tr>
<td>500</td>
<td>900</td>
<td>1000</td>
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<tr>
<td>MAMOUN ALBATEGNI</td>
<td>IBN JUNIS</td>
<td>COCHEOKING</td>
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<tr>
<td>1500</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>U. LUGH BEICH</td>
<td>COPERNICUS</td>
<td>WILLIAM H. TYCHOBRAHE</td>
</tr>
<tr>
<td>R. NAPIER. HOOKER</td>
<td>GALEON NEWTON.</td>
<td>KEPLER FLAMSTEED</td>
</tr>
<tr>
<td>S. BIRD. BRADLEY.</td>
<td>GRAHAM K. L. R. DOLLOND.</td>
<td>RAMSDEN MASKELYNE HERSHEL</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 Agricola to Werner and Hauy; and some account is given of the principles of classification on which the different systems are founded. Notwithstanding the labor 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 profiles 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 elements.

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 forms." (Introduc. à l'Etude 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 classed in an arbitrary manner.

In every system of classification, it is proposed either to afford 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 classed. The first is called the artificial mode of classification; the latter, the natural. Some mineralogists regard the former as underriving the name of 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 species 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 distinct systems; the one which should arrange minerals according to the appearances and properties in which they may be sharply 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 Dr. 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 Proportions." The views which Berzelius has disdosed are novel and highly important, and may ultimately give an entirely new form to the science. He defines mineralogy to be that science which treats of the elementary combinations of inorganic substances, found in or upon the earth, and of the various forms and the different admixtures under which these bodies make their appearance. The knowledge of the combinations themselves, their composition and chemical properties, belongs to chemistry, so 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 be that of mineralogy also. If this has not hitherto been the case, it may be attributed to the incipient state of chemistry, but 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 such as have inflammable bodies, or salts for bases; and by electro-negative, the oxygen and oxids 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 sour 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,
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Thus, in the union of two acids, the weaker serves as a basis to the stronger; and every combination of two or more oxides, poiffeles the 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 of an inflammable or earthy 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 less frequently two acids and one base, refembling the two claffes of double salts in chemistry. It is not uncommon to find 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 affines the character of a science. We immediately discover a numerous clafs of minerals, the similarity of which to salts had already been pointed out by chemists, though they were unable to make a more extensive application of these refemblances. This clafs consists of minerals in which fex acts the part of an acid; it contains an endless variety of single, double, triple, and quadruple fults of different degrees of neutrality, or with excess of acid or bafe. Thus also oxyl of titanium, oxyl of tantalum, and several metallic oxides, not considered as acids, occasionally act the part of acids; and so that the whole of the extensive range of earthy minerals may be classed on the same principles as fults.

That fexyl performs the functions of an acid in the mineral kingdom, was an opinion advanced by Mr. Hume so early as 1805, and he adduces the neutralizing effects of fexyl on alkalies in the formation of glafs as an illustration. (See Silicates.) Berzelius regards this new view reflecting the combinations of fexyl with different bases, as the most important step which mineralogy has ever made towards its perfection as a science.

The circumstances 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 fubstance of which a folution contains itself, or with which it is saturated, forms the crystal; but this crystal includes parts of the folution between its planes, which not uncommonly 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 1 per cent., and sometimes less; and 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 doctrine 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 arragonite owes its peculiar form to a particle of fritolin 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 falt alum. If, says he, we were to go no farther than to consider this falt as consisting of potash, alumina, sulphur, hydrogen, and oxygen, we should, in a scientific view, derive but little advantage from such a statement. We come a step nearer the nature of the compound, when we consider it as composed of sulphuric acid, alumina, potash, and water. This was long regarded as the composition of alum; hence it was called a triple falt, as consisting of three principal ingredients. The next step to a more perfect knowledge of alum, was the considering it as consisting of sulphate of potash, and sulphate of alumina, with water of crystallization. The doctrine of chemical proportions completed our knowledge of this falt, 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 clafs 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 till 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 expedition of the nature of minerals, conformable to the improvements of chemical science.

Silex 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 silex supplies the place of an acid, (being the electro-negative ingredient,) throws the greatest light over the rest of mineralogy. The minerals of this order are the most numerous, and he has given to them the name of silicates. Silex, as an acid, poiffles the property of forming silicates of many different degrees of saturation. The most general are those in which the silex contains the same quantity of oxygen with the base. These he denominates simply silicates. When the silex contains three times the oxygen of the base, they are called trisilicates. When twice the oxygen, disilicates. But when the base contains more oxygen than the silex, they are called fusilicates, and are designated by the term bis, ter, &c. to announce that the base poiffles twice or three times the oxygen of the silex. 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 at this time that he calculates the oxygen in the following earths and alkalies as under:

<table>
<thead>
<tr>
<th>Substance</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>lime</td>
<td>38</td>
</tr>
<tr>
<td>harytes</td>
<td>28</td>
</tr>
<tr>
<td>soda</td>
<td>10.5</td>
</tr>
<tr>
<td>potash</td>
<td>25.66</td>
</tr>
<tr>
<td>water</td>
<td>17</td>
</tr>
</tbody>
</table>

In 100 parts of silex or sile: - - - 49.64

alumina - - - 46.7
magnesia - - - 38
lime - - - 28
harytes - - - 10.5
soda - - - 25.66
potash - - - 17
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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 Trifilicate, a mineral from Adolf,ors, analyzed by Hasslinger.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Proportions</th>
<th>Calculated Proportions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>57.77</td>
<td>28.75</td>
</tr>
<tr>
<td>Lime</td>
<td>35.50</td>
<td>9.80</td>
</tr>
<tr>
<td>Alumina</td>
<td>1.83</td>
<td></td>
</tr>
<tr>
<td>Oxyd of iron</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Lofs</td>
<td>4.83</td>
<td></td>
</tr>
</tbody>
</table>

The above are examples of simple silicates; but Berzelius states that silicates resemble other acids, forming also double salts or silicates; and we most frequently find that the bases which have a tendency to produce double salts with other bases do the same with flexes.

