BED & PLATEN
Book Printing Machines

American and British streams
of ingenious regression in the
quest for print quality

A technical study by
Douglas W. Charles
with a foreword by
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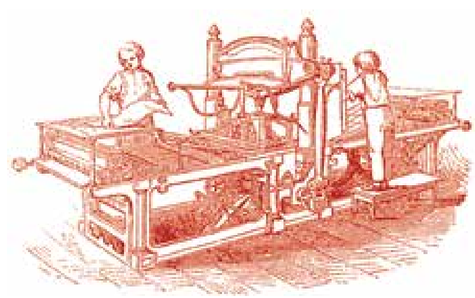

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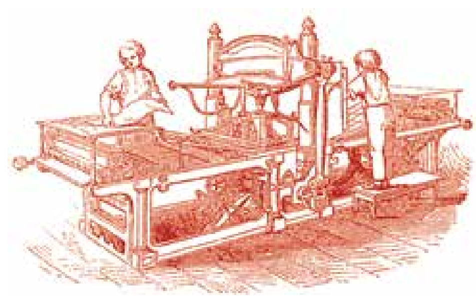

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FOREWORD

The bed and platen printing machine seems to be the "missing link" in the story of the evolution of the printing press. The narrative, as usually presented, begins with Gutenberg's adaptation of the wine press, followed centuries later by Blaeu's improvements in the 1620s. In the nineteenth century we see the transition from the wood of the common press to the iron hand press of Stanhope and Clymer.

We read how the *Times* of London on 29 November, 1814, overnight went from being printed on a "battalion" of iron hand presses, to being printed on a single steam-powered cylinder machine, the famous invention of Koenig & Bauer. And from then on into the twentieth century, we read that it was the cylinder press that achieved miracles of speed and productivity.

But that is not the full story. Not long after the introduction of the iron hand press (Stanhope about 1800, Clymer's Columbian about 1813) there were many minds at work on the idea of applying steam power to the iron platen press.

Indeed, many of the same pioneers of the iron hand press—Phineas Dow, Erastus Bartholomew, Seth and Isaac Adams, Otis Tufts, and Stephen Ruggles—also worked on what came to be known as the "bed and platen" machine. As it happened, all of these men were working at the same time in Boston. They constituted what Douglas Charles has called a "Pool of Genius."

These men competed to produce a printing machine that could automate the work of the iron hand press. The cylinder press was satisfactory for high speed news printing, where fine presswork was not important. But cylinder machines were not satisfactory for book work. Their problems included difficult makeready, slurring, workups, misregister, and the wear on type. It was not until later in the century that the cylinder machine was refined to do quality printing.

While this work went on, it was the bed and platen machine that became the predominant press in American printing offices. With skilled handling, it could rival the best work of the hand press, with far greater speed and economy of labor. Between 1830, when Isaac Adams patented his first press, until about 1880 when the bed and platen press finally neared its end, an estimated ninety percent of American book printing was done on Adams presses.

In Britain, where the cylinder machine had first appeared, cylinders coexisted with bed and platen machines of a distinctly national character. These were widely employed—generally on quality work—but never dominated the industry so totally as in the United States.

The success of the bed and platen press in midcentury America was complete, but it has never been documented. The British experience has been similarly ignored. While hundreds of iron hand presses are still in use, not a single bed and platen machine is known to have survived. We are fortunate that the previously untold story has been fully and ably detailed by Douglas Charles. It is safe to say that he knows more about the history and workings of the bed and platen printing machine than anyone today. Thanks to his efforts in gathering this complex information and presenting it here, the bed and platen printing machine can now be restored to its place of importance in the evolution of the printing press.

—Stephen O. Saxe

Bill of Fare.

GLOSSARY

Apron: Pointing board, feed board.
Bed and platen: Excludes job presses. Herein, *platen, platen press* and *bed and platen* refer to the large platen presses typically used for bookwork in the 19th century.
Belt shipper: Belt shifter.
Blow: Pressman's term for the air outlets of the Adams press delivery bellows.
Bottombar: The lower transverse impression-resisting girder of a platen machine, corresponding to the *winter* of a handpress and the *impression bed* of a British double platen.
Box: Bearing in which a shaft or journal is supported and rotates. Also a closely-fitted support through which a bar or rod moves.
Carriage: Horizontally-reciprocating portion of platen machine, usually bearing the form rollers, friskets and tympans. In 19th century writing, often applied to type-bed assembly (as in handpress usage), but herein *type-bed* refers to the type-bed itself and its attachments.
Chuck: Treadwell's term for the dog-clutch on the *verge* that controlled his type-bed motion.
Coffin: Sometimes synonymous with *type-bed* as a hangover from handpress usage.
Crab: Another term for *mouse roller*.
Cut: Any typographic plate or block bearing an illustration. An illustration.
Cylinder; Cylinder press; Cylinder machine: Flat type-bed and cylindrical impression component.
Dip line: The pitch line (pitch diameter) of a gear.
Dog hand: Catch or pawl.
Double platen; Double: Machine having one platen and two type-beds or two platens and two type-beds.
Double-ended; double-feeder: Machine having one platen, one type-bed, and a carriage bearing two friskets upon which impressions were taken alternately.
Duct: Fountain, in British usage.
Ductor: Herein: The roller which takes the ink from the *fountain roll* and transfers it to the rest of the inking system. The word is variously used in source texts, sometimes denoting the fountain roll. In the U.S. pressroom it was the "duck roller".
End: A double platen machine's two *ends* each consisted of type-bed, ink-table, table bolt or clutch, tympan and frisket. The word *end* is italicized where necessary in the text for clarity.
Feeder: Termed *layer-on* in Britain.
Fly: Termed *taking-off apparatus* in Britain The human version was a *flyboy* in the U.S., a *taker-off* in Britain.
Fountain roll: The roller which comprises the principal part of the ink fountain.
Geared inking: Form rollers positively driven through contact with distributors running atop them, the distributors driven through gears by a rack on the side of a reciprocating type-bed.
Gudgeon: Treadwell's term for journal, *v. pivot*.
Horse-whim: Vertical shaft with horizontal beam to which a draft animal was hitched.
hp: Horsepower.
Impression-bed: Heavily-girdered structure fixed in the machine frame which supported the type-bed during impression.

Impression bolt: A pair of these threaded forged rods united the platen and the *bottom bar* or *winter* of the Adams and its US competitors. They resisted the force of the impression, relieving the frame castings of that duty.
In; Out: An *end* is *in* when under the platen, *out* when in feeding position.
Ink table: Also: Ink plate, ink slab. Flat surface upon which ink is distributed and carried to form rollers. May be fixed to the type-bed (British doubles) or stationary (Scandinavian). In lieu of the ink table, some presses (American) were fitted with cylindrical distributing drums. J.M. Napier's doubles were fitted with both.
Inker: Form roller, in British usage.
iph: Impressions per hour. Equivalent of number of sheets printed on one side per hour.
Jauns wheel: Treadwell's term for the large bevel gear which drove the two bevel gears on the *verge*.
Layers-on: British usage: Feeders.
Machine; Press: British usage distinguishes the terms, using *press* to denote *handpress*. A *machine* derives its motion from a rotary power source such as a hand-crank, waterwheel, steam engine, etc.
Mitre cog wheels: Treadwell's term for bevel gears.
Mouse roller: Aid to ink distribution consisting of a short roller (about the size of a proof brayer) mounted in a traveling frame and reciprocating axially across the face of a distributing drum to smooth the ink film. Standard equipment on the 1836 Adams, optional on Hopkinson & Cope's doubles. Also *crab*.
Nippers: Grippers.
Pall: Pawl.
Pitman: Heavy rod or bar connecting a crank with a reciprocating part of the machine. Connecting rod. Adams: Rod connecting crank with impression toggle.
Pivot: Early 19th century term for journal.
Rabbit: Rabbet, rebate.
Race: Groove in a cam or wheel in which a follower or traveler runs to convert rotary to reciprocating motion.
Rag wheel: Ratchet wheel.
Riders: Rollers placed atop the form rollers or the distributors to increase their effectiveness.
Rolling power: Refers to the number and effectiveness of the form rollers.
rpm: Revolutions per minute.
Single platen; single: Machine having one platen and one type-bed.
Slider: Double platens: Can refer to the individual sliders or to the assembly of two sliders and their linking bar. The *ends* were engaged to the reciprocating slider to put them into operation. The slider reciprocated while the machine ran, whether or not either of the *ends* was in use.
Spiral eccentric pulleys: Treadwell: The scroll drums on the *verge*.
Striker: Hand-lever.

Table bolt: British double platens: Attached to each type-bed (under the ink table) upon a spring-loaded arm, it was lowered into a mortise on the *slider* to put the *end* into action. See page 82 below for an illustration. Napier, from 1853, used a heavy arm hinged to the bed under the ink table. A rectangular "bolt" on its end dropped into a specially-formed slider mortise. Napier called his arrangement a "clutch".
Taker-off: British usage. U.S.: *flyboy*.
Toggle: Pair of levers hinged together which, when straightened, increase their overall length. One extremity of the toggle was fixed, the other moved vertically to apply pressure to the bed or platen of a machine in order to take an impression.
Traveler: The small "fish" or "feather" that followed the groove in the *worm drum* of a British double platen. The traveller was pinned to the *slider* to which the *ends* were engaged to put them into operation.
Trimming: A machine's general operation, the interrelation of its normal motions and timings.
Tympan: Adams's idiosyncratic misuse: Pointing board or feed board, also called the *apron*. This odd use of the term probably arose from the fact that, on the handpress, the sheet was pointed on the tympan. Adams also uses *tympan* in the accepted sense, referring to the resilient packing between the platen face and the form. For our purposes, *tympan* shall refer to the total packing (parchments, paper, blankets of felt or rubber), whether attached to the impression surface or moving with the carriage.
Type-bed: The iron table upon which the type-form is locked for printing.
Verge: Treadwell's term for his vertical windlass, corresponding to the spit of a handpress.
Waver: British usage for distributor rollers. Also: Distributor. Angle-roller. Table-roller.
Winter: Bottombar.
Wood cut: Wood engravings were often thus mis-termed.
Worm drum: Grooved drum mounted longitudinally in the frame of a British platen. It formed part of the bed motion.

INTRODUCTION

From a technological standpoint, the bed and platen power press represented a backward step in the development of printing machinery. The first generation of successful printing machines, from 1814, consisted of a variety of flatbed cylinder presses, English-made, and iron handpresses were used for works pretending to quality. In 1821, however, Daniel Treadwell's American platen machine appeared, with features dictated as much by the nation's paucity of technological resources as by typographical desiderata. The Treadwell proved a success; it was faster than the handpress and produced work of comparable quality. Its acceptance initiated the rise of the platen machine to a virtual monopoly of U.S. book printing. America's first cylinder was imported from England in 1825, by which time the platen was established in the few shops then requiring mechanization.

In Britain, birthplace of the cylinder, patent restrictions and growing expertise with cylinder machines held platen development in abeyance until the 1830s, British printers using cylinders or handpresses on work that, in the United States, would have been done on platens. The separate lines of platen evolution in the two countries naturally resulted from their differing economic, social and technological contexts, British printers typically seeking economies of capital investment and space while their American colleagues strove to control labor charges.

The classic British machine was the double platen, offered by several firms, but in the United States after 1836 there was no practical rival to the Adams single platen. Comparing an Adams and a double platen of similar footprint and sheet size, the Adams required one low-wage feeder and half the time of a journeyman, for a production of about 900 iph. The British double was manned by four low-wage attendants and a journeyman, for an output of up to 1,600 iph.

Adams presses were arranged to take the impression by raising the type-bed against a fixed platen; British machines pulled the platen down to a movable type-bed. Including patent-dodging variations from the Hoe and Ruggles drafting tables, the toggle was the only impression mechanism employed on American platens. London's J.M. Napier applied toggles to his double platens, but other British makers had earlier adopted an overhead beam like that of the Columbian handpress, drawn down by the action of crank and connecting rod. Manipulation of the tympan was not mechanized in British practice; in the United States the tympan was handled mechanically or attached directly to the platen.

British commentator Jackson Gaskill noted one of the platen machine's great perceived virtues, writing in 1877, "The work produced by them resembles [hand]press-work more than that thrown off by any other machine." Makeready procedures differed little from those familiar to handpress men. The platen's flat impression diminished the pitfalls of slurring, misregister, and form wear to which early cylinder machines were prone, difficulties exacerbated by the use of soft packing and the practice of raising or lowering impression cylinders to regulate the impression.

A typical printing form of the early to mid-19th century, with its myriad inaccuracies, presented a surface poorly suited to the rolling impression of the cylinder press. In order to get a fair impression soft tympans were applied to cylinder presses and pressmen freely altered cylinder heights. The necessary precise match between the velocity of the impression cylinder surface and that of the form was seldom achieved, resulting in excessive wear of the form and, in extreme cases, plates driven from their positions and type pushed off its feet. The cylinder's rolling action tended to loosen quoins and cause workups; publishers feared plate breakage, especially of stereotypes. The flat platen impression sidestepped many of these problems.

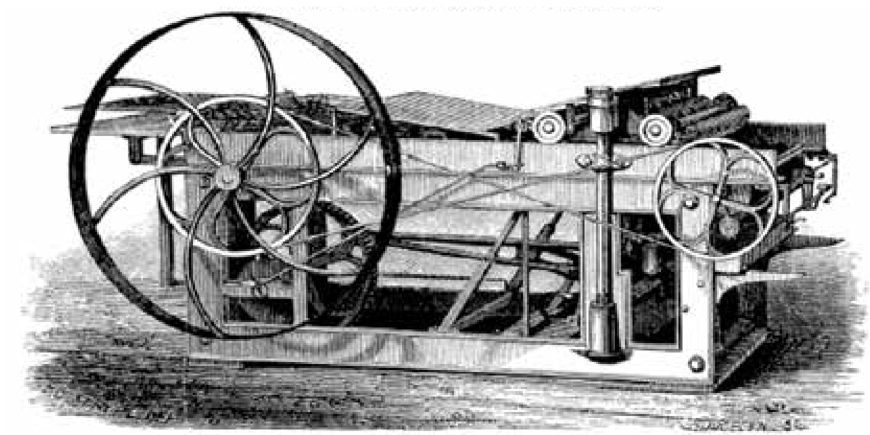
Hard-packed tympans were applied to platen machines well before their adoption on cylinders, one writer noting as early as 1841 that the British Scandinavian machine was operated with paper instead of woolen blankets in the tympan. Platen machines normally printed upon dampened paper; ideally a quality sheet was "dry to the touch, cool to the cheek" when ready for press, as in handpress practice.

Until engineers and printers responded to the technical requirements of the cylinder press, and type founders, platemakers, and ink- and papermakers improved their products, the advantages of the platen were compelling. But by the 1880s the necessary conditions for good cylinder presswork had been met and new purchases were almost always cylinders. Platens continued to be used for short runs, reprints from old plates, bible work, and such specialties as banknote and playing card printing. In their 1888 study, *Modern Printing Machinery and Machine Printing*, writers Wilson and Grey characterized Britain's remaining platen owners as "addicted to old plant".

On both sides of the Atlantic examples continued in work until well into the 20th century, without, however, gaining the literary attention paid to other forms of printing presses. Exemplifying the imbalance, one respected 20th century author devoted sixty-nine pages of his oft-cited history to the iron handpress while ten pages sufficed for his treatment of the bed and platen machine. The present work attempts a measure of redress.

In the text "platen", used generally, denotes a typographic printing machine in which the type bed or beds and the platen are horizontally positioned, and in which one or the other acts vertically to take the impression. The familiar small jobbing machines are outside the scope of this study, as are specialty presses. Press and paper sizes are given in inches, with regard to platen machines usually referring to the dimensions of the platen. Terms peculiar to this study are glossed beginning on page *vii*. In this text, numerals in red ink refer to illustrations.

AMERICAN PLATENS



1. Large two-roller Adams with three-stepped spring-spoke flywheel, from the 1856 catalog of Bruce's New-York Type-Foundry. The spring-spoke flywheel was better adapted for steam power than the earlier, heavier style, designed for hand operation where power was unavailable. Courtesy Stephen O. Saxe

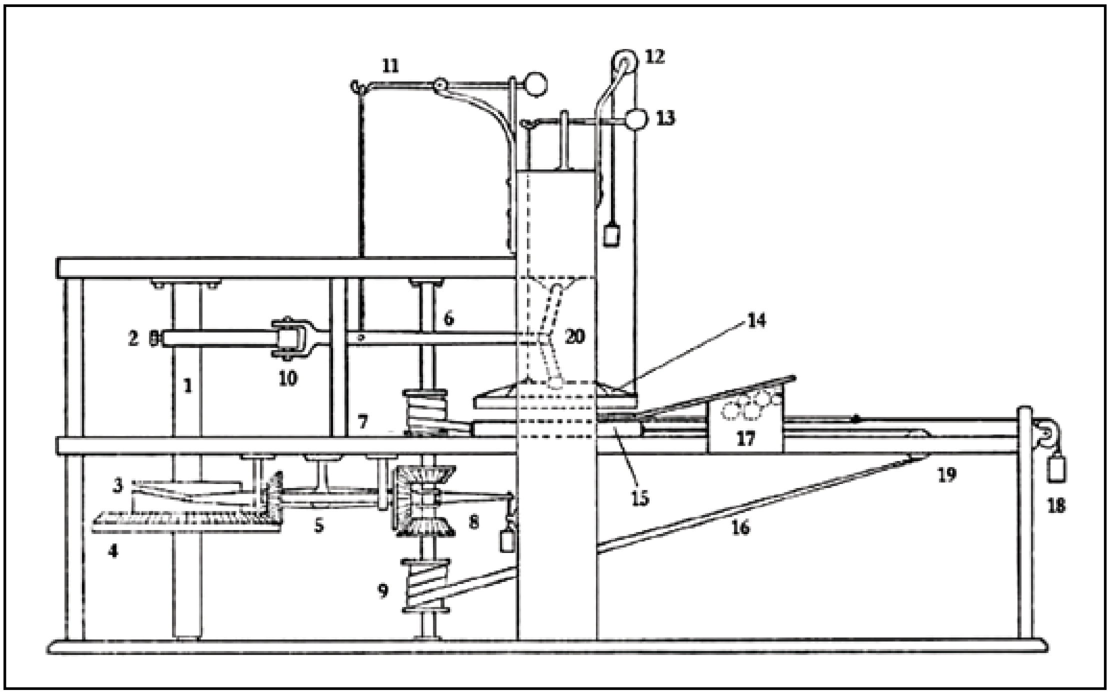
"The Adams may not have been the first power press built, but it was the first to secure general introduction in this country, and, like the hand press, it is yet with us ... It was so well built, and required so little in the way of repairs or high-priced pressmen, that it held its own in many offices until the present day. ... While no book printer would install one nowadays, those who have owned a press of this kind have usually preferred to wear it out rather than throw it away."—Charles H. Cochrane (*The American Bookmaker,* Nov. 1895, p. 137.)

The story of platen development in the United States is essentially that of the Adams Bed and Platen Power Book Press. Nowhere else did a single type and make of machine become so utterly dominant. Across the Atlantic, most book printers employed a mixed economy of platens and cylinders, made by various concerns.

Other platen machines did gain acceptance prior to the 1836 introduction of the improved Adams; in fact, Daniel Treadwell's platen of 1821 was the first such to prove commercially useful, and the first printing machine built in the United States. Pressure to raise quality and reduce labor drove evolution of the platen to its culmination in the form of the Adams press, the progenitors of which had been associated with Treadwell's project. Despite the ubiquity of the Adams during its palmy days and the survival of many into the 20th century, no example remains.

The question of transatlantic influences has yet to be addressed, but mechanics on each side were doubtless aware of their colleagues' activities on the other. At least one Adams went to Britain; no British platen seems to have been imported. Patent information and reports of new developments appeared in journals and travelers' observations circulated. Patent law was far from mature; ideas were borrowed without acknowledgement; coincidence played its part.

The presses are treated in chronological order to show the progress of design, following the normal arc of development from pioneering simplicity through complexity to efficiency. Not surprisingly, most available information relates to the improved Adams, but enough has been found concerning the other presses to allow appraisal of their mechanism and a notion of their role in the evolution of the printing industry.



TREADWELL 1821

2. The early Treadwell single, depicted, with slight variations, as described in the patent specification. The heavy vertical pieces are the *cheeks* (italicized terms include several Treadwellisms), the two horizontal frame members extending to the left (the rear, or *West* end) are the *tail pieces*: the right-hand extension is the *rail way* (19) upon which the *bed* (15) moves. The *vertical cam shaft* (1) receives power from below and carries the *impression cam* (2), the bed motion control cam (*grooved cam*)(3), and a large bevel gear driving the small bevel wheels on the windlass shaft (*verge*) (6) via the short *horizontal shaft* (5) and its *jauns wheel*, the bevel gear enmeshed with the two gears on the windlass shaft at (8). The *impression slide* is seen running between the impression cam and the *toggle* (20), its *friction roller* (10) against the impression cam nose. The smaller vertical shaft just to the left of the cheeks is the windlass shaft or *verge*, with its scroll drums (*spiral eccentric pulleys*) (7, 9) and straps (16) to move the bed. The clutch (*chuck*) is between the two bevel gears (8) on the windlass shaft, connected through levers—visible behind the shaft at (5) with its right end above (8) weighted for stability--to the grooved cam on the cam shaft. The vertical cords arising from the right edge of the platen are the *tympan tensioners* running over pulleys (12) with weights hanging from them; the weight (13) on its lever on the head beam counterbalances the *platen* (14). The impression slide counterbalance is at (11), the throw-off handle depended from this lever. At right is one of the two weights (18) which keep the *frisket slides* on the sides of the bed (15) under tension. Just to the right of the cheeks is the slanting feed *apron* upon which the frisket rests when the bed is out, with the inking system (17) beneath, between the *jambs*. From Wyman (1888), p. 341.

TREADWELL 1821[1] • BOOTH 1822

Daniel Treadwell of Boston devised the world's first commercially successful platen machine in 1821. Treadwell had examined cylinder machines while visiting England, 1819-1820, noting their unsuitability for conditions then existing in the United States. Upon returning to Boston he began the development of a platen machine, based on the handpress. American realities drove Treadwell to timber construction, restricting his use of metal to the impression toggles and various smaller parts. For lack of machine tools, the bed of the first machine was of stone and the platen of wood. The second example was fitted with iron bed and platen, an old lathe having been found and altered for the work. Later presses incorporated more metalwork and other improvements while retaining the massive timber framing. Treadwell pioneered the use of composition rollers, fitting them to the first and all subsequent presses. The early single press was about eleven feet long, four feet wide and six feet high; it handled a medium (18x26) sheet. Later presses were built to take a medium-and-a-half (24x30) sheet. Treadwells were often installed in pairs, as shown in **5** below.

The first presses were built in Phineas Dow's Boston workshop. (Dow, a skilled mechanic, moved to Philadelphia after his shop burned in 1830.) Four of the earliest Treadwell presses were purchased by publisher Nathan Hale and installed in his *Boston Daily Advertiser* office, where they were first horse-powered, then driven by steam. Four others, co-owned by Hale and bookseller Timothy Carter, were placed on the Boston Mill Dam, where they were driven by water power. Carter later recalled, *The Treadwell Press did fine work but required much room and much power.*[2]

Chronicler Morrill Wyman sounded a human note: ... *one of [Treadwell's] most reliable assistants was a young woman who laid on the paper to be printed, and became quite familiar with the working of the machinery, so that going afterwards to Philadelphia with one of the presses, she taught others how to manage it.*[3]

In Philadelphia, printer Isaac Ashmead installed two Dow-built Treadwells and then had six more made locally. All were doubles. Dow sold several more to other Philadelphia printers.[4] By 1835 some fifty Treadwells had been built.[5] They were at work in New York, Boston, Baltimore, Hartford, Philadelphia, and in Washington, D.C., where Gales & Seaton used them on large-volume government printing, as noted in a list of patents published in 1876: *Daniel Treadwell, Boston, March 2 (1826), power printing press—this press was about this time in operation in the offices of the "National Intelligencer", and was considered by the proprietors, Messrs. Gales & Seaton, one of the most valuable discoveries ever conferred upon the art. It was said to be the only press on the cylindrical principle, adapted to book printing, which it executed in the most beautiful manner.*[6] An 1834 issue of *Niles' Register* credited Gales & Seaton with four steam presses "with a perpendicular pressure", without specifying make, in company with three cylinders.[7]

The Harper firm's first power press was a Treadwell installed in their New York plant in 1828. Driven by horsewhim, it lasted until replaced by a Hoe cylinder in 1833. The 1832 *Encyclopaedia Americana* said: *In this country, Treadwell's power press is the machine most used.... cleaner and better impressions are supposed to be obtained from it than from any other machine*[8] Treadwell gave up his interest in the presses in 1829, having realized about $70,000 from his press-building venture.[9]

Daniel Fanshaw

Few American printers in the first years of mechanization had sufficient volume to support a machine press or the capital to invest in one. Daniel Fanshaw of New York was a notable exception, at least as regards volume; he held the American Bible Society printing contract from 1817 and that of the American Tract Society from 1825.

Fanshaw installed two Treadwells in 1826 and eventually worked a number of them, printing mostly from stereotypes, powered by steam at the ABS and by two mules on an endless-track "engine" in the upper storey of Tract House at the ATS.[10] In a letter to Treadwell, Fanshaw wrote, *Your presses work well, and are the admiration of all who see them.*[11]

The ABS's *Thirteenth Annual Report* of 1829 states that eight Treadwells were running on the first floor of Bible House by May of that year. At this point Fanshaw held a loan from the ABS amounting to $9000, which had been borrowed "to procure power-presses". Pasko said that in 1829 Fanshaw, having mortgaged his office to the ABS in order to purchase more Treadwells, possessed ten of them.[12] Figures from later years indicate his operation of up to twenty presses.[13]

In 1844 the American Bible Society reviewed its printing operation and found that, in quality and price, its product was no longer competitive with that of commercial printers. The Society was impressed with Harpers' new illustrated bible (*v.* page 45) and the Adams machines upon which it had been printed. Harpers offered to print all the ABS work for one-half Fanshaw's price. Fanshaw and his then-seventeen-year-old Treadwells came under criticism; he lost the ABS contract that year and that of the ATS in 1846. The societies went on to establish their own printing facilities. Fanshaw's business declined to a trickle; he retired to a comfortable living from his real estate holdings.[14]

The press

At 500-600 iph, a Treadwell single more than doubled the output of a vigorously-worked handpress, while requiring the services of a feeder and a taker-off and the attentions of a pressman. An extra boy was required on the early horse-driven presses—innocent of flywheels—to encourage the horse to continue in its circular path when the press came on impression, the animal balking at that point.[15] Itself a first, the Treadwell embodied such innovations as an impression throw-off, points on the frisket, revolving disc distribution and gear-driven composition rollers. Treadwell's double machines—actually pairs—were the first such presses made. Nevertheless, the Treadwell's timber frame, long equal-length toggles, and longitudinal orientation of platen and carriage clearly betrayed its handpress ancestry.

The following description is based upon Wyman's account of 1888 and the 1826 patent, a transcription of which appears herein as Appendix B. According to Wyman the original sketch for illustration **2** was made from the patent specification rather than an actual machine, while the originals for **3** and **5** seem to have been made from "life", perhaps by or for William Van Norden, who had planned a history of American printing. The patent specification itself was carefully worded to obviate any need for illustration.

Drive

Power was transmitted to the machine via a vertical *cam shaft* at the rear of the press, extending down through the pressroom floor to the power source. This shaft carried the impression cam, the grooved bed-motion control cam, and a bevel gear from which the bed-motion was derived. (The early doubles were simply two presses in a single back-to-back frame with the vertical cam shaft rising between them, the same cams and gear operating both ends, as seen in **5**. No flywheel was provided, so the animal or engine had an easy time of it until the moment of impression, when great resistance was suddenly experienced. One or more later presses were fitted with horizontal shafting and a flywheel, as seen in **3**.

Impression

The impression cam on the cam shaft straightened the toggle via a horizontal bar (the *impression slide*) with a roller on its cam end, and its other end bearing upon the center of the toggle, which faced the rear of the press. The bar could be lifted so that its roller cleared the impression cam, thus suspending the impression while the press continued to cycle. The bar was lifted by means of a cord passing up to a counterweighted lever on the head beam, with a rod-handle hanging near the feeder's station.

In its raised position the platen rested at a tilt with its front edge somewhat elevated, easing the passage of the blankets as the carriage ran in. A small roller on the platen edge smoothed the turn of the blankets. Platen guides were fitted to the frame cheeks. The platen was raised by a counterweighted lever on the head beam, linked to the platen by a cord or chain. At rest, the rear end of the platen was but half an inch above the form, the front end two inches above.

Bed motion

The bed (Treadwell uses *bed* to indicate the assemblage of type-bed and form, frisket and tympan, and their attachments) was driven to and fro by straps from a vertical windlass (the *verge*) at the rear of the press. Two scroll-drums, or *spiral eccentric pulleys*, one for the in-pulling strap and one for the out-puller, were keyed to the vertical windlass shaft. Two bevel gears ran loose on the windlass shaft in permanent engagement with a large bevel gear (the *jauns wheel*) on the inner end of a horizontal shaft, the outer (rear) end of which was bevel-geared to the vertical cam shaft. Thus, the two bevel gears on the windlass shaft rotated constantly, in opposite directions, without moving the windlass shaft.

A dog-clutch (the *chuck*), formed as a collar around the windlass shaft, was keyed to that shaft but free to move vertically so as to engage either of the bevel wheels, causing the windlass to revolve in the direction of rotation of whichever bevel gear was clutched, or the chuck could rest midway between the gears. Timed movements of the chuck effected the in-rest-out-reverse-in-etc. cycle of the carriage. The vertical motions of the chuck were controlled by a lever whose outer end ran in a circumferential groove or *race* cut in the rim of the carriage-motion control cam affixed to the cam shaft, the race formed to give the required timing cycle. This motion could be disengaged by a hand-lever near the feeder. The scroll drums were shaped with a varying radius to progressively accelerate and decelerate the bed, with gentle starts and stops.

Tympan, frisket

The frisket frame was hinged at its inner side (nearest the platen) to a pair of five-foot horizontal bars sliding through brackets on each long side of the bed. These bars moved out from under the platen along with the bed but were arrested by stops on the press frame, so that although the bed moved out almost three and a half feet, the frisket came out only two feet (and was held motionless while the bed completed its outward run. As the bed ran in the slack in the bars was taken up and the frisket was pulled along with the bed, to its position under the platen for the impression. Cords from the outer ends of these bars connected them to weights (**18** in 2) which served to keep the bars and frisket tight against the stops on the bed when under impression, and firmly against stops on the frame when the bed was out. The frisket's outer corners were fitted with studs that rode up inclined slides supporting an iron plate (the *apron*). The printed sheet was flown and a fresh one pointed while the frisket remained momentarily at rest on the apron Register points were attached to the frisket, which was covered with stout paper cut out and reinforced in the normal handpress manner.

The tympan was a piece of cotton doubled over the inner (platen-end) bar of the frisket, with its outer edges sewn over and held taut by a rod. Blanket and packing were placed inside the fold of the cloth. Cords attached to the ends of the rod at the outer end of the tympan ran vertically up over pulleys mounted on brackets arcing out from the head beam, thence down to two weights. These held the tympan taut against the platen surface when the bed was in and raised the tympan vertically, out of the feeder's way, when the bed came out. Both tympan and frisket were motionless during the second part of the bed's outward run, its reversal, and the first part of its inward run. The interval provided sufficient time for the sheets to be changed, while the extended bed travel allowed the bed to pass completely under the inking system. This arrangement also allowed the blanket to air-dry a bit between impressions.

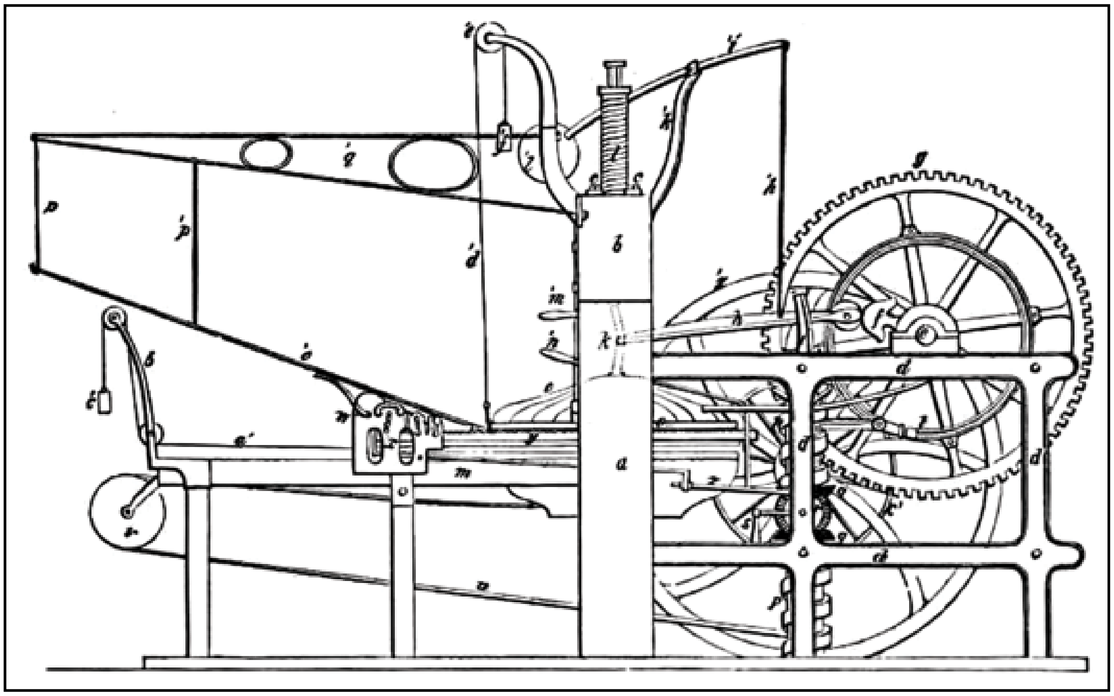
Inking

Beneath the feed apron, in addition to two form rollers, were one wooden and two composition distributors, their journals (Treadwell: *gudgeons*) running in boxes fixed to the sides of the plate-iron apron supports (the *jambs*). The wooden distributor was in contact with the composition rollers and geared to a five-foot rack on the off-side of the bed, the reciprocation of the bed driving the entire train of rollers. The fountain was mounted beneath the apron upon a moveable frame which, activated by a pin on the vertical mainshaft, moved the fountain against the nearest composition roller to add ink, and away again to allow the fountain roll to turn, for each impression. A pawl on the frame turned the fountain roll through a ratchet-wheel on the end of the fountain roll as the fountain moved away from the roller. The fountain roll formed one side of the fountain, as in modern practice, but there was no fountain blade, so the thickness of the ink film on the fountain roll was controlled by adjusting the clearance between the roll and the fountain bottom. Ink control was perhaps refined by the use of such *ad hoc* devices as pieces of tin or reglet judiciously positioned to slightly scrape the fountain roll at various places along its length.

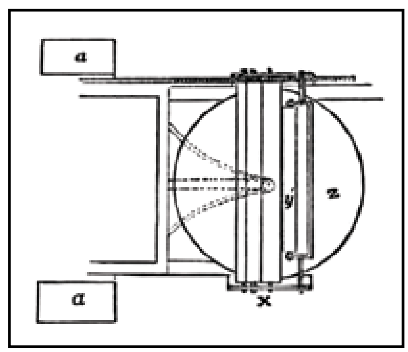
Distribution was aided by a revolving disc like those later fitted to platen job presses, but made of wood. Mounted horizontally in a framework fixed to the outer end of the bed, and reciprocating with it, the disc was turned through about 45 degrees for each impression by a ratchet-wheel on its underside contacting a pawl on the press frame as the bed moved. The disc passed under the inking system twice per impression.

McNamara's mystery machine

A phantasm, noticed only because it was described and sketched by Stephen McNamara, relying upon an account by old-time printer Andrew Overend, in an *Inland Printer* article.[16] Overend's description of the press, and the resulting sketch, seem to be the products of faulty recollection after the passage of many years, conflating features of the 1830 Adams double-

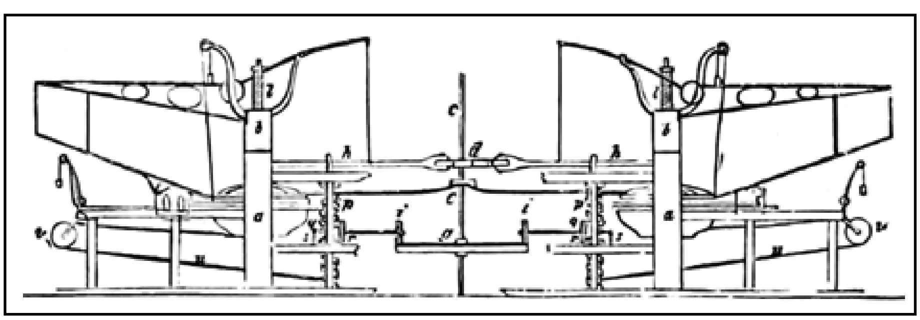


3. Treadwell single with horizontal shafting. Platen return by springs atop the head, but other motions largely unchanged. An obvious visual departure from the presentation in 2 is the long, elaborately-supported feed apron perhaps necessitated by the lengthwise orientation of the sheets piled on it. Note the shape of the impression cam. The dark circle on the camshaft is a wheel carrying the switch cam for the chuck on the verge, and the camming for ink fountain operation. According to a Fanshaw letter of 1826 at least one of this type was made (for a newspaper in Boston). From Wyman (1888), p. 341.



4. Right, the Treadwell ink distributing disc, attached to the type-bed, under the inking system (*a*, *a* are the cheeks; the bed is near its impression position). The rack extending to the right from the bed drove the ink rollers. From Wyman (1888), p. 343.

5. Treadwells were often installed as pairs—two presses sharing a central vertical camshaft. From Wyman (1888), p. 344.



feeder with those of the Treadwell doubles (pairs). Additionally undermining Overend's account, Treadwell had written in 1854, *Being at this time engaged in other pursuits, I made no efforts to alter or improve the plan of the press. Others soon came in with machines made all of cast-iron... and, as the printers about this time enlarged the size of their paper, my early presses were incapable of working it, and were necessarily given up.*

EXTRACTS

From a letter to the *New York Gazette* by Daniel Fanshaw, dated July 28, 1826 (*sic* omitted). Note the reference to a projected (but evidently unrealized) self-flying arrangement in the last paragraph: In answer to your letter, requesting a description of the printing presses you were so much pleased with when you examined them in operation at my office, I with pleasure send you the following account of them.

Mr. Daniel Tredewell, of Boston, is the inventor, and has had several of his power presses at work in that city for the last four years; but would not allow even printers to see them, as he had made no application for a patent till last spring. Each press occupies a space 3 feet by 13. The frame is much like that of the common standing press. The platen is like that of the common printing press, and gives the impression with what is called by printers, "the long, soaking pull." The bed, on which the form lies, is drawn in and out by straps. The paper is laid on the frisket by a girl (there is no tympan,) and when printed, taken off by another, who stands at the opposite side of the press. The laying on and taking off the paper is all the labour, the machine performing the remainder of the process of printing. The blankets receive the air at every impression, by being drawn up in front of the press as the form is running from under the platen. At each impression the rollers (which are of a soft elastick composition), supply themselves with ink, and commence the operation of distribution, on a round turning table, previous to applying the ink to the form.

Four of these presses are worked by turning a shaft, and require the power of a small horse. Instead of a horse, I use a small steam engine, similar in appearance to a cooking stove: it occupies the space of 2 feet by 4, and is the invention of Mr. Isaiah Jennings, of this city: it consumes less than half a cord of pine wood per week; and is worthy of the attention of manufacturers and proprietors of packets.

The inventor of the press has so admirably constructed and timed the movement of each part of the machine, that nothing which we think necessary for fine work in the common printing press is lost sight of in this.

The presses can work as fast as it is possible to feed them with paper, but I drive them with little more than twice the velocity of the common printing press. Going at that rate, they produce work far superiour to what I can obtain from my other presses. One great excellence of the machine I have endeavoured to describe is, that it does not wear out type more than half as fast as it is worn in the common way of printing.

The price of four presses, with the right to use them, I think will not exceed $7000.

The inventor is now building one for a newspaper in Boston. It is to be worked by a boy or man, turning a crank. One boy will be required to put on the sheet, and the machine will lay it aside on a table as it is printed.

Yours, respectfully, D. Fanshaw, American Tract Society House.

From *Niles' Register*, June 7, 1828, pp. 234-5: The "American Farmer" contains the following description of the printing presses, now in operation in the office of Messrs. Gales & Seaton, of Washington... These presses are the invention of Mr. Daniel Treadwell, of Boston. They may be propelled by any power. The four [presses] are moved by a beautiful high pressure steam engine of about five horse power. They each strike off about five hundred sheets an hour, and each press is attended by two girls... The cost of the four presses, we understood, to be about 5,000 dollars, the amount paid to the patentee for the privilege of using them 3,000 dollars and the steam engine about 2,000 dollars—making an aggregate cost of from 10,000 to 11,000 dollars. The engine consumes six bushels of Richmond or Potomac coal per day, and the attendance on the whole machinery, besides the two [sic] girls, is the superintendent of the presses and an engineer.