Example of a double silicate. Trifilicate of Potash and Lime; the Isalopohilamite of Werner. Apophyllite of Haüy. It contains

<table>
<thead>
<tr>
<th>Compound</th>
<th>Proportions</th>
<th>Calculated Proportions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>24.82</td>
<td>22.82</td>
</tr>
<tr>
<td>Alumina</td>
<td>23.28</td>
<td></td>
</tr>
<tr>
<td>Potash</td>
<td>18.02</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>13.43</td>
<td></td>
</tr>
</tbody>
</table>

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 latter three times the oxygen of the bases. It is composed of one particle of trifilicate of potash, and five particles of trifilicate 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 siliceous minerals, and in estimating their proportions; and we may make a similar application of the same principles to other minerals.

The mineralogical arrangement proposed 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 potassium, and placing every compound body according to its most electro-positive ingredients. But he observs, that in the present state of science, we must be content with an approximate arrangement. He divides simple 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.
   Sulphur.
   Nitricum, or the radicle of azote.
   Muratic radicle.
   Phosphorus.

2. Metalloids.
   Fluoric radicle.
   Boron.
   Carbon.
   Hydrogen.

   Arsenic.
   Lead.
   Potassium.
   Nickel.
   Tungsten.
   Copper.
   Antimony.
   Uranium.
   Tellurium.
   Zinc.
   Silicum.
   Iron.
   Tantalum.
   Manganes.
   Titanium.
   Cirtium.
   Zirconium.
   Yttrium.
   Selium.
   Glucium.
   Bilnefus (uncertain).
   Aluminum.
   Uranium.
   Iridium.
   Magnesium.
   Platinum.
   Calcium.
   Strontium.
   Platinum.
   Barytium.
   Palladium.
   Sodium.
   Hydrogen.
   Potassium.

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 he divides into orders, according to the different electro-negative bodies with which the most electro-negative are combined. The characters, and the formula proposed by Berzelius to express in a concise manner the different mineral combinations, is unnecessary to state, as these 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 proposed 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 constituent ingredients from the mechanical admixtures which they may contain. If, indeed, chemistry should ever 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 undertake 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 proposed 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 constituent ingredients from the mechanical admixtures which they may contain.
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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.
Order 2.—Volatilizable wholly or in part by the blowpipe.

The minerals of these two orders are arranged as they are more or less volatile, have a metallic or non-metallic luster, are magnetic or non-magnetic, or are reducible to the metallic state.

CLASS III.—Earthy minerals.
Order 1.—Soluble wholly, or in a considerabe portion, in dilute muriatic acid.
Order 2.—Fusible wholly before the blowpipe.
Order 3.—Insoluble before the blowpipe.
The minerals of orders 1 and 2, are arranged according to their degrees of hardnes.

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 concomitant 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 fearfully 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 in the series 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 "in which moist easily befits" the first cultivators of every branch of natural science, and we are not to expect that geologists in the future will easily 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 sup-

porters of each not unfrequently disagreed in their inferences from the same facts, and also in their exposition 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 rested 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 subterraneous 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 these elements exit in the central recesses of the earth, or in what manner they are arranged, will perhaps forever remain unknown.

"A great essaying the feeble efforts of his slender proboscis against the side of the elephant, and attempting thereby to investigate the internal formation of that large animal, is (says Dr. Watson) no unapt representation of man attempting to explore the internal structure of the earth, by digging 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 substances ejected from volcanoes, 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 stones, of which the surface is principally composed.

The mean density of the whole globe, as ascertained by the observations of Dr. Mason, corrected by professor Playfair, is at least five times that of water. The experiments of Mr. 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 lime-stone, 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, 5320 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. Mason 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.

From observations made on the vibration of pendulums in different parts of the globe, M. De la Place has recently inferred, that the layers or beds of which it is composed, regularly increase in density as they are nearer to the centre. These facts and inferences comprise all our present knowledge respecting the internal part of the earth.

The structure of the external part of our planet is exposed to observation in the intercourses 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

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gular rife to the surface in an inclined position. It is probable that the total thickness 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 facts 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 Neptunists. The celebrated professor M. Werner of Freiberg has given to these opinions a regular systematic form; hence the Neptunist theory is more frequently called the Wernerian sytem 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 Huttonians and Plutonists, and their theory has been called the Plutonian system.

Mr. Jameson describes the lime-stone formation, as it occurs in the primary, and secondary, and fossil rocks, to illustrate a principal formation suite. The first member of the lime-stone suite is the white granular lime-stone, which occurs in the first member of the sires, the variegated lime-stone, which has left translucence than the preceding, but more than the following members of the sires. This lime-stone shows the first trace of petrifactions. The following rocks, the flint (or fratured), contain the third member of the sires, the grey flint lime-stone, which is scarcely translucent on the edges, and is full of petrifactions. It has some resemblance to the lime-stone of the transition period, but only a very remote one to the primitive. Chalk is the newest formation of this 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 earliest to the latest periods, in which we observe a gradual disappearance of the crystalline, and increase of the sandy aspect, corresponding with the relative age of the different members of the sires, and the state of the sediment, from which they were precipitated, and all serving as proofs of the immensity, but gradual, alteration of the state of the universal waters.

As the waters, according to this system, covered the whole globe during the formation of the primitive and oldest transition rocks, neither land-plants 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 Transition Rocks.) The first relics of land-plants 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 the younger formation 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 deposits from the earliest to the newest, we find, says Mr. Jameson, such differences in them, as show 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 precipitations, are composed principally of siliceous, argillaceous, and magnesian earths. These rocks, as granite, gneiss, and mica-flate, contain metals that are of contemporaneous formation with them, and that scarcely occur in newer periods; these are tin, molybdenum, 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-stone, and the occurrence of coal and salt, and the disappearance of the old and the appearance of new metals. Besides the general faeces discovered in the productions of different periods, we have inclusions of the repetition of certain products at considerable intervals, and in formations of different eras. 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.