From *Scientific American*, August 28, 1869, pp. 130-131:

THE EARLY AMERICAN IMPROVEMENTS IN PRINTING PRESSES

Few men have borne a more important relation to the wonderful progress made in this country, during the present century, in the improvement of printing presses, than Phineas Dow, of this city [Philadelphia]. ...

Phineas Dow was born in November, 1780, in Londonderry [N.H.]... [and] was apprenticed, in his fifteenth year, to a carpenter. ... About 1803 he went to Boston, where, after working some time as a journeyman coach-maker, he became the proprietor. ... until the war of 1812 prostrated that branch of industry. [He then undertook] making the elaborate cabinet carving [decorating] the furniture used by the wealthier classes... up to the time the war closed. During this period, he was the intimate acquaintance of Daniel Treadwell, who, as his next-door neighbor, was prosecuting his trade as a silversmith. ...[Together they devised a screw-making machine. At the war's end, Dow] started a machine shop, where machinery of all kinds was repaired or manufactured, and it was as a machinist that he first established the connection with printing presses. ... Dow paid special attention, in his machine shop, to fire engines, and displayed such skill that he received all the patronage ... of the city of Boston ... While he was repairing, making and improving fire engines he was equally ready to execute orders for other descriptions of machinery, and as it fell within his province to repair old printing presses, his establishment became the headquarters, in Boston, of this business. For a time his efforts were confined mainly to various forms of the old-fashioned hand-press, and he also made and sold some ten or twelve hand-presses, called the Dow press ... But not long after the close of the war, his friend Treadwell returned from a trip to England, with a firm conviction that the time had arrived for the construction of more rapid printing machinery than the old hand-press. ... From the plans and descriptions furnished by Mr. Treadwell, Phineas Dow made first a model, and, subsequently, a series of working power-presses, ... the first ever made or used in the United States. ... Treadwell was so far in advance of his time, that, after his power-press was completed, he could find no purchasers. ...

... Treadwell commenced the printing business himself, running his presses by horse power, but as soon as he was fairly at work ... his establishment was burned to the ground ... the hand-pressmen of that day were intensely hostile. ...

Mr. Treadwell, still undaunted, had other presses made, and for greater security, as well as to gain less expensive power, he established another printing office on the mill-dam, in or near Boston, where his presses were run by water-power.

Mr. Dow subsequently made for Mr. Isaac Ashmead, of [Philadelphia], two of the Treadwell presses; and Mr. Ashmead was so well pleased with their operation that he had six other presses of the same pattern made by other machinists. ...

While the Treadwell presses were being manufactured, Mr. Dow had in his employment... Seth and Isaac Adams—the inventors and patentees of the Adams press. They were originally cabinet carvers, and they were useful in the machine shop in making patterns, as well as in various other affairs requiring superior skill. Isaac Adams possessed great fertility of invention, while his brother Seth was a shrewd business manager ... Prior to their famous invention [the 1836 Adams], and while they were still working for Mr. Dow, they invented a power press which was also called the Adams press [1830 Adams], and which attracted considerable attention. Mr. Dow made a number of these machines, and among other sales, he effected several in Philadelphia, including one to Samuel Coates Atkinson, of the *Post and Casket*; one to Joseph R. Chandler, proprietor of the *United States Gazette*; and one to Jasper Harding, proprietor of the *Inquirer*; and while he was putting up these three presses, he effected sales to other Philadelphia printers and publishers.

Mr. Tufts, who subsequently invented and manufactured several presses of novel construction, was also one of the journeymen engaged in Mr. Dow's machine shop at the period when these important improvements were gradually being perfected.

... [Dow] labored steadily during his leisure moments, in conjunction with Mr. Sawyer, a cabinet maker, to perfect a power press that would make a simultaneous impression on both sides of the sheet; and after spending several thousand dollars and much time in completing a machine of this description, his efforts were apparently about to be rewarded with success, when a destructive fire consumed his whole establishment [1830].

After spending several years subsequent to the destruction of his machine shop in several places, Mr. Dow permanently established himself, in 1841 or 1842, partly at the solicitation of Mr. Isaac Ashmead, as a machinist, in Philadelphia. ... His superior knowledge of the machinery connected with power presses, which were then rapidly coming into general use, gave him, for a time, a monopoly of this branch of his business in Philadelphia, and made him "the doctor" of all the sick power presses of the city. ... —*Printers' Circular*

From *The Atlantic Monthly*, vol. 32, issue 192, October, 1873, pp. 473-475, bracketed material is this author's:

DANIEL TREADWELL, INVENTOR (by Morrill Wyman)

[Daniel Treadwell returned to Boston from England] in September, 1820.

After examining the steam cylinder press while in England, he was satisfied that, although it might answer sufficiently well for newspaper work, a better power press for book work might be constructed by using the platen rather than the cylinder for the impression.... Soon after his return he commenced the construction of such a machine, which was completed in about a year, being the first press by which a printed sheet—a copy of the Boston Advertiser—was printed on this continent by other than human power. The difficulties ... may be better understood when we know that there was not a single steam engine at work in the old peninsula of Boston, and but a single one at the foundry at South Boston. There was not a lathe to be procured large enough to face the platen, which was consequently constructed of wood.

… After satisfying himself of the quality of the work, and of the important saving in expense over that of hand printing. … Treadwell determined, in connection with two partners, to commence the business of printing, and continue it until the printers should be satisfied that it would be to their advantage to adopt his press and purchase the right to use it. Accordingly a second machine was built, type purchased, and workmen procured. … Journeymen were opposed to his plan … one of his most reliable assistants was a young woman who laid on the paper to be printed, and became quite familiar with the working of the machinery, so that going afterwards to Philadelphia with one of the presses, she taught others how to manage it. The business was carried on about two years with moderate profit; one of the principal booksellers of Boston [Timothy Carter] then purchased the establishment, with the patent right for Massachusetts. During this time Treadwell received contracts from several booksellers to print works for them; and many books are now to be seen with the imprint, "Treadwell Power Press". The opposition of the journeymen was violent and unremitting, and once when his warehouse took fire and the presses were injured, some of the journeymen were suspected of setting the fire.

… Between the years 1823 and 1829 [Treadwell] constructed several sets of power printing presses, and put them in operation in New York for the Bible and Tract Society there, in Philadelphia, Washington, Baltimore, and Boston; and in some of these cities they were in use for more than twenty years. There is good reason to believe that no form of power press for book printing constructed since then is capable of producing a better impression or making any considerable saving in the cost of the work. … From the manufacture and sale of the rights of using his presses Mr. Treadwell received about $70,000. …

From Pasko (1894), p. 28: [Isaac Ashmead] introduced the Treadwell press in [Philadelphia] in 1827, and was thus the first power-printer there. Horses were first used to furnish the motive-power, but after the number of presses had increased to eight, being in part of medium size and of medium and a half, he put in a four horse-power steam-engine. These presses were afterward exchanged for a better make.

Ibid, p. 184: In 1826 [Daniel Fanshaw] put in the first power-presses ever used in a book office in New York, and shortly after mortgaged his entire establishment that he might have nine more. These were the Treadwell. … He lost his contract with the Bible Society in 1844, having been bickering with it for several years, as he refused to put in any larger presses than medium and a half, and still insisted upon his rights to the two outside quires of paper in each ream, which had once been considered as a perquisite of the trade, but which was a claim which had been given up by all other printers when the Fourdrinier machine came in. Shortly after the Tract Society undertook to do its own printing, and Mr. Fanshaw's business shrank to very small proportions. …

Ibid, p. 547: The later Treadwell press was put into operation in Batterymarch street, in Boston, in 1827. … Nine presses of this kind were used in the Bible House, in New York, at one time. They have not been employed since about 1845.

From Ellis (1905), p. 62: The first "power" or steam press upon the bed and platen system was that made by Daniel Treadwell of Boston, U.S., in 1822, but it does not seem to have ever got upon the market.

From Green (1951), p. 147: … With the backing of two Boston men, [Treadwell] set up a complete establishment for book printing. A second press was added in 1822, and contracts were made with Boston publishers for the printing of a number of books. After having been in successful operation for about a year, the printing office was sold to a Boston printer, who, later, purchased two more presses. A total of four presses were purchased by another Boston office, which a short time later burned to the ground with total destruction of all equipment. … Apparently, after the business was well started, Treadwell handled only the sale of the rights to purchase or make the press, and his friend Dow contracted for the actual manufacture. … Although the first press was put in operation in 1821, a patent was not obtained until 1826. By delaying the issue of the patent, Treadwell hoped to extend its life and hence earn protection for as many years as possible.

… In 1830, the R. Hoe & Co. advertisement indicated they were makers of the Treadwell press, but their later advertisements omitted mention of the press.

From Comparato (1979), p. 17, with passage from Ellen Ballou's *The Building of the House: Houghton Mifflin's Formative Years* (Boston: Houghton Mifflin, 1970), quoting an 1893 letter to Houghton from Timothy Carter: Timothy H. Carter, Boston printer and publisher … bought Treadwell's printing shop on Batterymarch Street, complete with presses, women and girls as operators, and rights for the entire state of Massachusetts. "The Treadwell Machine Press came into the market and Mr. Hale of the Boston Daily Advertiser, and myself, purchased exclusive rights of use for this part of the country, and in a short time Mr. Hale had four of them running in his office by horse power and then by steam power, and we also had four jointly owned, running on the Mill dam by water power. The Treadwell Press did fine work but required much room and much power."

Ibid., p. 18: Although the Treadwell thereafter [1829] declined in use, R. Hoe & Company in 1830 advertised as its "manufacturers", but this may only have been an invitation for repairs or custom work.

From Daniel Paul Nord, "Benevolent Books: Printing, Religion and Reform", in Robert A. Gross and Mary Kelley (eds.), *A History of the Book in America*, Vol. 2. Chapel Hill: University of North Carolina Press, 2010, p. 231. Neither Hoe (1902) nor Tucker (1973) mention any Hoe involvement with Treadwell: … Treadwell began experiments with power printing in Boston in 1822; the ABS opened negotiations with him in 1823; and by 1829 the society had installed sixteen Treadwell presses, probably built by Robert Hoe of New York under a franchise arrangement with Treadwell.[17]

NOTES

1. Treadwell's best customer, Daniel Fanshaw, briefly described the press in a letter of 1826. Wyman (1873) lauded Treadwell and presented a tailored account of his pressbuilding activities, managing to avoid naming Hale or Carter and utterly ignoring Dow's vital contributions. Stephen McNamara wrote on the Treadwell in *Inland Printer*, October 1884. Moore (1886) pp. 35-38, provided a full description and history, originally written for the *Boston Journal*. Wyman (1888) included an excellent description of the machine, an account of its development and early use, and the cuts shown above. Hoe (1902) presented an oft-seen cut of the 1830 Adams double ender, with cutline calling it a "Treadwell". Green (1951) provided an account of the Treadwell, with a sketch of the single redrawn from Wyman (1888). Comparato (1979), pp. 10-11, 15-19, summarized Treadwell history. Wilkes (2004) pp. 227-228, illustrated his Treadwell article with sketches of the early single and a double (the latter taken from McNamara 1884). Sources of misinformation abound. The machines were operated under licensing agreements, so Treadwell delayed patenting until 1826. His U.S. patent is dated March 2 of that year, and appears herein as Appendix B.

2. Comparato (1979), p. 17.

3. Wyman (1873), p. 474.

4. Green (1951), p. 147.

5. William S. Pretzer, "'Of the paper cap and inky apron': Journeyman Printers" in *A History of the Book in America*, ed. Robert Gross and Mary Kelley (Chapel Hill: The University of Carolina Press, 2010), p. 165.

6. Century (1876), p. 312. In this passage "cylindrical" indicates power input through rotary motion, rather than referring to the mode of impression.

7. *Niles' Register*, June 28, 1834.

8. *Encyclopaedia Americana*. Philadelphia: Carey & Lea, p. 340.

9. Morrill Wyman, "Daniel Treadwell, Inventor", in *The Atlantic Monthly*, October, 1873, p. 475.

10. Century (1876), p. 130.

11. Wyman (1888), p 345.

12. Pasko (1888), p. 446.

13. By 1830, according to the website *manifoldgreatness.org*, Fanshaw had sixteen Treadwells. Van Winkle (1836), p. 30, mentioned twenty-two. Dana (1858), p. 44, said Fanshaw's shop housed nineteen machines when his plant burned in 1836. Wilkes (2003), p. 227, wrote that Fanshaw ran as many as twenty presses. A vexing question is whether the paired machines were counted as one press or two in the various statements.

14. Wosh (1994), pp. 23-24.

15. Green (1951), p. 146.

16. *The Inland Printer*, Oct. 1884.

17. But see Nord's n. 39, p. 596, in which he references an extensive list of Society materials which may support the Hoe connection.

BOOTH 1822/1823

Ralph Green's 1951 article described Jonas Booth's first machine (1822) as a double-ender, with two friskets and a single type-bed. In addition to the reciprocation of the friskets to present first one sheet and then the other to the action of the platen, the single type-bed was reciprocated under the ink rollers. The wooden frame of this machine proved too weak for the constant starting and stopping of the heavy bed and Booth's later machines were fitted with stationary beds. Booth's business was confined to New York. He gained a U.S. patent Sept. 1, 1829, in his name and those of his sons James, Thomas, Jeremiah and Jonas Jr., but did not continue in the press-building business.

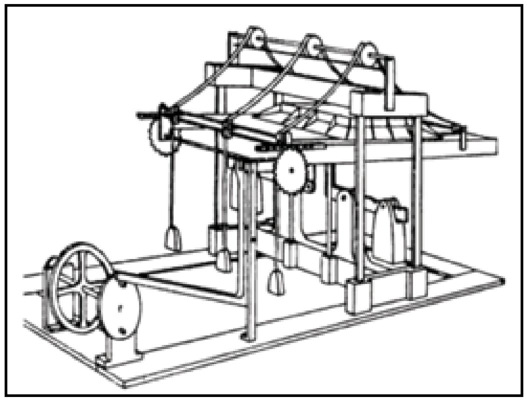
In 1822, Jonas Booth installed the first steam powered printing press in America, greatly multiplying his production capacity and lowering costs. Booth's printing concern became the first major show printing firm in the United States, according to an article by Neil Cockerline.[1]

Pasko's *Dictionary* entry on Booth said ... *Aided by his recollections of the presses he had seen in England, he built a machine in 1823 upon which was printed an edition of Murray's Grammar. This was the first machine press in New York. A few years later he built at Worrall's another press which was used upon the Courier and Enquirer for some time. In 1826 or 1827 he began using composition rollers, casting them himself. They had previously been unknown on this side of the water. He also made his own inks. His first printing was of books, the second of lottery tickets and bills, and finally it was theatrical work. In this he was the American pioneer.*[2] The machines Booth saw in England were cylinders; Treadwell used composition rollers before 1826. The press built by Worrall & Co., New York, was a cylinder, according to Comparato.[3] According to an entry in *A History of American Manufactures from 1608-1860,* Shadrach van Benthuysen of Albany was said to have employed a Booth platen.[4]

A summary of 1829 patents in the *Journal of the Franklin Institute* said*, For an improvement* *in the construction and operation of the Printing Press, denominated 'Booth's Improved Double Printing Press;' Jonas Booth, sen., James Booth, Thomas Booth, Jeremiah Booth, and Jonas Booth, jun., New York, Sept. 1. In this press the platten is firmly fixed, and the table, or bed, and form, are made to rise up to it, by means of levers adapted to that purpose. The form has no horizontal motion, there being a frame, carrying an inking roller, which passes in between the form and the platten, to ink the former. The sheets to be printed are carried in, and delivered by means of straps, one being carried in, and another delivered, whilst the form is inking. There is no claim, and of course the whole arrangement is intended to be patented. The mode of supplying the rollers with ink, and the structure of some other parts, are such as are well known.*[5]

The April 1891 issue of *The American Bookmaker* included the eighth in its series "Evolution of the Printing Press" with an illustration taken from the now-lost patent documents. The author obviously knew little about the press, indulging in a vague disquisition on the supposed deficiencies of the platen as a type. For lack of better, here are excerpts from the article, and its accompanying cut:

... the design of the Booth press is still extant in a practical illustration made for the Patent Office. The platen was stationary, the bed moved up and down, and the sheets passed through between them on tapes. Differing, however, from later presses like the Adams, the bed was moved to the end to be inked.



6. Drawing of Booth's press.
From *The American Bookmaker*, April, 1891.

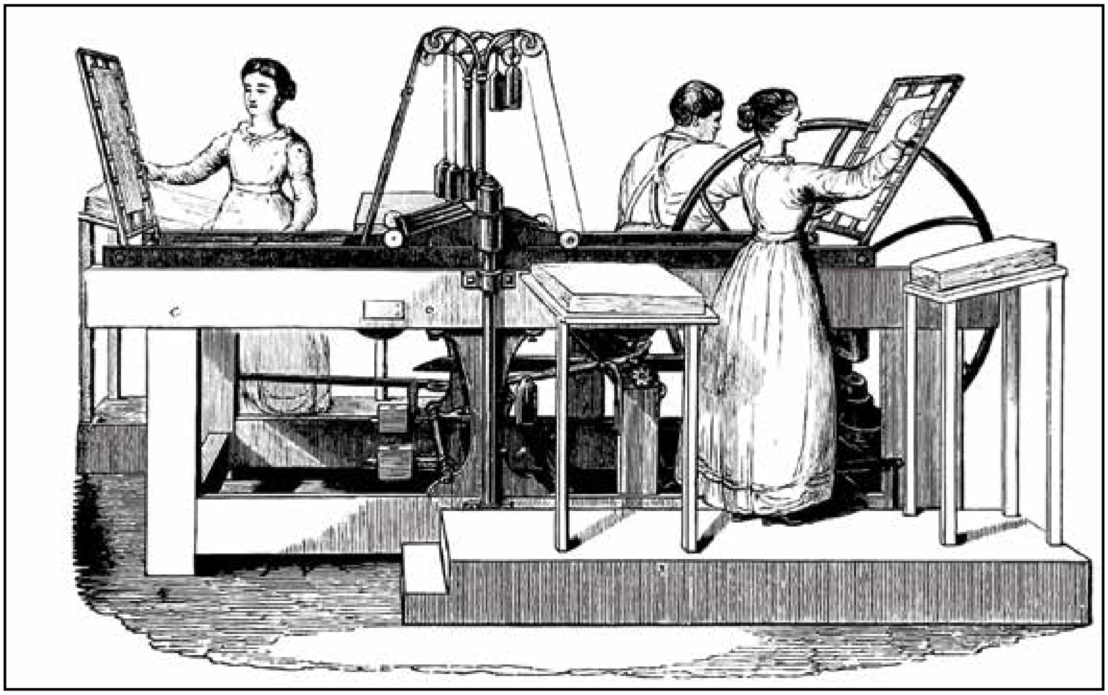
Several serious defects will be found in this press... There was no space left in Booth's apparatus for stationary rollers ... and therefore there must have been a long stop after the impression was taken before the form was sufficiently inked to be returned.

... The feeding arrangement was very unsatisfactory. The sheet upon this press was apparently laid upon the tapes and held there until it was drawn partly in. There was no fly and no method of taking off the paper, except by the hands. The contrivance of a feed board, so far as is shown, was not adopted. ... It is only by closely examining models such as these that we are enabled to see the successive steps of improvement.

NOTES

1. Neil Cockerline, "Ethical Considerations for the Conservation of Circus Posters" in *waac Newsletter*, vol. 17, no. 2, May, 1995.
2. Pasko (1888), p. 68.
3. Comparato (1979), p. 43.
4. *A History of American Manufactures from 1608-1860.* New York: E. Young, 1868.
5. *Journal of the Franklin Institute,* Vol. III, New Series, p. 400.