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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 Fiesite.) The nature and position of these rocks bear a similarity to that of many volcanic rocks. They are denominated in the Wernerian system overlying 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 newest flat 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 turbulent 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 menstruum.

Nor can this objection be removed, by supposing the aqueous fluid to pollefs 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 stood so high over the whole earth?" To this objection, which is flated in the words of Mr. Jameson, 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 truth, and yet, although we 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 affirms; whereas, if the water, which deposited the primary rocks, covered the globe in a calm and quietest stop, 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 this 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 fearfully 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'Aubrillon. 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 eminent 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 the identity, nor the univerfality of such formations, has at least established an important fact, that processes of a nearly similar 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 causes 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 cavens 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, exiled on our continents at the very period of their birth; they effects of those catastrophes that fractured the strata of which these continents are composed. A success-
system.

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 transports of loose materials diminished in proportion to the progress of vegetation on the surface, when its sponginess was 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 causses which produced these changes, for they are still operative, and if studying them with care, we may ascertain all that have effect in any particular place. We may even trace, says: M. de Luc, what each cauze has effect 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 attesting 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 strata were precipitated) into the interior parts of the globe; hence also resulted a cauze of succive 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 affirmed to explain the fractures and deprehe of its surface, but is at variance with the atertained mean densiμ of the earth. It must be acknowledged that the theory of M. de Luc has some advantages over that of Werner, as it alligas a cauze for the retiring of the water, and the elevation and deprehe of the flarata; whereas, in the system of Werner, the present inclination of the flarata is supposed to be coeval with their first formation, a supposition which seems contradiμted 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 saperities are smoothed down or covered with vegetation; and the proceedes now taking place have a regular and progressive tendency to bring the fald parts of our planet into a quiecent and permanent state.

Plutonian or Huttonian System.—The Huttonian system of geology does not carry us back to the original formation of the globe. Dr. Hutton, its author, supposes that the preλent dry land was at a former period the bed of the ocean. According to this theory, the strata were not precipitated from a chemical solution, on the contrary, they exhibit proofs that the fulidences of which they are composed exist 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 so generally diffused, as to leave no doubt (says Dr. Hutton) that all the strata were formed from the materials of continents that previously existed, and that these materials have been carried into the sea by the fames causses which are now wearing down our present continents. Every island or continent, he observes, has two extremities, the mountain-fummit, and the sea-shore. On the one extremity there is no increafe, but a conflant decay. The rocks being split into fragments by the agency of heat, friott, and moifure, these fragments are removed by rains and torrents in gradual succellion, from the highest fitation to the loweft, and are further broken in their deffeet. Having reached the shore, they are dashed by the returning tides upon the coast, and serve as the instruments of its deftruction, aiding the violence of the waves in excavating and breaking down the fald ground. Thus the preλent dry land is constantly diminishing, and thus the materials of former continents were carried to the ocean, and sprawd over its bed, either in the state of gravel, sand, mud, or impalpable fement, covering the remains of marine animals by succive depositions. According to this theory, the agent by which these loft materials were formed into solid strata is subterranean fire, which is supposed to exist in the central recedes of the globe, and to have periods of increased activity, by which certain parts of its surface are heated and consolidated. The fame internal fire acting with great intenfity 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 maε continuing to expand, raised up the strata 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 fame difintegrating causses by which former continents had been wasted; valleys were excavated in the fofter beds by rains and water-courfes, and the ocean commenced its attacks upon the coast. Thus, materials are preparing for the formation of the strata of future continents to be raised from the ocean by the fame caufe. "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 fee 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 difcern neither a beginning nor an end; and in the planetary motions, where geometry has carried the eye to far, both into the future and the past, we discover no mark, either of the commencement or the termination of the prefer order. It is unreasonable indeed to suppose that such marks should any where exist. The Author of nature has not given laws to the universe, which, like the constitutions of men, carry in themselves the elements of their own deftruction; he has not permitted in
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 has no doubt gave a beginning, to the present syllable, at some determinate period of time, but we may fairly surmise that great catastrophe will not be brought about by the law of nature, 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 fritata incumbent on it. It is regarded by Dr. Hutton as a substance which has been eroded from great depths in a state of igneous fusion, burrowing through the fritata in some parts, and upheaving the whole from their submarine 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." In 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 conglomerate of parts, separately formed and agglutinated together. The perfect consolidation of granite may be ascribed to a further proof of its having been rendered fluid by heat; had it crystallized from an aqueous solution, we should have found interfaces between the crystals. The veins of granite which frequently shoot into the incumbent felsiclit, offer 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, "consider the proof of the igneous origin of all mineral substances as completed. Whence, 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 form (says professor Playfair) to be supported by all the evidence that is necessary to constitute the most perfect demonstration."

The other part of the conclusion, that heat was the cause of the fluidity and subsequent elevation of these mineral bodies, is, he admits, a matter of theory. "The cause, however, which is aligned 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 all the phenomena of metamorphism, above and 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 deserve a moment's consideration, if it were so artificially 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 fritata, and settling in an horizontal plane. The truth is, that his theory, at the same time that it conceives this stone to have been in fusion, supposes it to have been ejected in that state among the fritata already consolidated; to have heaved them up, and to have been formed in the concavity so produced as in a mould. The covering of the fritata thus raised up, may have been buried under 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 schistus incumbent on its sides. This schistus, forming the exterior crust, was immediately acted upon by the cauæ of waste 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."

"That even Mont Blanc itself, as well as other unstratified mountains, was once covered with schistus, will appear to have in it nothing incongruous, when we consider the height to which the schistus still rises on its sides, or in the adjacent mountains; and from the appearance of waste and degradation which these mountains exhibit, it is certain that the schistus must have reached much higher than it does at present."

Mineral and metallic veins, that intersect rocks and fritata, are supposing 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 condensed and crystallized on the sides of metallic veins.

The mineral veins are generally filled either with granite, porphyry, green-friee, or bafalt. They are of vast extent, often traversing through a 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 fritata which they intersect, and are considered by Dr. Hutton as affording strong proofs of the former.

The bafaltic dykes bear more immediately the marks of their igneous origin, as the composition and appearance of this stone have a near 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. Bafaltic 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 felsiclit, green-friee, and bafalt, 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 the farther the flatra were removed from the granite, they were less affected upon by central heat, and were left in a more earthy flat; but where the materials of flatra were easily fusible, such flatra became more crystalline than other flatra in a similar situation, but composed of refractory materials. While the flatra were in a loose flat, 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 flatra, which may frequently be observed in schistose rocks adjoining the granite, as represented in Plate III.

The theory of Dr. Hutton is discredited from that of former Plutonists, by the aid which it derives from the introduction of compulsion, as a powerful agent in the formation of our present flatra.

It has been objected to the system, that the present flat 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 carbonate acid being driven off, whereby it is converted into quicklime. Now if the lime-flint rocks had been subjected to a great heat, they would have been left in a caustic flat, 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 carbonate 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 affirmed 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 extrication of the carbonate 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 pressure of 32 atmospheres, or 1700 feet of sea, is capable of forming a lime-flint in a proper heat; that under 86 atmospheres, answering nearly to 3000 feet, or about half a mile, a complete marble may be formed; and finally, 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."—Transactions 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 compulsion, and the different circumstancies under which mineral bodies become consolidated after fusion, greatly modify their flat, 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 fuses. See Rowley-Rock, and Trap-Rock.

In what manner the subterranean heat is generated, or by what causes it is called into a more active flat at particular periods, the supporters of this theory do not think it necessary to inquire; it is sufficient that the effects are everywhere 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 depths. The bed of the ocean is heated at a considerable distance from Sicily during some of the eruptions of Etna, as is proved by froundings 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 Veluvius. 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, prove the existence of subterraneous fire under almost every degree of latitude; and the enormous 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 size those which are at present in a state of activity; and according to Humboldt, the most ancient volcanic lavas bear the nearest resemblance to primary rocks. These ancient lavas were probably erupted under the pressure of the ocean, at the period when all the present continents were covered with water.

The number and extent of ancient and extinct volcanoes 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 miracle to the subterraneous furnace, in order to prevent the unnecessary elevation of land and the fatal effects of earthquakes; and we may well affirm 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, if, in contemplating the possible effects of subterraneous heat, we did not bear in mind the important difference between combustion and ignition. Melted 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 pressure, 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 circumstancies wanting to confirm the opinion, that the American continents are of more recent formation than those of Asia or Africa; and tradition, according to Plato, seems to have preserved some remembrance of continents that have sunk down in the Atlantic ocean. (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 subterraneous fires cease to operate on the surface. Such is nearly the present state of Asia, compared with that of South America. Africa, perhaps, may be considered as a continent nearly exhausted: the secondary flatra are already carried away in many parts; and the primary mountains, by their decom-
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 present 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 scenes 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 before the rocks and stratæ attained their permanent level above the ocean, they may have been subjected to partial or more general subfidelities, 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 subfidelity, he thinks, is implied by many phenomena which present themselves to the attentive geologist.

According to the theory of Dr. Hutton, all valleys have been originally formed and excavated by rivers. Every river, says professor Playfair, appears to confine 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 valleys communicating with one another, and having such a nice adjustment of their declivities, that none of them join the principal valley on too high or too low a level, a circumstance which would be infinitely improbable, if each of these valleys was not the work of the flame 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 walking and erosion of the land; and that it is by repeated touches of the fame 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 wasted, till we come in sight of the original structure, 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 unhaply, 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 valleys, and gradually detached mountains from the general mass, cutting down their sides into steep 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 accidental into steady causes. Hence, says professor Playfair, fragments of rock from the central chain are found to have travelled into distant valleys, 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 shores of the Baltic. These loose blocks of stone point out the great changes which have happened since the commencement of their journey, and in particular serve to shew, that many valleys which now deeply intersect the surface, had not been begun to be cut when these flaky 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 process by which valleys are excavated may be seen in many alpine districts; but is nowhere more strikingly displayed, than in the interfection of the Alleghany mountains, in North America, and particularly where the Potomack 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 valleys, is accordant with existing appearances in many situations; but will not apply to the formation of all valleys: nor is it correct, that none of the upper valleys join the lower at a higher level; for numerous instances of such valleys might be cited, from which the rivers descnnd in cascades from the upper to the lower valley. The stratæ on the opposite sides of valleys have often a different angle of inclination; which proves, that the valley had been originally formed by some great convulsion, that had fractured the stratæ, and elevated them on one side, or depressed them on the other. Indeed it appears consistent with the Huttonian theory itself, that valleys may have been originally formed by fractures of the stratæ produced by the convulsions 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 admit with Dr. Hutton that granitic 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 stratæ, and subsequently consolidated by subterranean heat. Nor do they admit, that the caules were aligned for the transportation of blocks of granite into distant 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 appearances of the globe. He supposes, that islands or continents may sometimes have been raised from the ocean by a sudden effect of subterranean heat, analogous to the rapid formation 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, sometimes forming a single wave of prodigious height. During the submarine eruption of St. Eriin, or Santorini, in the Grecian Archipelago, which took place in 1650, the sea rose to the height of 45 feet, and that at such a distance from the volcanic island, that some galleys of the grand signor 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 observed to accompany the more formidable earthquakes. This phenomenon is in all probability occasioned by the upheaving of the bed on which the sea rests, though it may not always be attended with a submarine volcanic eruption. Professors 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 so suddenly, as to drive the ocean with great impetuosity over the highest mountains, and transport vast fragments of
of rock into distant countries. By the sudden rush 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 simply sufficient for the effect, and in accordance with phenomena that occur on a smaller scale in our own time.