ADAMS 1830[1]



7. **A late version of the 1830 Adams double-feeder. The ladies are working the fly frames, a feature enabling each to both feed and fly, saving the labor of two operatives. The vertical crankshaft driving and controlling the press is visible to the right of the nearer lady's knee. It was driven from the flywheel shaft via bevel gears. The pitman is the horizontal arm with the sharpened end, actuating the impression toggle to raise the bed against the platen. The slanting lever beneath the type-bed with a small weight upon it actuates the fountain roll and ductor by means of bed motion. The fountain is on the stand just left of the near lady's skirt; its ratchet wheel is visible. The distributing drum for the left end is just visible under the upper frame rail, left of the type-bed and platen. The cube-shaped counterweights are part of a torsion-bar and link arrangement that assisted the bed guides in keeping the bed level. The weights above the platen are tensioners for the tympans; their positions show that the carriage is out to the left, the left end's tympan held vertically by the weights. The platen is fitted with wheels to ease its movement to one side to gain access to the form. Near the ladies' feet are the impression throw-off levers. The carriage is out to the left, the right-hand frisket is under impression.** Hoe (1902), p. 11.

A wooden-frame double-feeder printing from a single form, the machine embodied several features which would be integral to the famous 1836 Adams, including type-bed driven upward against the platen by toggle joint to take the impression, modified crank-motion actuating the impression toggle, roll-away platen, and reciprocating carriage transporting the form rollers and friskets. It shared with Booth's second design the great advantage of moving the type bed a few inches vertically rather than, as in the Treadwell, cycling it through several feet horizontally. In addition, making the impression through motion of the bed, instead of the platen, obviated platen counterweights. The weight of the bed ensured its return to rest.

Isaac Adams was the patentee; he installed the prototype for Boston publisher Jenks & Palmer in late 1828. In 1829 he was joined by brother Seth and Boston inventor/machinist Erastus Bartholomew to manufacture the machines. The presses were originally made in platen size 20x26; they were about thirteen and a half feet long, five feet wide, and five feet in height from working floor to top of platen. Adams promised 1000 iph. Although the press was cataloged as late as 1856, it is unlikely that many were sold after the 1836 introduction of the improved Adams. George Bruce's New York Type Foundry in 1856 offered the machine in platen sizes 23x29½ for $750, 21x35 for $775, 25x37½ for $800, 26x40 for $900 and 28½x43 for $1000.[2]

The presses

Elements of two somewhat different presses feature in the following descriptive notes, juxtaposed to suggest the lines of evolution that culminated in the 1836 Adams. The specification of 1830 obviously describes an early version, as shown in Figs. 1 and 2 from the drawings of Reissue 546 shown below, while its specification and Figs. 3, 5, and 6 delineate a developed version, as illustrated in 7 above. Patent drawings notwithstanding, it is doubtful that any two of these presses were identical, and probably many were altered during their working lives. A motivating factor in the improvements in this machine, and the adoption of iron construction for the 1836 improved Adams, may have been the introduction in 1834 of Otis Tufts' well-received, all-iron press.

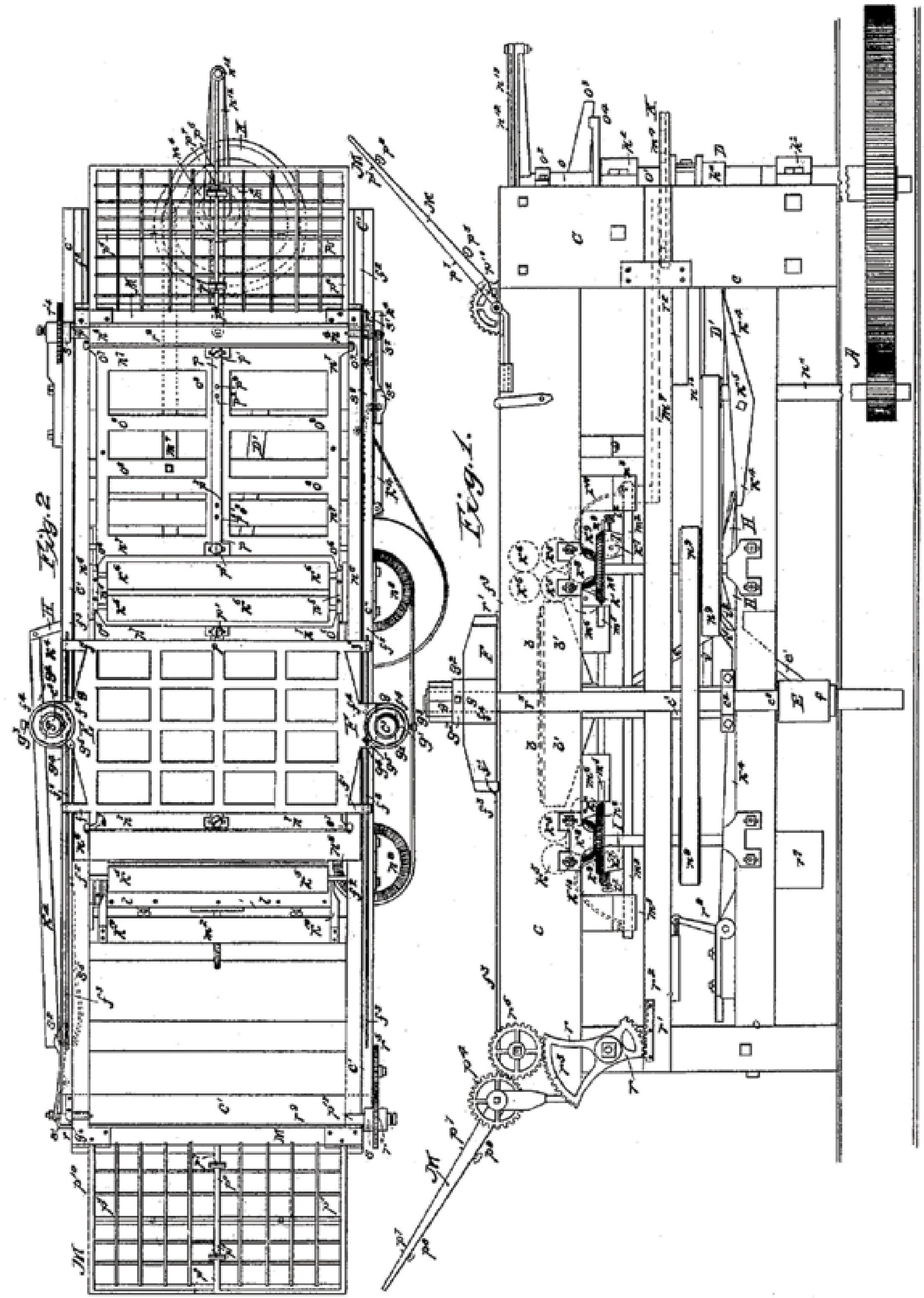
Power

The 1830 Adams specification describes power input from a room beneath the press, into which the lower end of the crankshaft projected and was geared to a vertical power shaft fitted with a flywheel and, on its upper end, a belt pulley. The two distributor drums and their rollers were driven from vertical shafts belted to the pulley. The upper ends of the vertical shafts were bevel-geared to the distributor roller sets. Reissue 546 describes a later arrangement, with power input from a horizontal flywheel shaft bevel-geared to the crankshaft, as shown in 7 above. Here the distributing drums were band-driven from a pulley on the flywheel shaft.

Impression

This machine's platen and type-bed were set across the press frame, with the ends of the platen and bed facing the side frames, contrary to the lengthwise orientation of the bed and platen on handpresses and Treadwells. This allowed a shorter carriage stroke, and better inking resulted from the shorter distance across the form covered by the form rollers. The platen was provided with runners or small wheels at its corners that rode upon iron rails on the upper frame members and allowed the platen to be moved from above the type-bed and form. When in operating position, the platen was secured by two stout rods (Adams: *impression bolts*) threaded into the outer ends of a fixed transverse iron *bottombar* (which Adams sometimes called the *winter*), whose ends were secured to the lower frame rails. Impression was adjusted by means of the nuts securing the platen to the rods. The projections on the platen through which the rods passed were open on one side to allow the platen to be moved from above the bed. The retaining nuts were loosened to release the platen and were indexed to ease exact re-tightening.

The type-bed was fitted with guides at each end which ran in vertical slideways on the inner faces of the frame rails, and further steadied by brackets attached to the underside of each end of the type-bed which extended downward to guides at the lower ends of the slideways. On some presses, the brackets terminated in sockets which slid up and down upon the lower parts of the platen rods. The cubical weights seen in 7 were attached to a cross-shaft



8. From U.S. Patent Office Reissue 546.

to which were affixed two short arms with vertical links to the type-bed. The weights eased the type-bed motion; the torsional resistance of the cross-shaft helped keep the type-bed level across the press, preventing the bed guides from binding in their slideways. The type-bed was scraped slightly concave to compensate for the upward spring caused by the pressure of the toggle beneath its center during the impression. The lower limb of the toggle was supported at the center of the bottombar.

The toggle was straightened via a connecting rod (*pitman*) by a crank on the vertical crankshaft, which was itself secured in bearings at one end of the machine and carried upon its upper end the mechanism controlling the carriage motion. Impression was suspended by lifting the pitman from the toggle center by means of foot-levers at the feeders' positions, the pitman then reciprocated through a slot in the upper toggle limb without moving the toggle.

Declension lever

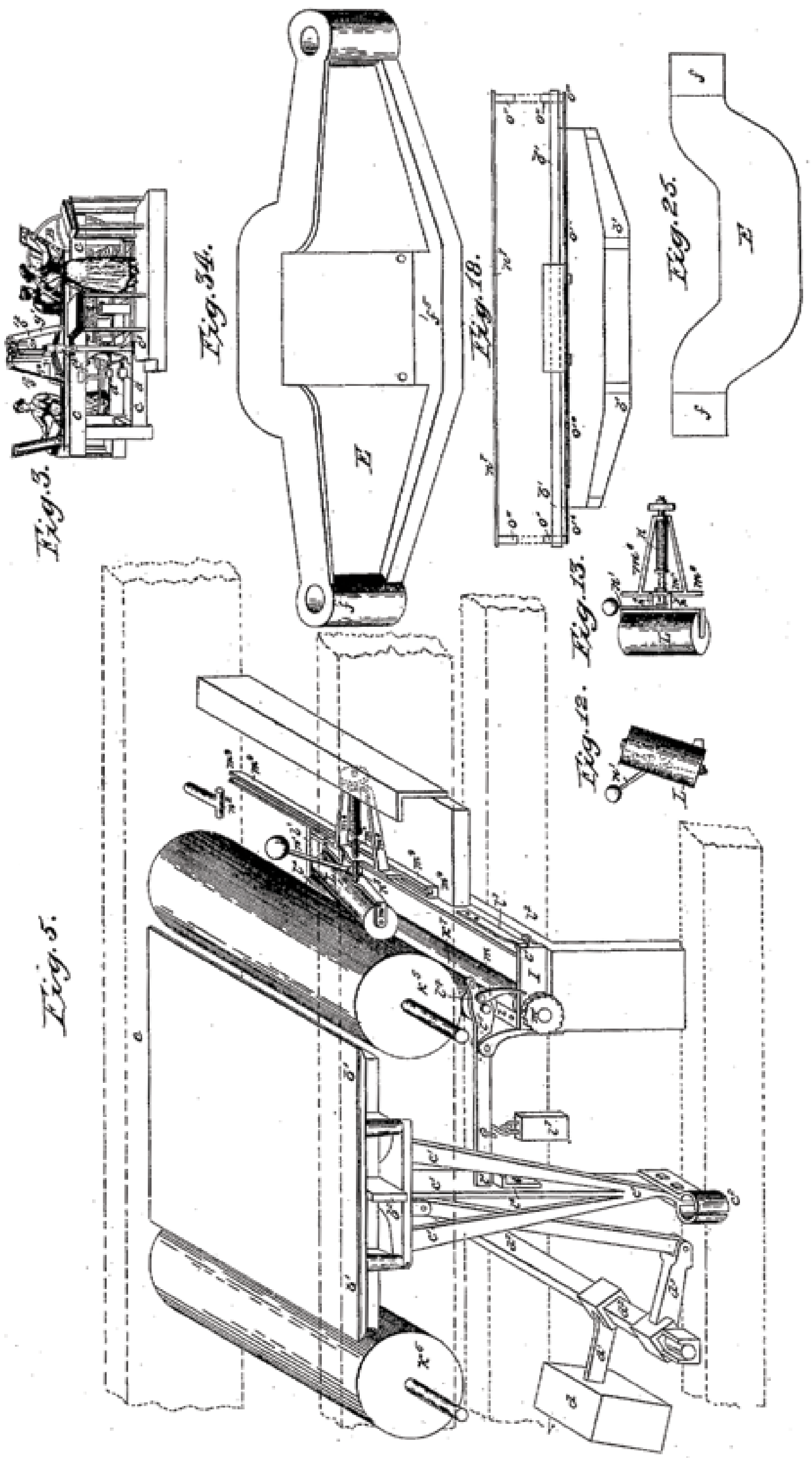
In order to allow the bed to remain stationary in its lowered position between impressions, the toggle must be disengaged from the constantly reciprocating pitman during about half the latter's stroke. At the moment the pitman end contacts the toggle center, not only is the pitman moving at nearly its highest velocity, but the toggle is at a point of great resistance to straightening. If the pitman-toggle contact were direct, a heavy jar would result, and after the impression another heavy impact as the bed dropped into its rest position. No machine could be expected to remain intact for long under such conditions.

Adams interposed a *declension lever* between the pitman and the toggle to modify the undesirable velocity characteristics of the crank motion, allowing jar-free operation. It consisted of a curved lever pivoted near the bottom of the lower toggle limb which, when engaged by the pitman, "rolled" against the lower toggle limb progressively from bottom to top, until its upper end met the toggle center pin, when it was simply carried along as the toggle was straightened. After the impression, the declension lever acted in reverse to allow the bed to settle to an easy stop. The *alternators* so vital to the success of the 1836 press derived from this simple device.

Carriage

The carriage was a light rectangular wooden frame reciprocating horizontally upon slides inside the upper frame rails. A frisket frame was placed on each end of the carriage; two or more form rollers were positioned in boxes at the center of the carriage between the friskets, receiving ink from two distributing drums, one at each side of the bed. The early presses' distributing drums oscillated axially while they rotated, deriving their axial motion from linkage to a cam race cut into a circular plate keyed on the crankshaft. The drums were flanked by composition distributors. A separate fountain was provided for each end (early models), the fountains moving a little to impart ink to the distributors. The fountain rolls were turned by pawls on the frame engaging ratchet-wheels on the rolls' ends as each fountain receded from contact with its end's distributors, *a la* Treadwell. The frame from which the fountains derived their slight motion was moved by another cam-race cut into the circular plate on the crankshaft. The covers of the fountains acted as fountain blades, adjusted to control ink film thickness on the fountain roll.

The distributing drums of the later models ran without axial motion; mouse-rollers reciprocated axially against the drums. A single fountain was fitted under the drive end.



9. From U.S. Patent Office Reissue 546.

Fountain roll and ductor (Adams: *dip roller*) were actuated by type-bed motion. The form rollers received fresh ink but once for every two impressions, rolling over the form once in either direction for each impression.

Tympans could be arranged in a manner similar to that of the earlier Treadwells, with one serving each frisket. Extensive overlaying must have been avoided, since duplicate overlays would have been required, one for each tympan. In the version of the press illustrated in 7 above, with but one fountain, the pressman may have compensated for the slight under-inking of the form for the impression from the left-hand end by placing an extra sheet of packing in the left-hand tympan. Reissued patent 546 also describes a single tympan fitted to the platen, a more convenient arrangement later adopted for the 1836 press.

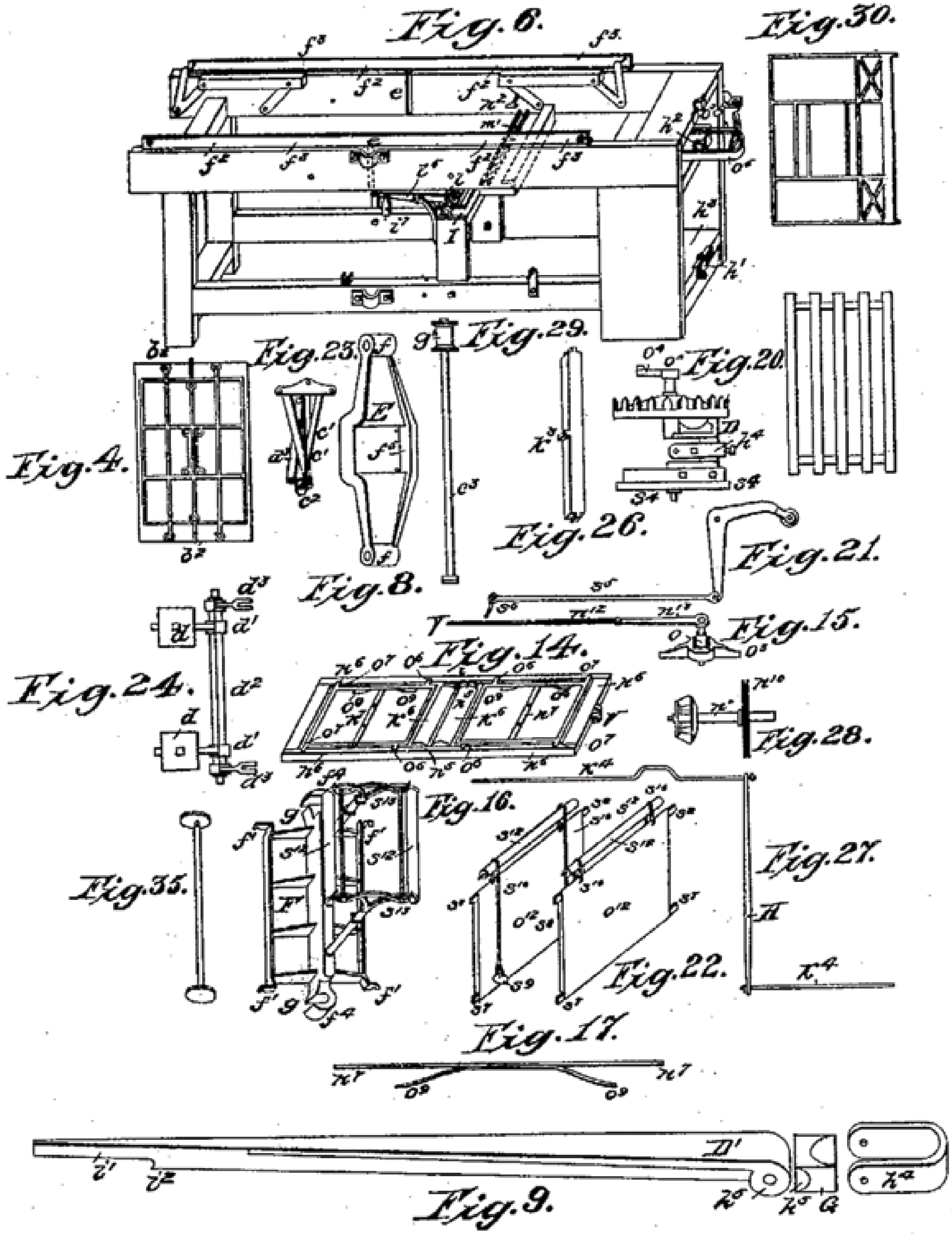
Carriage motion was effected, through a crank and connecting rod, by an ingenious interruptor motion; only the patent specification can do it justice: *The [carriage is] operated by a crank motion on the end of a shaft which stands on the end of the shaft of the crank that gives the impression, the top end of which forms a step in the lower end of the short shaft. In order to give a periodical motion to this shaft an iron bar 18 inches long 3 inches deep and one inch thick is put thro' it near to its lower end and hung at its center on a pin which is put thro' the shaft. The top end of the lower crankshaft has an arm on it with a projection on its upper side which strikes the bar near to one end and carries it around one half of a revolution, which moves the rollers over the bed by means of the crank and pitman on its top end. That end of the bar is then raised by an inclined plane on the middle cross bar of the end of the frame so as to clear the projection on the arm. The friskets with the rollers and frame then stop until the impression is given, when the arm strikes the other end of the bar and carries the rollers over the form again, and so on in rotation.*

The carriage-motion crank was moved through a half-turn for every full turn of the crankshaft, and remained at rest while each frisket was under impression. On later models, the tilt of the bar was controlled more precisely by means of an iron hoop attached to the press frame (Fig. 6 in the drawings) upon whose upper rim the inclined plane was formed, along with a slight notch to ensure accurate positioning of the carriage.

Fly frames

The fresh sheets were placed on hinged frames called *fly frames* (or *feed frames*), covered with netting and fitted with points, at the ends of the press. Each attendant pointed a fresh sheet upon her fly frame while her frisket was under the platen, the fly frame standing upright. She removed the just-printed sheet from her frisket as her end of the carriage came out from under the platen. As an impression was taken upon the other frisket, she turned her fly frame down upon her frisket, impaling the fresh sheet on its points. She then returned the fly frame to its upright position before the carriage began to move. Holes in the frisket bar that supported the frisket points admitted the fly frame points, protecting them from damage when the fly frame was turned down. This arrangement allowed each attendant to both feed and deliver, saving the wages of two operatives on each press.[3]

The fly frame motion of the early version was mechanized: Short racks on the outside of the press frame at each side engaged sectors on the fly frame shafts. The racks were attached to a rectangular frame within the press frames; the rack-frame moved at the moment of impression to lower the fly frame at the end whose frisket was out, impelled by a roller on the impression crank striking a specially-shaped bar on the rack-frame. Weights returned the rack-frame to its position.