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 afflict in transporting still farther the debris formed by the first irritation. The ice on the higher mountains, containing imbedded malles of stone, would be flung off, and being specifically lighter than water, it would render the flumes buoyant, and carry them to distant countries. In the 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 those 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 the confused 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-flone and lime-flone, such intermixture 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, preserving 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 savannahs of America, had been covered with mottes and grails, which in decaying, had piled 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 moilure; 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 silicious and calcareous flone, 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, fig. 7. Now 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 distant 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 strata three or four hundred feet above the chalk, it must have been equal to fuse the chalk itself, and convert it into crystalline lime-flone, or to soften it so much, as to mould the strata upon it, or at least to shew the effects of heat on those parts most immediately in contact with the chalk. Some of these strata being of the very hardest kind (particularly the mill-flone 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 see in our own times: of the former, we have influences in beds of compact lava; and of the latter, in the recent formation of some land-flones. The united effects of both are seen in the indurated argillaceous beds erupted in the flate of mud from the volcanoes in the Andes. See Volcano.

The effects of compression at the common temperature of the earth, have not been sufficiently attended to by geologists; nor have those changes which are now taking place, particularly in the softer strata and beds of land, been fearfully 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 happiest 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 Vines, Mineral and Metallic System, in Miffs, which denotes a compound interval, or an interval composed, or conceived to be composed, of several subintervals. Such is the octave, &c.

The word is borrowed from the ancients; who call a simple interval, digitem; and a compound one, stytem. As there is not any interval in the nature of things, so we can 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 stytem is properly an interval which is actually divided in practice, and where, along with
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 less 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, Melopoeia, Mutations, and Rhythm.

Roman Music.—The ancient Romans, who borrowed all their music and its technique from the Greeks, as appears in Vitruvius, Martianus Capella, and Boethius, and had no system of their own, yet simplified the notation; and, instead of the 1562 characters of notation, substituted the letters of the alphabet, and thus formed a scale of two octaves, or a 15th, from the lowest A, or prolamphanemos 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 septemt, the octave was but a recurrence of the fame found as the first note A, and that in ascending to the double octave, the intervals were the same as in the fist, reduced all to the seven first letters of the alphabet, only, instead of capital letters, wrote the second series in minuscules, or small letters. See St. Gregory.

At length, says Baronius, in the eleventh century, Guido Arétine, a native of Arezzo, in Tuscany, a Benedictine monk of the monastery of our Lady of Pomposa, in the duchy of Ferrara, invented a new system of sounds, which, with subsequent additions, is still the foundation of the general and universal system of Europe.

System of Guido. We shall not here dispute, 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 solmification; diaphonia, or organizing, other terms for the beginning of counterpoint; intervals, diatonic, or figiting a part above or below the chart, or plain-song.

The two great defects in the rude system of Guido, as far as it goes, were the want of semi-tones in transposed keys for harmony and modulation, and a time-table for melody. And those deficiencies occasioned by the ecclesiastical modes or tones, floated all material improvement in eccular 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 times-table, and the free use of all the semi-tones in the modern chromatic scale, till the time of Ockenheim and his admirable disciple Joquint, in the fifteenth century. See Guido, Gammut or Scale, Hexachords, Points, and Counterpoint.

Vol. XXXIV. System of Rameau. This system has been so amply discussed in the articles Basse Fondamentale, Harmonics, D'Alembert, the Abbé Roussel, and M. Lamarde, 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 generator. It had been discovered by Galileo, and afterwards confirmed by Mercurius, that every base or low found divides itself into its aliquot parts, 3, 4, 5, 6; which divisions finely, 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 15th, 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 in the single string or found, we have all the concords perfect and imperfect; unison, 6th, 5th, and 4th, 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, 15th, 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 dipt into harmonics and the theory of found, had published two quarto volumes on practical music, from the scale or gammut 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 geometrical's "Elemeu de Musique theoretique et pratique, suiviens 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 terza fanta disputed and claimed as his own property by M. Rameau. Rouleau, who was partial to his talents, and opposed his syste 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 musicians. He has, however, honoured his syste with a very flattering eloge, in saying "the syste of the illustrious Tartini, being written in a foreign language, often profound, and always dipt, is accessible to few, and even those few are discouraged by the obscurity of the structure 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 appears 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 comraden Stillingfleth, 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, was published at Padua, in 1754.

Mr. Stillingfleet probably treats St. Anthony of Padua’s first violin with the more respect, from having heard him perform, and being well acquainted with his compositions and character. He does not always subcribe to his opinions, and sometimes, like less 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 treatize, entitled "De principio dell’ Armonia musicale, Contenuta nel Dia-tonico Genera Dissertazione," 4to. 1767. But Tartini himself says, that it was written only to explain the first.

The systen of Tartini, as explained by Stillingfleet, has a long article assigned to it 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 classes 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 musical articles of his work, which was published in 2 vols. 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 systens that have been current at different periods, in the several parts of the world, the encyclopedists introduce what is called Kirnberger’s systen, in the following manner.

"In all the systens which we have analyzed, we have had recourse to several 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 systens 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 systen 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 systen, withstanding 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, before the time of Rameau; it seems as if we might reasonably regard it as the only true systen, and conseqently that which we ought exclusively to adopt.

"We are now going to analyze such a systen, 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 author, with whom we have the happiest to be particularly acquainted, and to whom we are indebted for all that may appear curious and useful in harmony, throughout the different articles of this supplement. This confession 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 systen having been adopted and explained by Mr. Kollmann, in his "Effay on Musical Harmony," published in 1796, and in his "Effay on Practical Composition," in 1799; as we have referred our readers to d’Alembert’s "Elements de Musique," for a clear and well-digested analysis of Rameau’s systen; and to Stillingfleet, for an excellent commentary on Tartini’s systen; we shall only point out the principles on which Kirnberger’s systen is founded, and refer our itulious musical readers to Kollmann’s full development of the systen of his profound countryman.

System of Kirnberger. "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 in different intervals; their names, the manner of expressing them, &c. we suppose already known.

Intervals are considered either in succession, as in melody; or in their combination, as in harmony.

"With respect to melody, intervals are easy or difficult to express; with respect to harmony, they are concords or dissonances. A constant and uniform experience proves that the most consonant intervals are the most easy to execute; 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 firings of equal length, thickness, and tension, render two sounds so similar, that one cannot be distinguished from the other. The unison, therefore, is regarded as the most perfect concord. After the unison, 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 firing 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 usual and well-known proportions," till we come to the second, which is in the proportion of 8 to 9. "The more close and minute the intervals," says Kirnberger, "they are always the more discordant. The second minor, therefore, is more discordant 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 which the ear can receive with sufficient facility to imagine it to be a concord. The ratio, therefore, of 6 to 7 is the last concord, and of 7 to 8 the first discord."

This is new doctrine. More liberties have long been taken with the flat 7th, than with any of the other discords.

The...
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 flat or bell gives, besides
the principal tone, expressed by 1, the tones expressed by
7; 6, 5, 4; all which together produce the total:
so that the tone which horn-players regard as B♭,
is a true natural tone, expressed by 7; &c.; as F is by 7, and
A by 7.

"We should do well, therefore, to adopt the tone in
our musical system, which is included in the first octave:
so calling C the fundamental found, which we call i,
it would fall upon A, and on B♭.

"The chord C, E, G, i, is literally a chord of four
founds, or confonants parts, and not the chord of the flat
7th. This is proved by the rule 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 7.

"As the minor 3d, 7, is the smallest chord, the major
6th, 7, which is its inversion, will be the greatest; and we
have, beside the unison and octave, still four kinds of con-
cord, the tierce, the fourth, the fifth, and sixth; or, rather
we have but two, the tierce 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, a false rela-
tion or redundant octave; a sharp 4th, or tritonus, &c.

"The following are the true concords, and their ratios:

| 3d minor, 7 | 6th major, 7 |
| 3d major, 7 | 6th minor, 7 |
| 4th, 7 | 5th, 7 |

"And if the note i or 2 be admitted, the interval is
expressed by 7.

"These intervals are in their greatest purity; but ex-
perience tells us that they may be a little altered, without
becoming concords. The 4th may be a semi-comma, or 7;
and, consequently, the 5th as much too flat.
The major 3d may be a whole comma, or 7; and the minor
6th as much too flat. And, finally, the minor 3d may be a comma, or 7; 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 sounds at once. These af-
femblages of simultaneous sounds 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 7th; all
arising from the triad; unison, 3d and 7th, or 7, 5th,
and 6th, to the fundamental base, or harmonic triad.

"It is probable (we are sure, from our researches, that
it is certain) there was much 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
fame 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
alacrait in finking it" whereas the sharp 7th has a contrary
disposition, and, as if charged with gas, forces its way up-
wards. The sharp 7th and the flat 4th are the only dis-
cords 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 paillage 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-bafe
players."

It is by making each of these chords an appoggiatura, or
fupending 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 fludent 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 dif-
cord of the 7th will make to whatever note it is fluered
and applied in composition; which will not be learned the
sooner for having new names, or being called accidental
instead of essential. The reit must be learned, whether
by their old names, or by no names at all.

The new note 7zd has not yet been adopted by composers or
performers.

The author of this fyltem takes great pains to explain
the difference between the accidental and essential discords.
But we fear that many of these distinctions are not so easily
retained by the student in harmony. M. Kollmann's plates will smooth many diffi-
culties in this study, which the plates in the Supplement
to the Encyclopédie leave in obscurity.

When the author quits 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 Rouffeau has well
remarked, is only the chord of the minor 6th sharpened
by accident. When our old musicians wifhed to make a paufe
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 demi-cadence."

We have menentioned all the singularities of this fystem,
and what remains, though the found and good doctrine of
the fift makers, is not new, and therefore needs no parti-
cular explanation.

We have enumerated all the musical systems that seem in-
titled 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 foudations:
such are thele of M. Sauerue, of the great geometrarian
Euler.
Euler, of M. Boigetou, of M. Serre, Dr. Smith's "Harmonics, or System of Tuning by Beats." M. Jamard, the worthy ci-devant canon of St. Genevieve, prior of Rocquefort, member of the Académie des 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 paffage-boat to the other world, published, in 1769, an ingenious tract, entitled "Recherches sur la Théorie de la Musique," totally diffènt 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 systemes, as they have been called, are received into practice, we can only allow them to be ingenious hypothesizes or speculations, sometimes correctizing, 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 refult of their calculations.

Here Kirnberger, an excellent practical musician, and profound contrapunctist, deferves more respect than mere speculations; 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 efers safely between both. There is fo little nature in music, that we leize on the slightest indication of her support.

The new scale of M. Jamard 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 2a, a new Interval in Secular Music.—Tartini, in 1754 and 1767; Balliere, in 1764; Jamard, 1769; Stillingfleet, 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: "Nato l'intervallo armonico della terza terza, o sia quarta, ed un avvertimento, che questo intervallo è di facili paffaion Item copia sopra il violino, ed è voluto dalla natura armonica perché si trova fatto dalla natura nelle trombe marina e da fiato, e ne' corni di caccia; trecento ne' quali non a luogo l'arbitrio umano ma la tota filsoarmonica natura. Si aggiunga dunque in nota musicale il termine e confusamente il fudetto intervallo alla scala diatonica commene infissata dall' ellef pio 4; e quella nota aggiuntale fegno con la cifra $\flat$ e difinizione di B fa fegnata con la cifra $\natural$."

Mr. Stillingfleet is very short on this subject. He has not translated this paffage, nor does he seem quite to agree with Tartini about its ufe, or the necessity of adopting it.

The paffage, translated as literally as we are able, is the following.

"There arises from the harmonical division of the scale, after the ratio of 4th, an interval from 4th, which is of an extremely easy intonation on the violin, because it is the work of nature herself on the tromba marina, and on the real trumpet and French horn, instruments not governed by the arbitrary will of man, but solely by natural harmonics. We shall, therefore add a musical note to the scale from the ratio 4th, and expressed by this character $\flat$, to distinguish it from $\natural$."

Kirnberger goes still further in pointing out the production and double ufe of this new note, as an extreme sharp 6th to C natural, and a flat 7th to the same base.