10. From U.S. Patent Office Reissue 546.

Only the fly frame at the end not under impression was activated; the carriage frame engaged a clutch arrangement on the fly frame at each end as the carriage came to rest at that end. The fly frame serving the frisket then under the platen was thus left disconnected from the rack and gears at its end, remaining upright to receive a fresh sheet. Although the fly frame was a device for feeding—or pre-registering—the sheet, in it can be seen the basis of the sheet-delivery fly pioneered on the 1836 Adams. Derivation of the fountain roll and ductor motions from the action of the type-bed also prefigured the 1836 design.

The patent drawings (8, 9, 10, 11)

Figure 1 is an elevation of the south side (looking north) of the press described in the 1830 specification; Fig. 2 a plan view of the same press. The distributors and their short vertical drive shafts are seen at each side of the type-bed; the two form rollers rest on the right-end distributors. The distributing drums ran in boxes in a frame (Fig. 11) that oscillated axially (north to south to north etc.) to smooth the ink film. The carriage is out to the right; the form rollers and right-end frisket with its central bar for the register points appear at right of the platen in Fig. 2. The long "tail" at the right end of the press is the carriage-drive crank and connecting rod. Below it at ***o*** on the crankshaft is the interruptor motion (Figs. 31, 32, 33) for the carriage drive, below that at **K** is the circular plate in which the cam races for the fountain frame (Fig. 10) and the distributor frame (Fig. 11) were cut. Lower still, at **D**, is the impression crank (Figs. 20, 33).

The fly frames are at **M**, **M**; their central crossbars supporting their points are clearly seen in Fig. 2; their operating gears and racks were operated by the timed movement of the rack frame show in plan view at Fig. 19. The rack frame return weight and its bell-crank linkage to the frame are at lower left in Fig. 1; the square weight is visible below the bottom rail of the press frame. The south end of the bottombar is at **E**. The bar **H** lifts the pitman to suspend the impression when the long triangular foot levers $\mathbf{K}^4$ are depressed. In the room beneath the press at **A** is seen the small pinion on the power shaft engaging the large gear on the crankshaft. A pulley on the upper end of the power shaft is belted to the right-hand distributor drive shaft, which is in turn belted to the left-hand distributor drive shaft. Just to the right of the bottombar end **E**, at **e**, can be seen part of the lower limb of the toggle (Fig. 7).

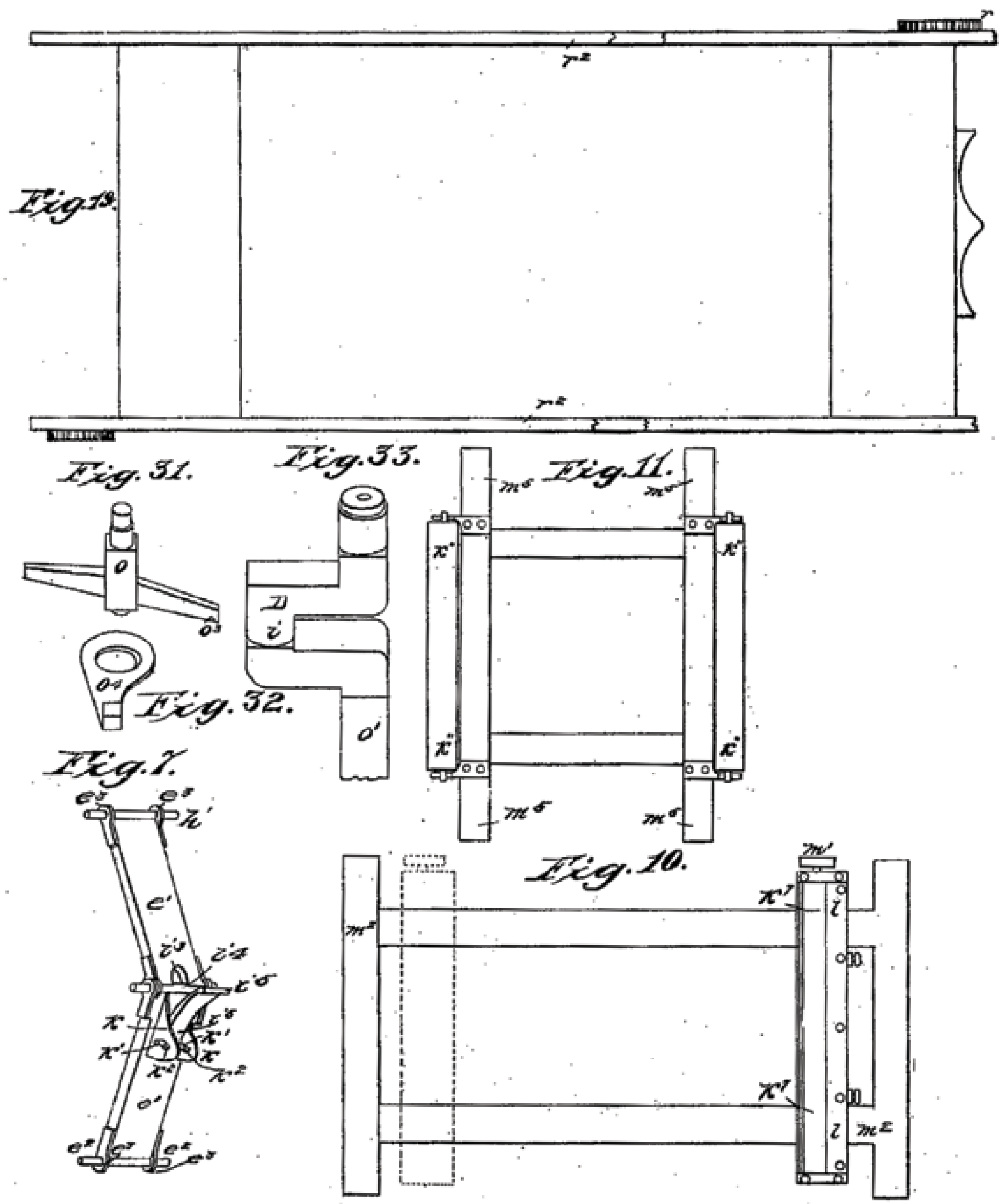
Figure 3 depicts the developed, or late-model press, as more clearly drawn in the Hoe (1902) cut above. The frame of this press appears as Fig. 6, its type-bed and inking arrangement at Fig. 5. The underside of the type-bed with its pin for the toggle appears at Fig. 4.

Figure 5 illustrates the later arrangement of type-bed, distributing drums, mouse rollers (Figs. 12, 13), one of the two counterweights and their platen-steadying linkage, the near-side upper and lower bed guides (the lower formed to embrace the near-side platen rod), the fountain, fountain roll with ratchet wheel, near-side fountain operating lever with pawl and ductor and weight, and, on the far-side frame rail, one of the T-studs that reversed the mouse-roller.

Figure 6 depicts a late-model press frame, with an iron hoop at the right-hand end to control the tilt of the interruptor motion bar (Fig. 31).

Figure 7 details the toggle and declension lever, with the aperture through which the narrow part of the pitman (Fig. 9) works just above the toggle center pin.

Figure 8 shows a late-model bottombar, better shown at Fig. 34, with the toggle seat upon its lower edge.



11. From U.S. Patent Office Reissue 546.

Figure 9 presents an exploded view of the pitman, with its strap and cheek-piece formed to allow freedom of movement vertically as well as horizontally. The shoulder near the left-hand end engages the declension lever to straighten the toggle, raising the bed to take an impression.

Figure 10 is a plan view of the reciprocating fountain frame and fountains of the early-style press; Fig. 11 is a plan of the vibrating distributor frame and distributor drums of the early style; Figs. 12 and 13 detail one of the two mouse-rollers employed on the later-style machines.

A perspective of the carriage appears at Fig. 14, the carriage drive at Fig. 15 (and Fig. 31).

Figure 16 is a perspective of the platen, with its runners at the corners, the openings for the platen rods, and the tympan supports. (The tympan arrangement is shown at Fig. 22).

Figure 17 is an elevation of a frisket upon long curved leaf-springs; Fig. 18 is an elevation of a frisket with studs impinging upon springs attached to the type-bed. The springs supported the frisket clear of the form until the moment of impression.

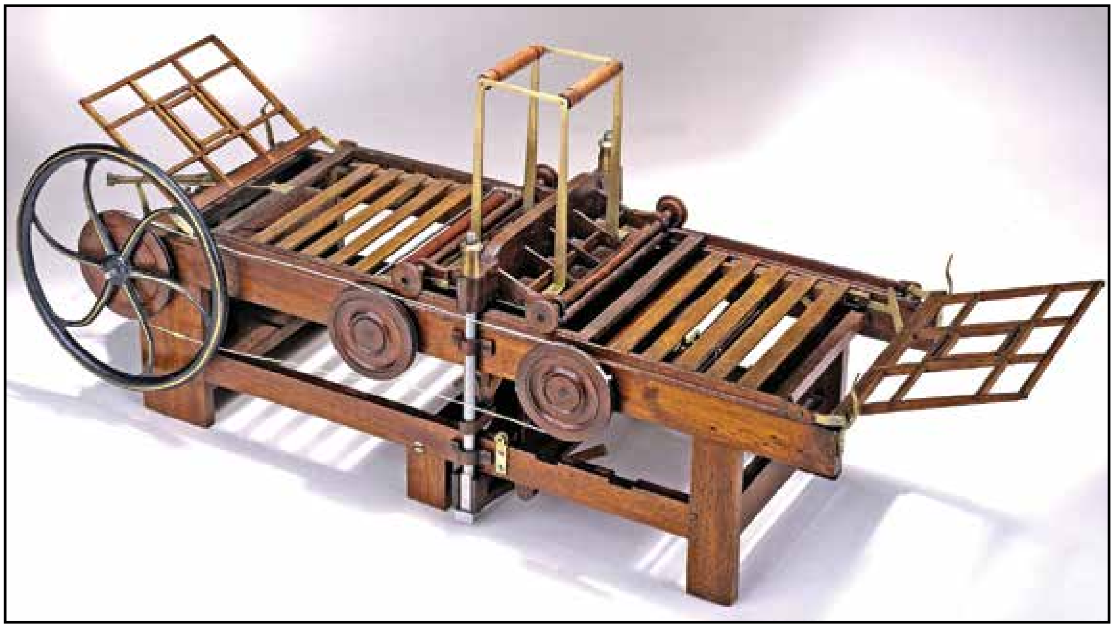
The rack frame for operating the fly frames is shown in plan at Fig. 19; the shape affixed to its right-hand end was engaged by a roller on the impression crank (Figs. 20, 31) at the moment of impression to activate the fly frame at the proper end of the press. As the crank roller passed the shape the weight seen in Fig. 1 returned the rack frame to its right-ward rest position.

Figure 20 shows a late-style crankshaft assembly with, from top, the carriage-drive crank, interruptor motion, crown gear (drive gear), impression crank (with pitman strap upon it) and, at bottom, a cam to pull the toggle off-center, operating through the bell-crank and connecting rod shown in Fig. 21.

Figure 22 is a perspective of the tympans or blankets, with their rollers and weights.

A form of bed guide appears as Fig. 23; Fig. 24 shows the counterweight and bed-steadying assembly in plan; Fig. 25 shows the early-style bottombar. Figure 26 shows the lower toggle limb, Fig. 27 the impression throw-off bar **H** and its foot-pedals in plan; Fig. 28 the later-style flywheel shaft with bevel gear and band pulley, Fig. 29 one of the two platen rods, and Fig. 30 an alternate form of fly frame.

The carriage-drive interruptor motion is detailed in Figs. 31, 32, and 33. The arm and "hand", Fig. 32, was keyed to the upper part of the crankshaft, Fig. 33. The short shaft of Fig. 31 ran loose atop the crankshaft, its tilting arm being pushed around one-half revolution by the "hand" on the arm of Fig. 32. The fixed inclined plane that controlled the arm's tilt is not shown (it was affixed to the middle rail of the end frame of the early-style press, or formed as part of a fixed iron hoop on later ones). Atop the short shaft of Fig. 31 was fixed the carriage-motion crank, as seen at Fig. 15. Figure 34 is a perspective of a late-style bottombar.



11. Patent model of the 1830 Adams double-feeder, showing superstructure on platen for supporting blankets, fly frames in position to receive sheets, and horizontal power shaft with cord drive to the ink distribution rollers. https://laurenwinterdawson.files.wordpress.com/2014/11/8a-isaac-adams-printing-press

EXTRACTS

From Hansard (1841), p. 162. Taking his phrase "rise and fall" seriously, could Hansard be referring to the 1834 Tufts press? A well-seeming press has also lately been imported from America, in which there is an admirable application of two friskets, which are made to run in and out and rise and fall alternately. The tympan is upon the platten. There appear, however, to be some practical defects in the working. Owing either to this or their high price, or prejudice, they have not been successfully introduced.

From Stephen McNamara's series "The Printing Press" in the *Inland Printer* for September, 1884, on the rivalry between Tufts and Adams: In 1831-2 Seth Adams, of Boston, constructed a wooden-frame double press, with one bed and platen, requiring two feeders, each of whom pointed and delivered the sheets. Simultaneously, Otis Tufts, of Boston, built a press quite similar, differing chiefly in the method of operating the carriage and impression; ... The Adams, at first, was light and fragile, often giving way, while the Tufts was strong and heavy. ...

Wm. J. Adams, of Philadelphia [said of the early style] Double Tufts: "Imagine a bed and platen in the center of the press (a feeder at each end on opposite sides), with a blanket double the size of the form suspended from the ceiling by cords, pulleys and weights, ascending and descending as the carriage moved forward and back; that is, as a sheet was going in for the impression, the blanket was drawn down under the platen, the other end going up like a curtain, and vice versa. ..."

The Double Adams was almost identical; [we will] let Jas. W. Osgood tell his story of this, the first machine press in the state of Illinois: "In 1838 I went from Boston to ... Vandalia, Ill., twenty-two days and nights on the road, at an expense of $108. The Double Adams started three months before I did, by way of New Orleans, and arrived a month later!

There were but five others west of the mountains at that time—two in the Cincinnati *Gazette*, two in Morgan's and one in the St. Louis *Republican* office, all Double Adams. I worked this press in the office of the *Illinois State Register* during the winter of 1838-39, then moved it to Springfield in 1840, where I left it."

The rivalry between Adams and Tufts for the ascendancy became so great, the former contracted to furnish a press to print 1,000 an hour or no pay; …

From *The Granite Monthly*, Vol. III, No. 2, November, 1879, p. 35: The only power presses then in operation were heavy, clumsy affairs; although some of them did good work, Mr. Adams believed that something better could be produced, … [His new press] was in successful operation about the fall of 1828. This press was taken and set up in a building on Bromfield street, by Mr. Jenks, of the publishing firm of Jenks and Palmer, who soon removed to a building on the corner of Water and Devonshire streets [where all was destroyed by fire]. Mr. Adams immediately went to work upon another. … While engaged upon it, Mr. Monroe, of the Baltimore *Patriot*, went to Boston to examine presses, with a view to the purchase of one. … [Adams explained the press, but Boston parties who were with Monroe advised that he get a cylinder. Monroe, unswayed,] agreed to purchase the press if [Adams] would warrant it to make nine impressions per minute, then regarded as a good rate of speed. This he agreed to do, and went on to Baltimore with the press, set it up and put it in operation in the *Patriot* office, and left Mr. Monroe abundantly satisfied, the press exhibiting a capacity for *fifteen* impressions per minute, or nine hundred per hour. The price of the press was $750. This is the style of press known as the "double-ender," with wooden frame, many of which are still in operation in different parts of the country.

Soon after this, Seth Adams, [who had been working at Dow's] went into partnership with Mr. Bartholomew, and Issac, who continued to work in the shop, had an arrangement with them for building his presses, for which a considerable demand soon arose. About 1833 he commenced getting up a new and improved press, all of iron (the same now generally known as the Adams press). … he was opposed by Bartholomew and his brother Seth, upon the ground that he could devise nothing better than the old press. … He persisted … went into the establishment of his old employer, Dow, to perfect the work. The first press … was taken on trial by William S. Damrell. The press gave excellent satisfaction …

In 1835 his brother Seth, having dissolved partnership with Bartholomew, bought land in South Boston [and built a shop]. The following year he went into partnership with his brother, and they engaged in the manufacture of his presses. After a time they added to their business, and manufactured steam engines, sugar-mills, and other machinery. …

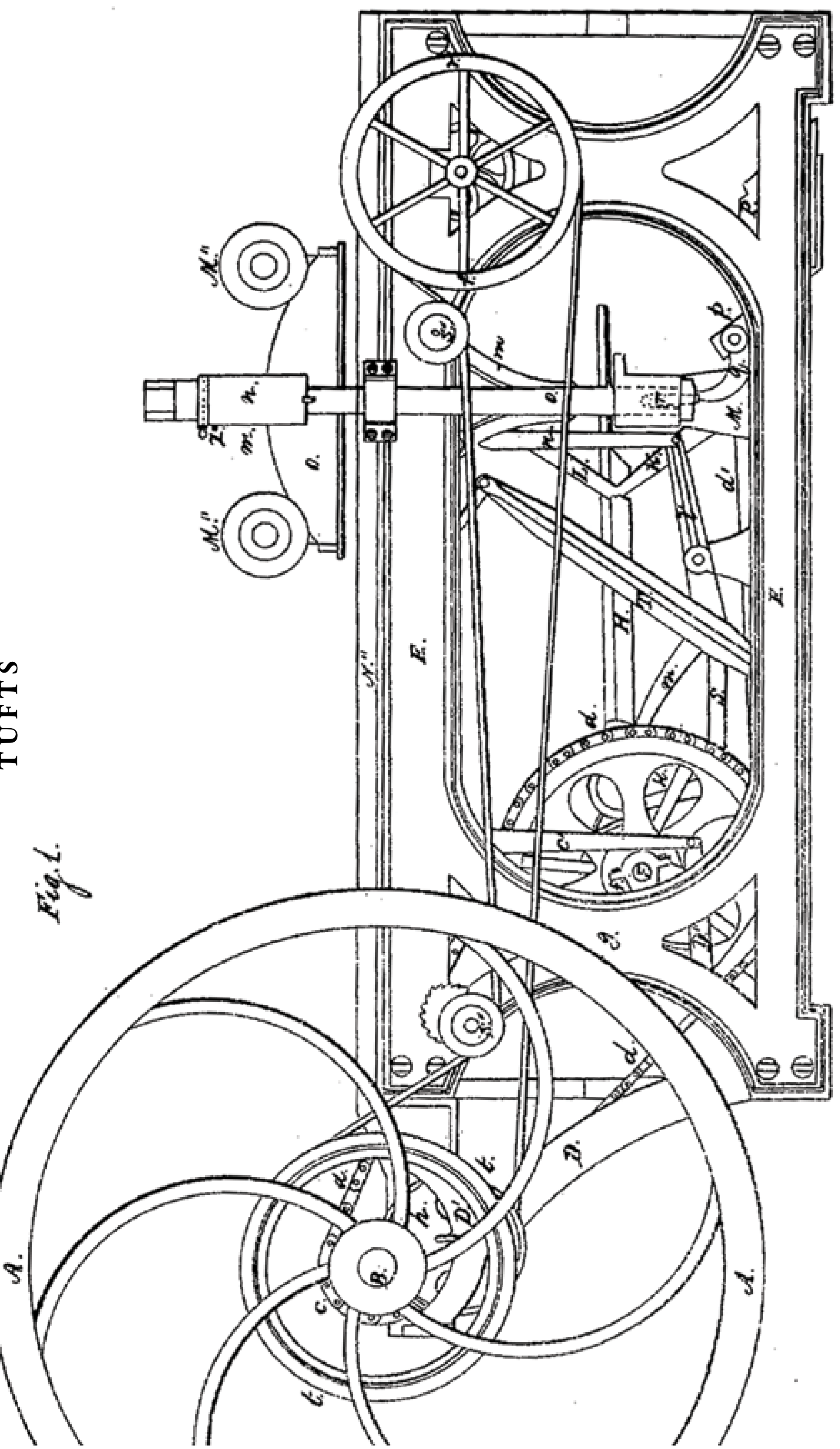
From Howells (1893), pp. 13-15, writing of a mid-century country shop: … A deputation of the leading politicians accompanied the editor to New York, … where he bought a second-hand Adams press of the earliest pattern and patent. … It had obscure functional disorders of various kinds … It went with a crank set in a prodigious fly-wheel which revolved at a great rate, till it came to the moment of making the impression, when the whole mechanism was seized with such a reluctance as nothing but an heroic effort at the crank could overcome. It finally made so great a draught upon our forces that … we got a small [steam] engine which could fully sympathize with the press in having seen better days.

NOTES

1. Isaac Adams received a U.S. patent dated Oct. 4, 1830, with specification, no drawings, reproduced as Appendix C. This patent was extended twice, lapsed on March 2, 1864 and reissued as Reissue No. 546, dated April 20, 1858. The reissue comprises specification and drawings and embodies the changes made in the press in the course of its evolution, describing and illustrating both early and late styles. Its drawings appear here; the specification appears as Appendix D. NMAH Smithsonian holds a patent model, GA catalog 11,024. Illustration 7 appears in the 1856 Bruce's New-York Type-Foundry catalog, Hoe (1902), Comparato (1979) and Wilkes (2004), p. 228. Hoe's cutline erroneously refers to the machine as a Treadwell. The U.S. National Archives, Washington, D.C., holds affidavits submitted 1849-1850 supporting Isaac Adams's request for extension of his 1836 patent ("Petition of Isaac Adams", House Committee on Patent Hearings, RG 233). From Adams and other leading press builders and printers, the affidavits convey valuable information about the manufacture, distribution and use of early machines in the U.S.

2. Granite (1879), p. 35; Bartholomew (1885), p. 174; Sandwich (1993), p. 12; *Printing Materials for Sale by George Bruce* (1856), p. 9. (Stephen O. Saxe kindly called my attention to these references.)

3. See British patent 6067 of 1831, granted to Robert Winch.



12. **From U.S. Patent 8380X**

TUFTS 1834[1]

Otis Tufts left a situation in Phineas Dow's Boston shop at some time around 1830 to start his own enterprise in that city. He began building platen machines, initially of the wooden frame double-ended type, patented in 1831. Eventually an all-iron version was produced, still using two friskets and a single type-bed, but with both friskets handled at the same end of the press. One frisket was available for sheet-changing while the other was under impression. The carriage, to which the form rollers were attached, released one frisket with its just-printed sheet and engaged the other frisket upon which fresh paper had been placed, taking it under the platen. The modernized Tufts was patented in 1834.

According to Green, *Shortly after [the introduction of the 1830 Adams], Tufts produced a somewhat similar press, but of heavier construction and better finish. A few years later he improved it considerably by discarding the wooden frames and using iron throughout, at the same time shortening the length by placing both frisket frames at the same end of the press. ... Printers who saw the press in action were most enthusiastic in their praise, as the machine was excellently constructed and much smoother in operation than its clumsy forerunners.* In addition to the pressman, two operatives were required, one to feed and one to fly.[2]

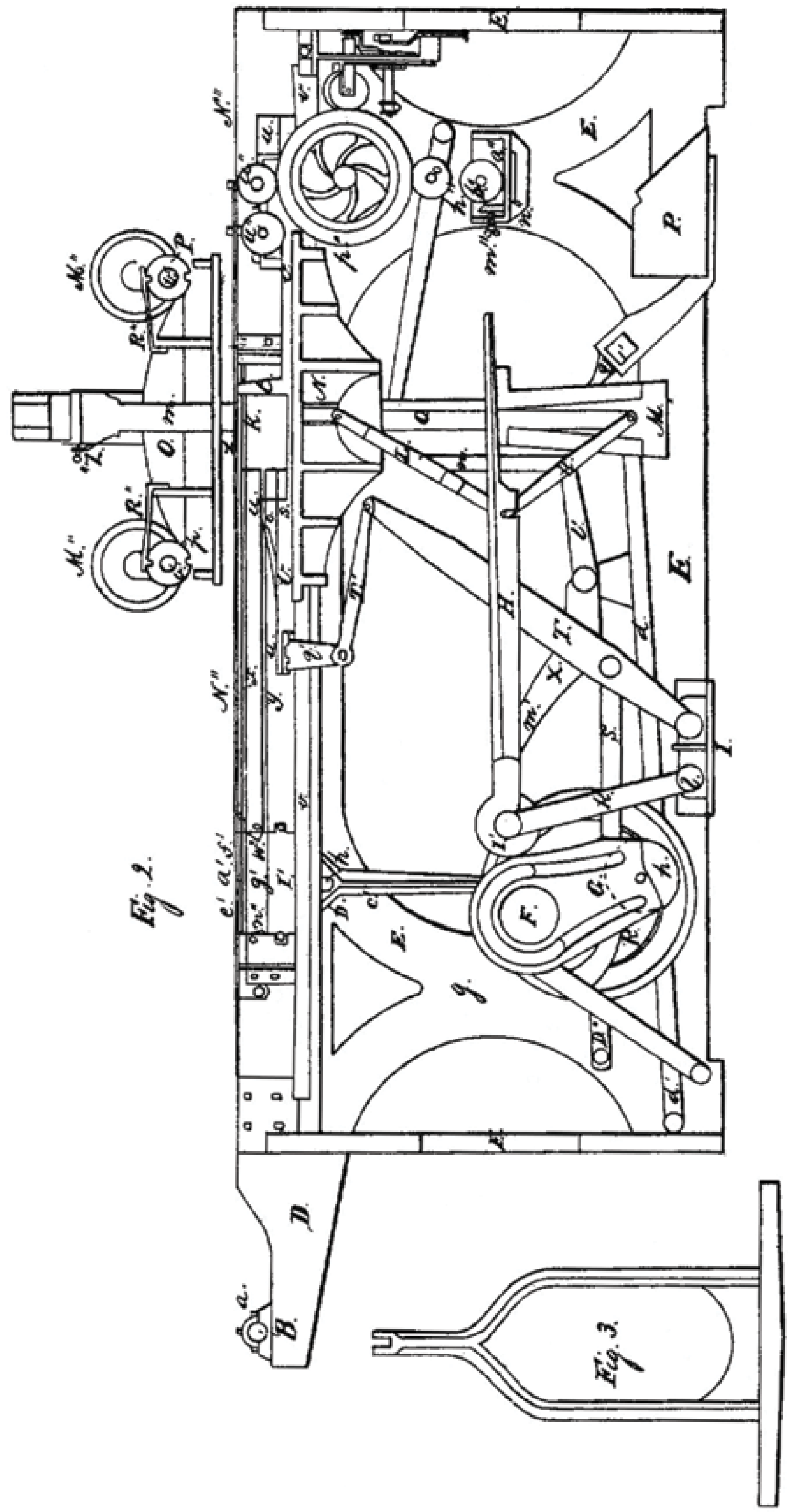
Tufts claimed to have made up to seventy presses from 1836 to 1843.[3] Comparato mentioned a mule-powered Tufts in John F. Trow's New York office, and two in the Albany office of Charles Van Benthuysen in 1850.[4] John Kingsley, in his 1845 patent for a perfecting bed and platen machine, called the Tufts "the best-registering machine with which I am acquainted".[5]

Mechanism

The mechanism of the refined press, as patented, is best understood by reference to the drawings in 12-16, from U.S. patent 8380X. The flywheel **A** was attached to the driving shaft **B**, impelled by the crank **e** or by other power. The driving shaft **B** was fitted with a pinion **c**, which drove the main shaft **F** via a chain belt, **d**. The frame **E** of the press was of cast iron but could be of wood. The main shaft **F** ran in bearings **f** attached to the upright posts **g** of the press frame; secured to its center was the impression cam **G** (Figs. 2, 5), having a roller **h** to reduce friction and present a new wearing surface to the roller **i** on the end of the pitman **H** for each impression. The roll **i** on the end of the pitman **H** followed the cam **G** to straighten the toggle **L**, **K**, pushing the bottom cross-beam **M** downward.

The platen **O** was drawn down upon the form by the rods **o** attached to the cross-beam **M** at its outer ends outside the press frame and reaching to the ends of the platen beam **m**. The platen was raised by counterweight **P** keyed to the small cross-shaft **p**. At **q** in Fig. 1 is one of two curved levers (one at each end of shaft **p** outside the press frame) that were pressed upward by the downward thrust of the counterweight, in turn pushing upward against an anti-friction arrangement in the lower end of the platen rod **o**. The cross-beam **M** was retained in its vertical motion by the long arms **d** (Fig. 6), one inside each side frame, in lieu of fixed vertical guides.

The rocking lever **K** (lower left, Figs. 2, 5) supported the cam end of the pitman; the other end of the pitman was notched to receive the center-pin of the toggle. Figures 1 and 2 depict the machine just after taking an impression; Figure 5 shows it at the moment of impression. In all Figures, the frisket carriage **U** is shown under the platen.



13. From U.S. Patent 8380X

Cam **A"**, Fig. 5, (in dotted lines), as it revolved would press down on the roller seen close below **F**. The roller was pinned to an arm **B"** shaped to press the upright lever **K** to the left, thus pulling back on the pitman and pulling the toggle limbs **K** and **L** out of their vertical (impression) position, in which they might have tended to stick. Cam **A"** was shaped to mirror the motion given to the pitman by the impression cam **G**.

To continue with Fig. 5, the large cam **R**, which is behind cams **A"** and **G**, actuated the lever **T** through the link **S** to move the frisket carriage **U** via link **T"** and bracket **q'**. Lever **T** was formed as shown at Fig. 3, with an opening to clear the pitman. The frisket carriage **U** comprised two side pieces joined at each end by brass or iron bars, and reciprocated on rails **v** inside the upper frame rails. The two friskets were rectangular frames with ears on their sides that ran in the grooves **x** and **y** in plates attached to the insides of the press side frames, and were covered, cut-out and reinforced in the normal way.

Elevators

The cam and linkage shown in Figures 6 and 7 were responsible for moving the vertical "elevator" assemblies also seen in those figures, and served to position the friskets in their proper grooves—**x** or **y**. One-way catches prevented the friskets from being accidentally displaced during operation. After an impression was taken on one frisket it was raised to groove **x** and pushed out by the vertical projections **t"** on each side of the carriage so that the sheets could be changed. On its return toward the platen, the carriage engaged the other frisket, in groove **y**, and carried it under the platen. As the impression was being taken on the second frisket, the first frisket, now with a fresh sheet pointed upon it, was lowered from groove **x** to groove **y**, ready to be taken under the platen.

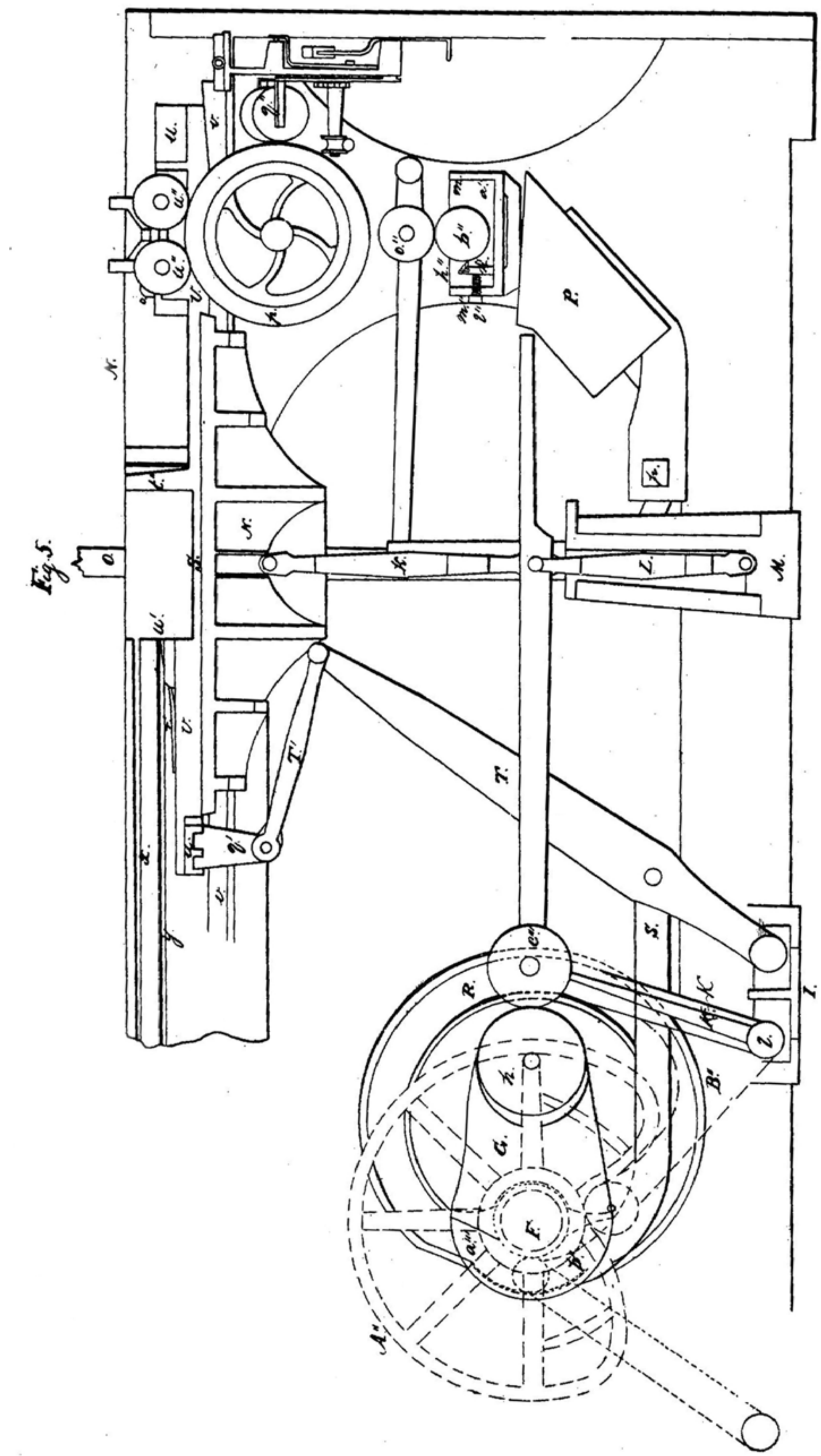
Details of the ink fountain are shown in Figures 4, 5, and 10, with the fountain roll marked as **b"**. As shown in Fig. 10, its bearings were adjustable, allowing it to be moved toward or away from the edge of the scraper plate **h"** to alter the ink flow. The screws **l'**, Fig. 4, afforded some local adjustment of the scraper plate. The heavy spring **e** held the ductor bearings against their adjustment screws.

The ductor **o"** was raised from the fountain roll to the distributing drum **p** by vertical extensions upon the cross-beam **M** as it and the platen rose. A mouse-roller, **q"**, assisted distribution; the distributing drum was turned by a band from a pulley on the driving shaft. Form-rollers **u"**, **u"** rested in bearings on the frisket carriage and reciprocated with it.

The platen rolled back upon the large wheels **M"**, which could be turned down to ride on the frame rails. The wheels were retained in their up or down positions by retaining springs **R"** dropping into notches in the circular plates **p"**. To release the platen from its rods **o** the nuts were taken off the tops of the rods, the press was turned until the toggle was straight, pulling the rods down and clear and allowing the platen to be rolled back. When the nuts were replaced, they were indexed to their former positions by a pointed set-screw **z** engaging marked holes around the periphery of each nut. Altering the positions of the nuts adjusted the impression.

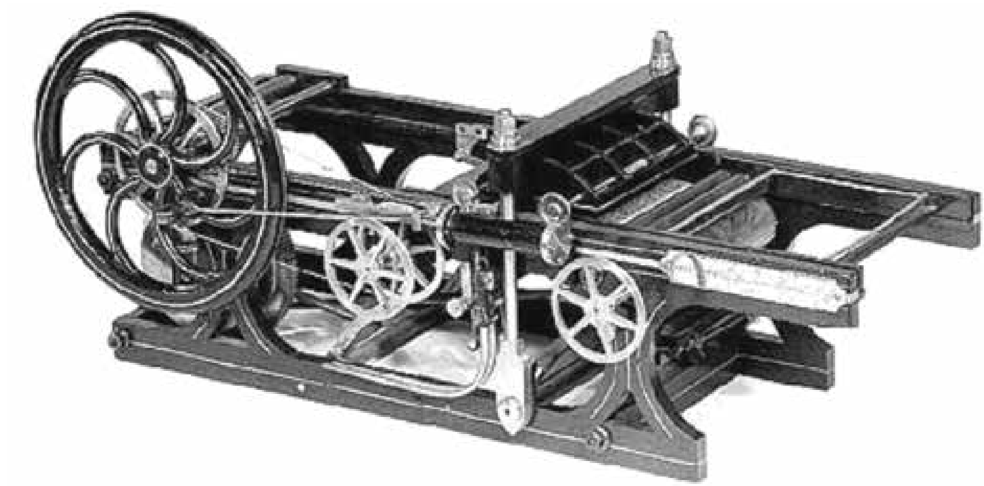
Pool of genius

Daniel Treadwell, Phineas Dow, Erastus Bartholomew, Otis Tufts, Isaac and Seth Adams—here associated with printing machine development—were among the Boston Mechanics, at the cutting edge of American technology of the early 19th century and working



14. From U.S. Patent 8380X

in the era's equivalent of Silicon Valley. They employed their skills extensively, engaging in mechanical, civil, and military engineering and even naval architecture. In consideration of their activities and influence at a critical juncture of their nation's industrial history, these men might be called "founding fathers" without diminishing the notables of 1776 in the slightest.



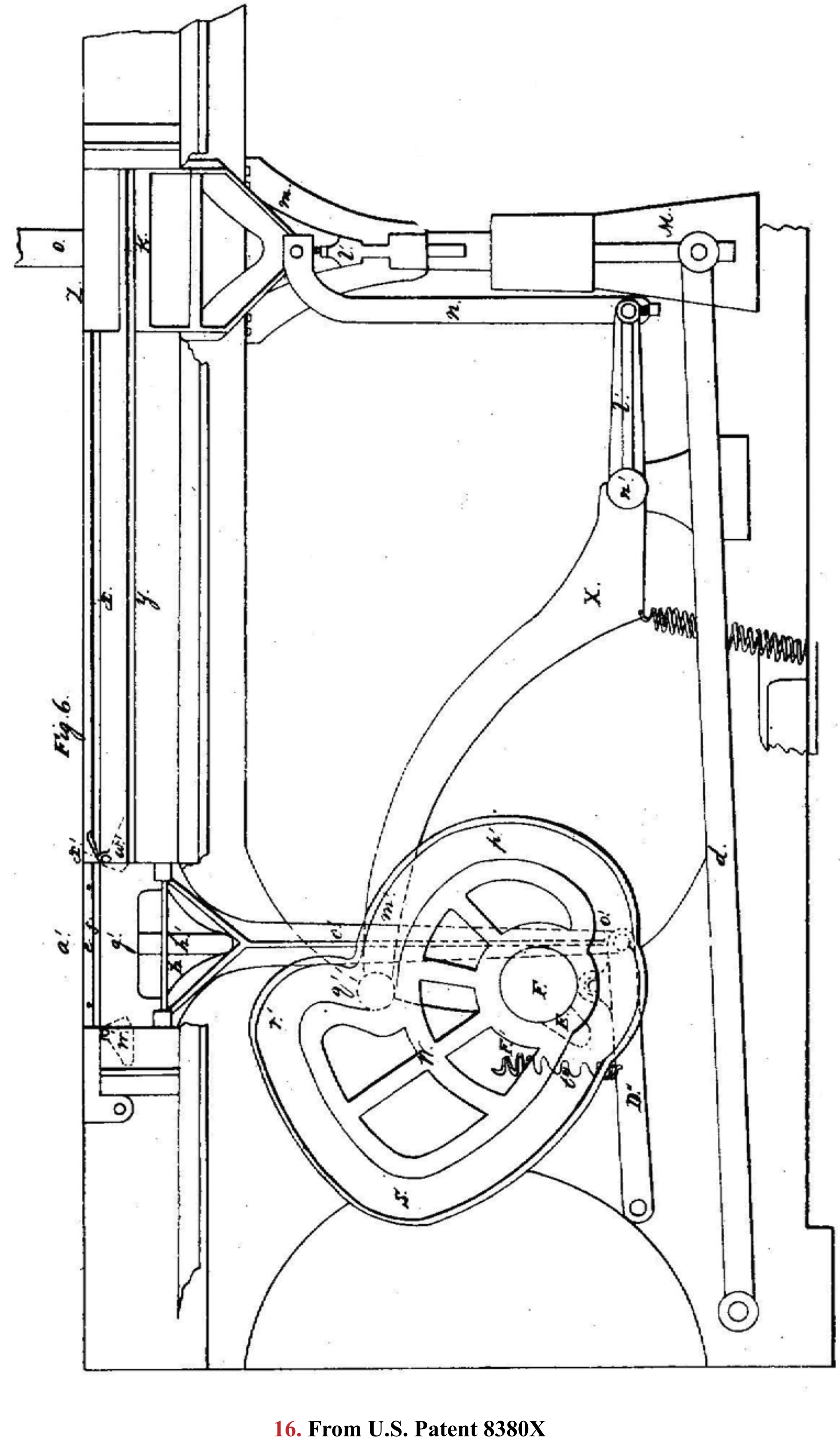
15. Patent model by Otis Tufts, possibly representing his 1831 press. The model is of a double-ended machine with a single cylinder steam engine connected to the flywheel and two sets of band-driven ink distributors, one on either side of the type-bed. (Tufts was also an engine builder; the horizontal steam cylinder is outside the near impression rod, its crosshead guides are fastened to the upper frame rail. It is unlikely that any press was actually so fitted.) Form rollers are attached to the frisket frame at the right of the platen; boxes for another set of form rollers appear at the platen's left where, evidently, the other frisket was placed. Graphic Arts cat. 11025, Information Technology and Society Division, National Museum of American History.