Though, as Tartini fays, it is in nature, and of early production by the voice and violin, upon keyed and wind-instruments it is purely imaginary.

Tartini thinks that, with the affiaitance of this new found, the enharmonic may be recovered.

In Stillingfleet's remarks on what Tartini fays 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 consonance.

This note seems brought into ufe in melody, particularly in descending, though unnoticed in harmony. See Music Plates.

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 inftruments and the voice which is formed upon them, or at least is obliged to conform to them, that no composer dares ufe them in any thing but tranfitant paffages; in flow and faltuned notes, they offend every natural ear; but the $\natural$, or new $\flat$ of these inftruments, if dwelt upon, or even ufed at all with other inftruments which have no such found, would drive an audience mad, or at leaft out of a theatre or concert-room.

The 3rd, given by the abbe Rouffier's triple progression, and 4ths and 6ths of Balliere, Jamard, and Kirnberger, in unison 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 left effort of the $\flat$olian harp, is not fo 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 fene for which it is alone designed. There is a little pedantry in Kirnberger's treatment of the subject. To all

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\[
\begin{align*}
\text{In E minor:} & \quad \begin{align*}
\text{In F major:} & \quad \begin{align*}
\text{Enharmonic:} & \quad \begin{align*}
\text{In one case it is a minor semi-tone.} & \quad \begin{align*}
\text{In the other a major.} & \quad \begin{align*}
\end{align*}
\end{align*}
\end{align*}
\end{align*}
\end{align*}
\]
his other precepts we can subscribe, as they are the result of great experience, profound knowledge, and sagacity. We know not whether his treatise should be called a system, like that of Guido, Rameau, and Tartini; the first built on the Gregorian system, and the second upon physical phenomena. Kirnberger's is but the last refinement of old doctrines. He says, that the 4th, the 6th, and flat 7th of the trumpet and French horn, should be adopted in our system, "as for the true natural tones!" We respect nature very much; but is not nature improved very much by cultivation in fruits and flowers? and why do all professors and perfects of nice ears complain of the din of the wind-instruments? System of Solmization. Dr. Wallis makes use of only four of the six syllables ascribed to Guido; mi, fa, sol, la; which method resembles that of the ancient Greeks in naming the sounds of the tetrachords; µ, µ, µ, µ. But it appears in Clifford's Collection of Divine Services and Anthems, published in 1664, that the English began to discontinue the use of two of the syllables of the hexachords, the ut and re, about the year 1650. Dr. Pepusch, however, in 1731, revived the ancient solmization, 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 fingering, as in the key of C natural.

\[
\begin{align*}
C & = D & E & = F & G & = A & B & = C \\
D & = E & F & = G & A & = B & C & = D
\end{align*}
\]

In keys with minor 3ds, let the notes have the same names as in the key of A natural.

\[
\begin{align*}
A & = B & C & = D & E & = F & G & = A \\
B & = C & D & = E & F & = G & A & = B \\
C & = D & E & = F & G & = A & B & = C
\end{align*}
\]

System, in Poetry, denotes a certain hypothesis, or scheme of religion, from which the poet is never to recede. E.g. Having made his choice either in the heathen mythology, or in Christianity, he must keep the two apart, and never mix such different ideas in the same poem.

Thus, after invoking Apollo and the Muses, he must bid adieu to the language of Christianity, and not confound the two systems. The fabulous fyle, indeed, is the richer and more figurative; but a pagan god makes but a miserable figure in a Christian poem. The fylem of poetry, Boughers observes, is itself wholly fabulous and pagan.

System, Field, in Husbandry, that fort of field management, or husbandry, which is practiced on farms of different kinds in different intentions. These fylemns have different titles, according to the number of fields or quantities of land which they embrace, and the manner in which they are cropped; as for four, five, and other number of field fylemns. The fylemns of field management will vary greatly, as the nature of the land or soil, and the quantity and sort of live-flock may be, as well as for many other reasons: such as the bringing of different sorts and qualities of land into cultivation, &c. See Crofts, Course of.

The different fylemns of husbandry which are principally practiced in some few places, have been thus comparatively flated, and drawn up by the writer of the Corrected Account of the Agriculture of the County of Middlesex. The Norfolk farmers have the merit, in common with the farmers of the South and West country downs, of cultivating a small portion of their land in a very superior fyle; but, as an extensive district, the general cultivation of the county is yet far behind even the South Downs; for there you are not disturbed with the sight of boggy moors, nor frozen pastures, no accidental flat or sharp alters the names of the notes in fingering, except B, which, when flattened in the key of C, is called F. When B is natural, F and C are called Fa; and when B is flat, F and B are so called.

In ascending one octave from C to D, the notes are denominated d, r, m, f, i, r, m, f. In descending, f, m, l, i, f, m, r, d. The Italians have long in their solfeggii, for the facility of the voice and purity of sound, changed the key-note ut to do.

In F, an octave ascending from C is thus denominated: d, r, m, f, i, r, m, f; descending, i, f, l, i, f, m, r, d. From G to C, with natural: d, r, m, f, i, r, m, f; descending, i, f, l, i, f, m, r. This is a pallage in the key of C, but, query in the key of G minor, what is E to be called?

After a careful examination of all the most favoured systems of solmization throughout Europe, we find no one which provides a specific name for every found in every key. The following rules will, perhaps, subject incipient vocal students to fewer difficulties, and enable them to distinguish a whole tone from a semi-tone, with equal certainty in all keys, as well as in those of the three hexachords. See Hexachord, and Mutations.
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.

SYSTEMATIST'S, 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 συστολή, to contract, in Grammar, denotes the shortening of a long syllable. In Anatomy, contraction; it is usually applied to the heart, and denotes its contraction, for the purpose of expelling its contents.

SYSTREMA, 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 systrophe.

SYSTYLE, in Architecture, that manner of placing columns, where the space between the two fults consists of two diameters, or four modules. See INTERCOLUMNATION.

SYTHE, in BOTANY. See SCYTIA.

SYXHINDENEM, or SXHINDENEM, a term purely Saxon, literally signifying six hundred men, or men worth six hundred shillings a-piece. See HENDEN.

SYZZGYUM, in Botany. Gært. v. t. 166. t. 33. (Syzzygium of Browne's Jamaica, 240. t. 7. f. 2.; apparently so named by the latter, from σύζγγυς, a conjunction, or copulation, in allusion to its "coupled leaves and branches,") is the Myrtus Syzzygium of Linnæus; but, as we conceive, rather belongs to the genus Eugenia. (See that article.) Gaertner distinguishes it only by having a berry with a single seed, instead of a drupa. Jaffeu however unites them. The pulp is indeed closely attached to the seed in Syzzygium; but the shell, or rather skin, is so thin in Eugenia, that it is hard to draw a line between these two fruits. Gaertner's definition, founded on the two cells of the former in Syzygium, does not hold good, the name being found in Eugenia, though one always becomes obliterated as the fruit ripens; just as in Olea.

Gaertner enumerates four species of Syzzygium. 1. S. carophyllæum, a Ceylon plant, which he supposes to be Myrtus ceylonica of Linnæus. 2. S. Makul, from the same country, with a more ovate fruit. 3. S. paniculatum, which is Eugenia paniculata of the Bankian herbarium. 4. S. lucidum, Eugenia lucida of the same collection. The original Jamaica plant of Browne is not included in this list.

SYZGY, SYZJIA, formed from σύζγγυς, which properly signifies conjunction, in Astrology, a term equally used for the conjunction and opposition of a planet with the sun.

On the phenomena and circumstances of the fyzygies, a great part of the lunar theory depends. See MOON.

1. It is shown in the physical astronomy, that the force which diminishes the gravity of the moon in the fyzygies, is double that which increases it in the quadratures; so that, in the fyzygies, 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 69 30; for, in the quadratures, the addition of gravity is to the whole gravity as 1 to 178 73.

2. In the fyzygies, the disturbing force is directly as the distance of the earth from the earth, and, inversely, as the cube of the distance of the earth from the sun. And at the fyzygies, 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 fyzygies 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 quadratures to the fyzygies, the moon's gravity is continually diminished, and its motion in its orbit is accelerated.

3. Farther, in the fyzygies, the moon's orbit or circle round the earth is more convex than in the quadratures; for which reason the moon is left distant from the earth at the former than the latter. When the moon is in the fyzygies, her apsides go backwards, or are retrograde.

When the moon is in the fyzygies, the nodes move in antecedentia fallæ; then flour and flower, till they become at rest when the moon is in the quadratures.

Finally, when the nodes are come to the fyzygies, the inclination of the plane of the orbit is the least of all.

Add, that these several irregularities are not equal in each fyzygy, but are all somewhat greater in the conjunction than in the opposition. See Physical Causes of the Moon's Motions.

SZADECK, in Geography, a town of the duchy of Warsaw; 22 miles N.E. of Siretia.

SZALGEN, or Island of Serpents, a small island in the Black Sea, near the mouth of the Danube. N. lat. 45° 25'. E. long. 39° 54'.

SZAMAILI, a town of European Turkey, in Basarabia, on the Danetler; 45 miles S.W. of Bender.

SZAMOSFALVA, a town of Transylvania, on the river Samos; 5 miles N. of Coldofar. N. lat. 47° 18'. E. long. 23° 23'.

SZAMOSVIVA. See SAMOSVIVAR.

SZARIGROD, a town of Poland, in the province of Podolia; 30 miles S. of Bara.

SZARKOVA, a town of Prussia, in the palatinate of Culm; 8 miles N.W. of Thorn.

SZASK, a town of Lithuania; 36 miles S. of Minsk.

SZASY, a town of Hungary; 4 miles E.S.E. of Chemnitz.

SZATHMAR. See ZATMAR.

SZAWLE, a town of Samogitia; 28 miles N.E. of Miedniki.

SZEBEN, a town of Hungary, on the river Tareza. In the year 1604 this town was taken by the troops of count Botikey, and in 1665 by the Turks; 30 miles N. of Cachan. N. lat. 49° 40'. E. long. 20° 49'.

SZEBENY. See HERMENSTADT.

SZEGED. See ZEGEDIN.

SZEKELY, or SZEKELY-HID, a town of Hungary, formerly a fortification. In the year 1660, it held out against the Transylvanian peacocks. In 1664, it was surrenders by the Imperial garrison to the Transylvanian prince, Abafti; but in the ensuing year it was dismantled; 7 miles N.N.W. of St. Job.

SZEKRZARD, a town of Hungary, on the river Saritz, with a castle; celebrated for its wine; 18 miles N.E. of Funikirchen.

SZELANTHA, a town of Prussia, in the palatinate of Culm; 5 miles S. of Strafburg.

SZELITZE, 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 rather wonderful account has been given of the different effects of the heat and cold, which Dr. Townfon, a late traveller into Hungary, seems not willing to give credit to; 5 miles W. of Czafhau.
SZERBANEST, a town of Walachia; 10 miles N.N.E. of Rucell.
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.
SZFRESSOW, a town of Lithuania; 40 miles N.E. of B-reskie.
SZERN, a town of Prussia, in Oberland; 4 miles E. of Gardensee.
SZERWENTY, a town of Lithuania, in the palatinate of Wilna; 16 miles S.E. of Wilkomierz.
SZIGET. See Sziget.
SZINYE, a town of Hungary; 14 miles E. of Czachai.
SZISH. See Sistova.
SZITES, a town of Transylvania; 4 miles W. of Scheiburg.
SZITTKEMEN, a town of Prussian Lithuania; 14 miles E. of Golymp.
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 March; 32 miles W. of Topolitzan.
SZOBOW, a town of Poland, in Masovia; 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 Selavonia, on the Drave; 27 miles N. of Polessa.
SZORENY. See Sevren.
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 Rosiene.

END OF VOL. XXXIV.
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