EXTRACTS

From Charles Brigham's "An Octogenarian's Reminiscences", in *The Inland Printer*, December, 1885, p. 158: On July 29, 1833, I commenced working for T. K. Collins [Philadelphia]. At that time he had two hand-presses ... he enlarged his office ... in the year 1836 he introduced the Tufts steam-power presses ... in the course of a few years we had six of them ... then the Adams superseded the Tufts, and we have now fifteen Adams presses ...

From an installment of Stephen McNamara's *Inland Printer* series "The Printing Press", appearing in the issue of September, 1884, pp. 7, 8. Tufts' failure to gain the market was at least partly due to his machine's requiring two operatives, while the 1836 Adams needed but one: In 1831-2 Seth Adams, of Boston, constructed a wooden-frame double press, with one bed and platen, requiring two feeders, each of whom pointed and delivered the sheets. Simultaneously, Otis Tuft, of Boston, built a press quite similar, differing chiefly in the method of operating the carriage and impression; both used the vertical shaft, like Treadwell ... The Adams, at first, was light and fragile, often giving way, while the Tufts was strong and heavy, ... in the former the bed was forced up to the platen, the latter had the bed stationary, so the platen was pulled down . . .

Wm. J. Adams, of Philadelphia, [relates] "Imagine a bed and platen in the center of the



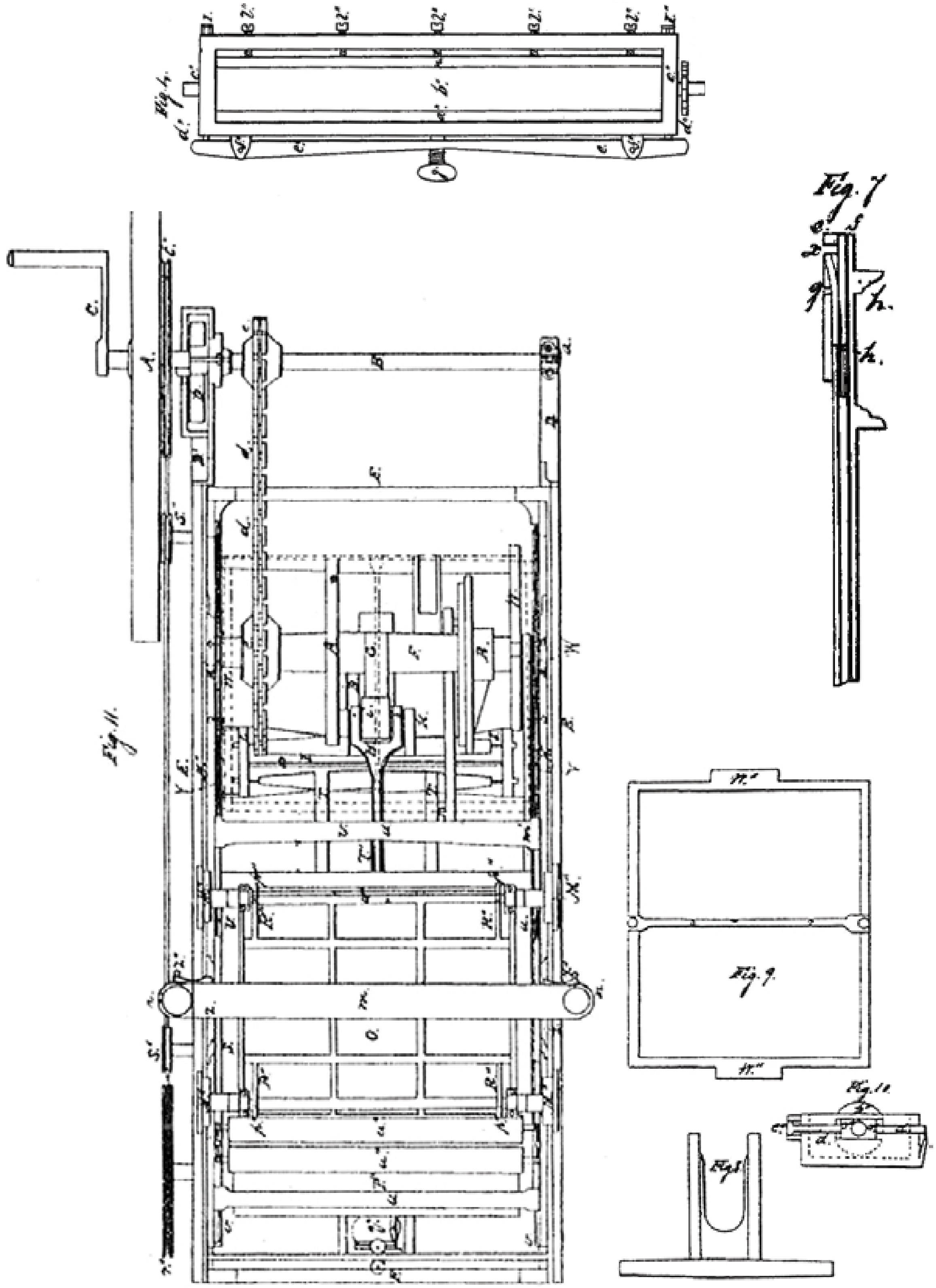
16. From U.S. Patent 8380X

press (a feeder at each end on opposite sides), with a blanket double the size of the form suspended from the ceiling by cords, pulleys and weights, ascending and descending as the carriage moved forward and back; that is, as a sheet was going in for the impression, [one end of] the blanket was drawn down under the platen, the other end going up like a curtain, and *vice versa*. Mr. John Warnock, who worked … in Collins' office, when the Tufts was first started, says its introduction was hailed with delight, which was soon dispelled by the care and attention required; it was soon after sold and shipped to Canada, being placed on the deck of a sailing vessel and thrown overboard during a storm, occasioning a hymn of praise by the chapel on receipt of the news of its well-deserved fate."

In the meantime, Tufts' brain was busy, for in 1834 he brought out his single Tufts press … The following enthusiastic description is supplied by Mr. Andrew Overend . . .

"This press excelled anything in the shape of a printing press ever made in this or any other country, for ingenious finish, workmanship, and numerous new and useful ideas. It was of iron throughout; had two friskets sliding in grooves one above the other; as one went in with a blank sheet above, the other was coming out below with one printed; the bed was stationary, the platen being pulled down with a beautiful toggle motion, the wheels [on which the platen rolled] were thrown up to permit [the platen to rise and fall] before starting the press. The tympan was a gem of itself, having a separate inside drawer to hold the spotted or overlay sheets; the roller boxes were split in halves and locked on top.The toggles resembled the present Adams, with the exception that the winter beam and the lower half [of the toggles] was one piece, and were connected directly to the side rods or draw bars that pulled the platen down. The throw-off, or impression trip, was very ingenious and noiseless in operation, operating directly on the pitman, or connecting rod, which was hinged and folded up like a carpenter's rule. The cam which moved the carriage back and forth was provided with a switch to throw it around another curve, while waiting for the friskets to slip by each other. The fountain was a beauty; it was like the Adams, except that attached to the screws at each end were two levers long enough to reach and cover a screw projecting from the middle; by turning this screw both levers moved, throwing the roller bodily to or from the blade; besides, either end being light or dark, could be changed instantly; and finally, if this press [had] required but one feeder, few, if any, Adams presses would have been built, for it was a wonderful masterpiece and did the best printing in its day."

Mr. Warnock, in describing this machine, endorses much of the foregoing and adds the following interesting facts: "It was thought by pressmen the art had reached its utmost limit upon its advent; the mechanism was so fine, the motion so life-like, printers flocked to Collins' office to see the wonder, but in the midst of all the rejoicing, the new patent of Isaac Adams was sprung upon us, and what was so valuable a short time before, could only be sold for old iron and brass. …"



17. From U.S. Patent 8380X

NOTES

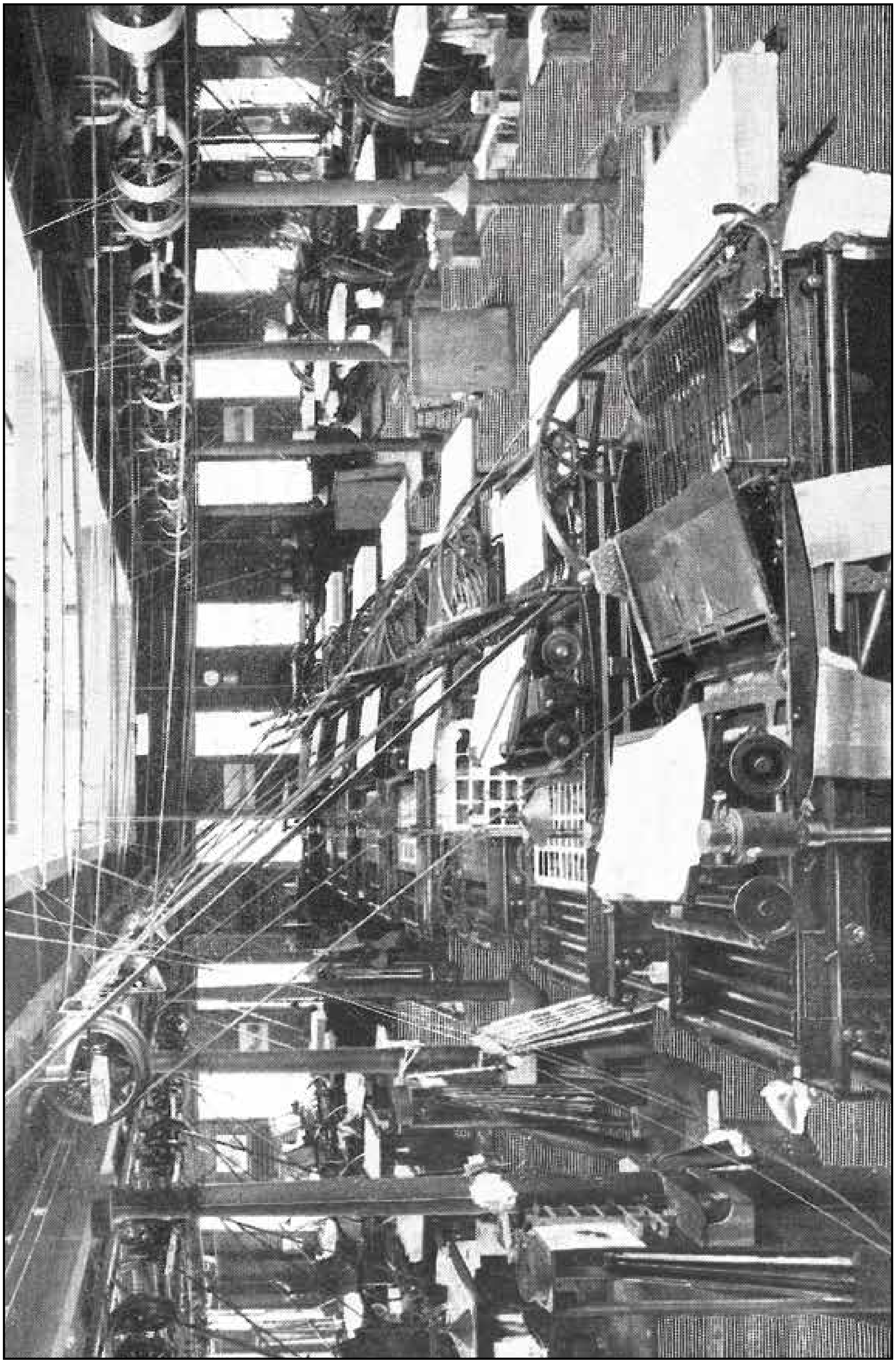
1. Otis Tufts gained a U.S. patent (8380X) for a power printing press, dated Aug. 16, 1834, with specification and drawings (*Restored Patents* vol. XVIII, pp. 347-360). The 1831 patent is unavailable. Wilkes (2004 p. 234) described the 1834 patent and reproduced two of its drawings. The NMAH Smithsonian holds a patent model (GA catalog 11,025) which deviates considerably from the patent description and perhaps representing the 1841 press. The U.S. National Archives, Washington, D.C., holds affidavits submitted 1849-1850 supporting Isaac Adams's request for extension of his 1836 patent ("Petition of Isaac Adams", House Committee on Patent Hearings, RG 233). From Tufts and other press builders and printers, the affidavits convey valuable information about the manufacture, distribution and use of early machines in the U.S.

2. Green (1952), pp. 149-150.

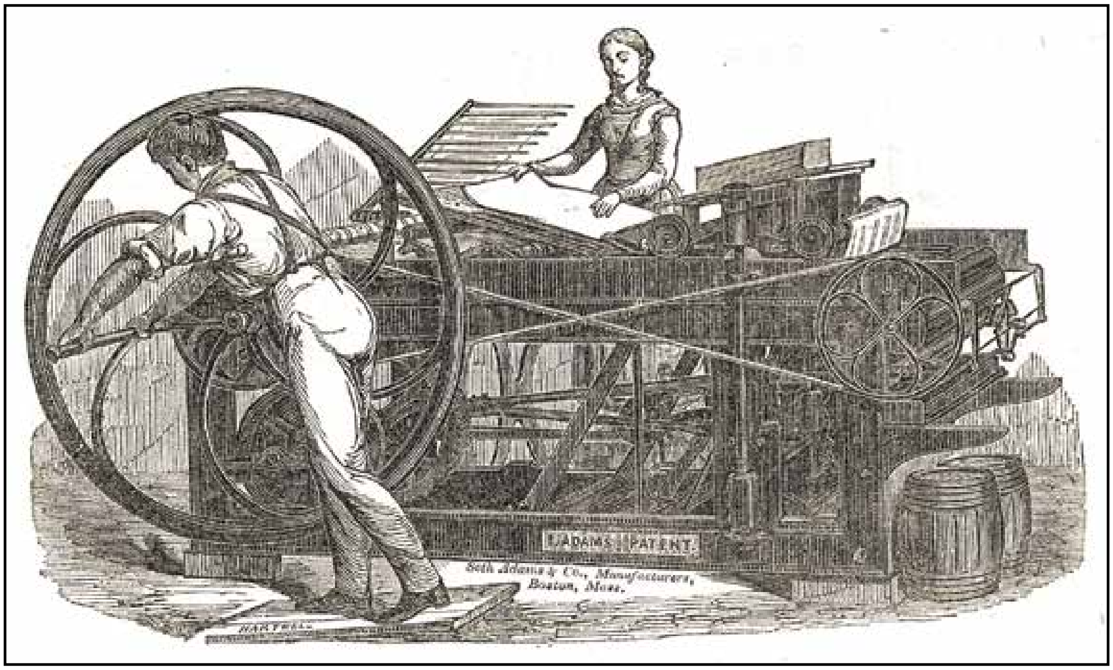
3. Affidavit of Otis Tufts in "Petition of Isaac Adams", House Committee on Patent Hearings, RG 233.

4. Comparato (1977), pp. 21, 44.

5. U.S. Patent 3874. Kingsley's machine seems to have remained a project.



ADAMS 1836[1]



19. Early two-roller self-flying improved Adams with "sidewinder" fly. The press is taking an impression as a printed sheet is flown and a fresh one placed on the pointing board. Atop the platen is the "horse" piled with fresh paper. Ink barrels repose beneath the ink fountain; the turner works on an inclined footboard. Seen clearly is one of the two impression bolts, linking platen and bottom bar to resist the force of impression. From Adams's *Typographia*, 2nd ed., 1845, p. 271.

The classic American book press was patented by Isaac Adams of Boston in 1836, made by the South Boston firm of I. & S. Adams until Hoe's buyout of 1859, and cataloged by R. Hoe & Co. as late as 1881. The Adams dominated the American book-printing trade for almost half a century; it was also employed in job shops and a number of newspaper offices. In contemporary accounts, this press was often called the "improved Adams" to distinguish it from the 1830 design, the "Adams of the first patent". Adams claimed the construction of about eighty presses between 1836 and 1842[2] and, according to one source, Hoe constructed more than a thousand Adams presses.[3] Production figures for the intervening years are unknown.

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18. At left, the Upper Pressroom at the Riverside Press, from *A Brief Description of the Riverside Press*, published by the press in 1899. The nearest machines appear to be four-roller presses, with form rollers removed. All but the nearest press have their pointing boards and delivery roller assemblies thrown up and their platens rolled back, exposing the cut-out friskets on the second and fourth from camera; the third's frisket is propped against it. The nearest press's pointing board is fitted with one of the transverse sheet-supporting rods, a pair of front guides and a counter. A long wooden handle, seen on the nearest press, runs horizontally outside the press frame from the feeder's position; moving it lowers the delivery board to accommodate the growing pile of printed sheets. The lever is held in any of several positions by pegs in the sweep seen behind the handle. Countershaft pulleys and press flywheels are three-stepped. The clerestory and windows were supplemented by electric light; the girl feeders had a retiring room for their use between tasks.

Significance

Arguably, the improved Adams press was a major factor in the growth of American literacy. It put affordable, attractive books into the hands of an expanding and increasingly educated market, encouraging the output of writers and illustrators. The Adams produced everything from primers to bibles to novels and magazines, printing from any typographical form with minimum wear to the materials and notable economy of labor. In skilled hands its output could rival artistic handpress work in quality, with vastly greater productivity. Its capacities drove changes in composing room and bindery economies while stimulating the wood engraving and platemaking trades.

The Adams press was made in a range of sizes and styles sufficient to satisfy almost any printer's needs. The typical U.S. book printing office, in the heyday of the Adams, contained little else in the way of printing machinery. In many small shops and some country newspapers a single Adams, often hand-powered, was the only machine. It has been estimated that ninety percent of mid-19th century American bookwork was done on Adams presses.

The press

The improved, all-metal Adams was provided with roll-away platen, impression by means of a toggle raising the bed against the platen, cylindrical distribution, travelling set-off sheet,[4] tympan attached to platen, reciprocating carriage with two (and eventually, four or six) rollers entirely covering the form and with grippers to hold the sheet on the frisket,[5] pointing board on which the sheet was registered prior to being seized by the grippers, impression throw-off, pneumatic control of sheet, and patented automatic fly delivery (blithely infringed and vigorously defended—to the benefit of both firms—by R. Hoe & Co., prior to 1859). The press required a girl to feed and the supervision of a pressman, who was typically responsible for two machines. The larger sizes ran about 800-900 iph. The Adams was a significant improvement over all previous platen machines, with full automation of every function but feeding, and smooth, crank-driven motions for the principal operations of the press.

Robert Hoe outlined the action: *In these machines, the type is placed upon an iron bed, after the usual manner of the hand press, and this bed is raised and lowered by straightening and bending a toggle joint by means of a cam, thus giving the impression upon the iron platen fixed above it, and firmly held in position by upright iron rods secured to the bottombar, a strong cross-piece, at the base of the machine. The ink fountain is at one end of the press; the inking rollers travel twice over the form, in a movable frisket frame, while the bed is down; the paper is taken in by grippers on the frisket and carried over the form, when the bed rises and the impression is given; and finally the sheets pass forward [rearward, actually] from the frisket by tapes to a sheet flier, which delivers them on the fly board. Although many of these machines were made and great numbers are still used, and notwithstanding the fact that it was thought by many experienced printers that fine book and cut work could be done in no other way than by flat pressure, this system of printing has given place to that of the cylinder press.*[6]

An 1852 encyclopaedia article said, *The platen press of the best construction has self-inking rollers and a fly ... The bed and platen are immense masses of cast iron, intended by their strength to guard against an inclination to spring, which is very apparent in the hand-press, and partially corrected by making the bed and platen slightly concave on their face.* The article went on to say that such a machine, 26x42, would weigh four tons, run 400 iph hand-cranked and 600 iph powered, and that, *Among the bed and platen presses, the most valuable and the most extensively used, are those manufactured by Mr. J. Adams [sic] of Boston. … Mr. Adams's press was the first in this country to which a fly frame was attached. It requires but one person (a woman) to tend it and put the paper on the register pins … It is adapted for stereotype and letter-press, as well as wood-cut printing.*[7]

Printing encyclopaedist Luther Ringwalt added, *For book-work requiring the finest effects, the most exact register, and where extra speed is not needed, this press is claimed by many to have no superior.* [8]

Writing in 1901, Theodore Low DeVinne said, *Considering the larger surface printed, as well as its greater speed, the improved Adams press did in one day the work of ten hand-presses quite as well as it had been done before, for its provisions for inking and exact register were of the best. For more than fifty years it was the machine preferred for book printing. Nor is it yet out of fashion. The Riverside Press has a large number in daily use.* [9]

DeVinne wrote in 1879 that one horsepower was sufficient for a double-medium

20. Price list of Adams presses, from DeVinne (1879), p. 437.

Bed and Platen Printing Machine….R. Hoe & Co.

No.	Size of Platen.	Rollers.	Price.	No.	Size of Platen.	Rollers.	Price.
1	14 × 18 inch	2 Rollers	$1,000	28	30 × 40 inch	6 Rollers	$4,400
2	19 × 23 ″	2 ″	2,125	29	27 × 41 ″	2 ″	3,250
3	″ × ″ ″	4 ″	2,375	30	″ × ″ ″	4 ″	3,750
4	19 × 25 ″	2 ″	2,150	31	″ × ″ ″	6 ″	4,000
5	″ × ″ ″	4 ″	2,400	32	26¼ × 43 ″	2 ″	3,400
6	20 × 25 ″	2 ″	2,300	33	″ × ″ ″	4 ″	3,925
7	″ × ″ ″	4 ″	2,600	34	″ × ″ ″	6 ″	4,200
8	22½ × 29½ ″	2 ″	2,550	35	27 × 43 ″	2 ″	3,400
9	″ × ″ ″	4 ″	2,950	36	″ × ″ ″	4 ″	3,925
10	″ × ″ ″	6 ″	3,195	37	″ × ″ ″	6 ″	4,200
11	24 × 29½ ″	2 ″	2,575	38	28¾ × 34 ″	2 ″	3,475
12	″ × ″ ″	4 ″	2,975	39	″ × ″ ″	4 ″	4,000
13	″ × ″ ″	6 ″	3,205	40	″ × ″ ″	6 ″	4,250
14	23 × 34 ″	2 ″	2,900	41	30½ × 43 ″	2 ″	3,800
15	″ × ″ ″	4 ″	3,300	42	″ × ″ ″	4 ″	4,350
16	24½ × 37 ″	2 ″	2,950	43	″ × ″ ″	6 ″	4,600
17	″ × ″ ″	4 ″	3,375	44	33½ × 43½ ″	2 ″	4,250
18	24½ × 39 ″	2 ″	3,000	45	″ × ″ ″	4 ″	4,850
19	″ × ″ ″	4 ″	3,425	46	″ × ″ ″	6 ″	5,100
20	″ × ″ ″	6 ″	3,650	47	30½ × 45 ″	2 ″	4,000
21	26 × 40 ″	2 ″	3,100	48	″ × ″ ″	4 ″	4,575
22	″ × ″ ″	4 ″	3,575	49	″ × ″ ″	6 ″	4,900
23	″ × ″ ″	6 ″	3,800	50	32 × 46 ″	2 ″	4,400
24	27 × 40 ″	2 ″	3,225	51	″ × ″ ″	4 ″	5,000
25	″ × ″ ″	4 ″	3,725	52	34 × 48½ ″	2 ″	4,800
26	30 × 40 ″	2 ″	3,650	53	″ × ″ ″	4 ″	5,500
27	″ × ″ ″	4 ″	4,175	54	″ × ″ ″	6 ″	5,800

The above prices include a Cone Fly-Wheel, Counter Cone, Tight and Loose Pulleys, Counter-Shaft, Hangers, Driving-Pulley for Main Shaft, two Friskets, six Roller-Cores, if Two-Roller; twelve Roller-Cores, if Four-Roller, and eighteen Roller-Cores, if Six-Roller; four Sets of Nippers of three each; Boxing and Shipping, or Carting and setting-up. For any articles in above list not required, a deduction will be made.

cylinder or Adams and that the weekly (sixty-hour) expenses of such a machine, valued with its connections at $3000, would run to $60. His published production figures, compiled for a job shop, are probably low for a book plant. DeVinne provided wage figures for Superior Adams Pressman of $22-$24 per week, Ordinary $20-$22, Inferior $15-$18. Girl Feeders were expected to donate their first two weeks' work; they were paid $7 per week when "expert". DeVinne's table of Adams prices for 1879 appears on the previous page.[10]

Palmy days

During their era of predominance Adams presses were employed in large numbers, as a few examples will show. In the East, John Trow's New York City plant was running thirteen Adams presses (along with a cylinder and three handpresses) by 1852. At the American Bible Society's new Bible House in New York City, secretary Samuel Tuttle noted in 1853 that the past year's production of the House would have required nearly a hundred presses and 200 men and boys in handpress times. Instead, Tuttle enthused, *the work was actually accomplished by means of eleven presses under the direction of eleven young women and five men!*[11] The Society's investment with the Adams firm, from 1845, seemed justified. Bible House contained fifteen Adams presses in 1894.[12]

Harpers ran thirty-four (value $75,000) before their fire of December 11, 1853,[13] twenty-eight in their new Cliff Street pressroom by 1855,[14] and thirty-five by 1865.[15] In 1862 the government of Turkey purchased a lot of ten machines, three of which Richard M. Hoe saw running government forms when he visited Turkey twenty years later.[16] In 1865 the U.S. Government Printing Office added twelve first-class Adams presses, costing taxpayers $36,000, to the existing twenty-three bought in 1861, the Office's first official year. The GPO had nine cylinders that year; by 1878 the balance had changed to twenty-six Adams presses and fourteen cylinders.[17] Boston's Rand & Avery in 1865 had twenty-one Adams presses and one cylinder.[18] The famous Riverside Press in Cambridge, Massachusetts housed eighteen Adams presses by 1868.

In the decades preceding the Civil War, Cincinnati became the publishing and printing center of the West, its output exceeded only by the Eastern presses of Boston, New York and Philadelphia. After the war, Chicago overtook "The Athens of the West" in publishing and book printing, leaving Cincinnati printers to concentrate on jobwork and its elaboration.

As early as 1834, however, the *Cincinnati Gazette* found its handpresses overburdened and purchased an Adams press (of the 1830 patent) for $750. It was Ohio's first power press; its success inspired E. Morgan & Co., who acquired their first power press the next year and by 1841 had five, water-powered, running 5000 impressions per press per day. These were almost certainly Adams machines, as by 1851 the firm was employing thirty-two hands to run nine Adams presses. By 1854 the roster had grown to twelve Adams presses, steam-powered, upon which a staff of twenty-five had printed 1.8 million volumes during the year previous. Also in Cincinnati, according to Sutton, by 1854 the Western Methodist Book Concern had four Adams and one cylinder; by 1870 the Concern had ten Adams and four cylinders; in 1859 Moore, Wilstach, Keys & Co. were running ten Adams presses.[19]

On the Pacific Coast, San Francisco job printers Towne & Bacon were running "two of the celebrated Adams power presses, acknowledged to be the best machine for fine bookwork ever invented" in 1861.[20] The 1871 San Francisco Industrial Fair saw printers Francis &

Valentine exhibiting their 28x42 Adams, on which the fair's daily newspaper was printed. The firm also ran a 30x44 and another, size unspecified, "for the finest kinds of job work", in addition to several cylinders.[21]

Harper's bible

The 1843 (copyright date) *Harper's Illuminated New Pictorial Bible* is perhaps the best-known Adams press artefact. The morocco-bound, heavily-illustrated bible put American fine printing on the map, according to Ringwalt. The leading wood engraver of the time, Joseph Adams, headed a team that engraved 1,600 cuts from designs mostly by John G. Chapman (21). Harpers mounted a massive publicity campaign and the work garnered a half-million dollars in receipts by 1858.[22]

Ringwalt related the story of the famous engraver personally making and putting-up the overlays for the first form over the course of two weeks, as related by "a prominent New York printer at a meeting of the New York Typographical Society in January, 1864", and demanding several grains of salt.[23] Joyner provided a slightly less expansive account while emphasizing the effect upon subsequent practice:

21. Page from *Harper's Illuminated Bible*, 1846.

How great and far-reaching has been the influence of Joseph A. Adams's remarkable fortnight's work in making ready the first forms … it would be almost impossible to compute. … Eminent engraver and artist, he well understood all the points essential to a perfectly successful picture; and 'day after day he cut, scraped, rubbed, and strained a new sheet over the whole,' eventually not only producing the finest work that America or any other country had seen up to that time, but, what is of more general importance, evolving the principle of hard packing and developing the system which obtains to-day of preparing overlays for cuts. That the Messrs. Harper were alarmed at the time the work took it is easy to believe; however, apart from the resulting technical advancement, it is interesting to note that this magnificent production 'enriched the projector and made the publishers comfortable.'[24]

Pasko simply noted, *Mr. Adams entered the pressroom with the workmen and cut overlays and suggested underlays, watching the effect of every new impression. It was days before the first sheet was ready …*[25]

The famous engraver's care may have alarmed the Harpers, but twenty years later Harpers' cut forms on Adams presses each absorbed from forty to 120 man-hours of makeready time.[26] The first of the bible forms required triple-rolling on the two-roller Adams, so Harpers ordered the first six-roller machines (six of them), which ran the bible forms in the normal fashion and were then employed on other demanding works. Harpers sold 25,000 copies of the illuminated bible in complete, bound form, and another 50,000 serialized.

Export

An 1865 article in *Harpers Monthly Magazine* stated that "not a few" Adams presses had been exported to Europe, including one or more acquired by William Chambers of Edinburgh, who'd seen them running at Harpers and "at once perceived their superiority over any European press."[27] In 1857 a Chambers publication had been anything but laudatory concerning American presses (*v.* page 68), raising questions about the apparent change of heart in Edinburgh.[28]

The Adams in smaller shops

Historian Ralph Green provided another glimpse into the era: *The smaller shops ... doing book and newspaper work, would have one Adams press. When such a press was used for newspaper work, it left its distinguishing mark on the make-up of the page. In order to lift the sheet from the form after printing, the frisket frame contained one or more longitudinal wires, which supported the center of the sheet. As these wires came right down on the form during the printing operation, it was necessary to provide a groove or channel along one side of a column rule, about one-eighth to three-sixteenths inch wide, and to cut the same opening through the head rules and heading. Six-column papers had one supporting wire and eight-column papers had two. If one should ever come across a small-town newspaper of the middle of the nineteenth century, with a narrow white strip right down the middle, it was printed on an Adams.*[29]

Decline

In addition to the improvements in cylinder presses beginning in the late 1860s, the tendency of publishers to use larger paper sizes and expanded imposition schemes for economic reasons pushed sizes beyond anything that could be printed well on a platen machine, but the trend was initially slow to take hold. Short runs, favoring the Adams, remained typical: *Mr. Welch [University Press, Cambridge, Mass.] introduced his stop-cylinder in the later fifties or early sixties, but as almost all editions of books were small in those days (500 copies being a good average) it was much cheaper to work them on Adams presses, these stop-cylinders being used almost wholly for illustrated work.* [30]

Encyclopaedist Pasko wrote, ... *competition among publishers developed the fact that it is better to print a 12mo as a 16mo than on its own paper. The regular size for 12mo was 22 by 41, but, by adding another row of pages, paper 30 by 41 could be worked. One-fourth of the presswork could then be saved, and the folding and sewing would be cheaper and more expeditious.*[31]

The increasing use of cuts had an effect, too. DeVinne recalled, *For nearly thirty years [the Adams] was regarded as the only machine fit for printing books. This preference was warranted by its success with type-work and with the small wood-cuts which were sparsely scattered over the pages of American books thirty-five years ago. It was not so successful with large and black wood-cuts ... It was on this press that the experiment of four and six inking-rollers was first made, but only to the improved printing of cuts of small size and light color; on full-page or double-page cuts the failure of the press to face the cuts was as decided as ever. The unavoidable inference* *that the Adams press was too weak for heavy wood-cut work was formed very slowly.* The light dawned, said DeVinne, when publishers noted ... *that for some years the large wood-cuts in manufacturers' catalogues, which had been printed by job-printers on cylinder presses, showed a sharpness of line, a fulness of color and a clearness of tint rarely seen in good library work. ... The easy victory won by the cylinder was largely due to improvements in their construction made after 1860.*[32]

Survivals

References to Adams presses running in the 20th century abound. The Riverside was running a number of them as late as 1911, when the firm's souvenir *The Riverside Press* offered a few words of explanation: *The Adams presses ... are used for printing the smaller editions, and much of the finest letter-press work is done on them; nearly all the work is printed on dampened paper. ... The famous printers of the old days found that by moistening the paper ... a clearer, better impression of the type was made, and in the highest grade of letter-press work done at Riverside this process is still in vogue ... .*[33] William Cubery, who had run Adams presses at the Riverside Press in the 1850s, explained, *No one was ever hurried in the Riverside pressroom. The best work, not the quickest work, was the aim of the establishment ...* [34] F.G. Kilgour wrote in *The Evolution of the Book* that the Riverside Press was running one as late as 1938.[35]

Technical notes

In contrast to their earlier machines, the Adams brothers' 1836 press was fitted with a horizontal mainshaft. A large spur gear fixed to the mainshaft was driven by a smaller pinion on the power shaft, which was fitted with a flywheel turned by hand or belted to any source of rotary power. The flywheel became lighter over the years, reaching its spring-spoked form with three-stepped rim in the 1850s. Judging from patent drawings, power shaft to mainshaft ratio on the early presses was about 3:1, resulting in a flywheel speed of 20 rpm at a hand-powered speed of 400 iph. Later, the ratio was increased to about 4:1, permitting a flywheel speed of about 53 rpm at a press speed of 800 iph, better suited to steam power.

A heavy pin in the rim of the large spur gear served as the impression crank; from it extended the impression pitman. A short flycrank mounted upon the pin moved the carriage by means of a connecting rod. Pitman and connecting rod were not directly connected to their respective motions but drove them through devices called alternators that modified the velocity characteristics of the crank-pitman and crank-connecting rod combinations in much the same way as did the declension lever of the 1830 design. Informally, the impression alternator was termed the "goose neck" and the carriage alternator the "duck bill".

Inventor's pride shows through the dry prose of the patent specification where Adams describes the alternators, the oscillating cams through which the rotary motion of the crankpins on the large spur gear was translated into the intermittent reciprocating motions required for proper action of the carriage and the impression toggle. The combination of crank motion and the geometry of the carriage-drive alternator afforded shock-free operation and precise register. The distance between the fulcrum of the alternator, and that of the rocking levers which were linked to the carriage, caused a roller linking alternator and levers to follow the slot in the alternator. The carriage alternator and the rocking levers were united

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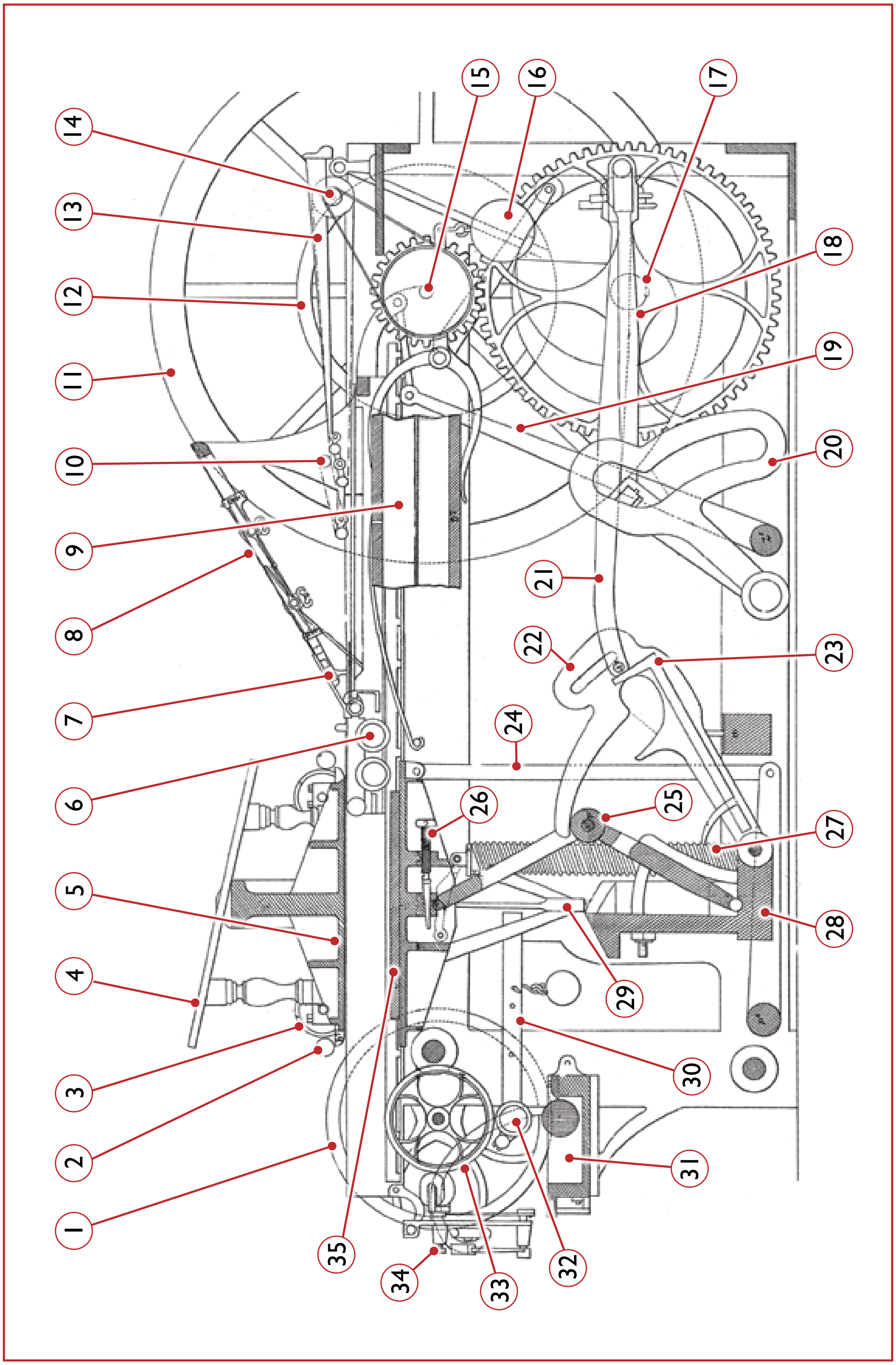
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20. Above, two-roller Adams press, sectional elevation from GB2264, a British patent granted to Isaac Adams in 1854. The carriage is out, with frisket resting under pointing board, form rollers just to right of type-bed. Upper grippers are resting at edge of pointing board upon a fresh sheet, lower grippers still open (upon frisket). The bellows is relaxed, its upward pointing air jets (the "blow") blew the tail of the printed sheet up into the nest of delivery rollers and tapes under the pointing board. These carried the sheet out onto the fly sticks, which then turned the sheet over onto the delivery table, off-drawing right. The table could be lowered by the feeder as the pile of printed sheets grew. Conventionally, the front of the press is the inking (left) end. The flywheel end is the rear. In this view the flywheel turned clockwise.

1. Distributor drum sheave, band-driven from flywheel sheave 12. Distributors on four- and six-roller presses were driven by a side-shaft and bevel gears.
2. Roller for shifting tympan, one on each side of platen.
3. Platen wheel, one of four, riding on tops of frame rails when moving platen.
4. Horse, for pile of fresh sheets.
5. Platen.
6. Form roller, one of two (or four, or six), bearings socketed into front part of carriage frame.
7. Removable bars, altering width of pointing board to suit various sheet sizes.
8. Pointing board, on which sheet was placed for feeding.
9. Sheet delivery bellows, or "blow", with rows of air holes along its rear edge.
10. Sheet delivery rollers and tapes, into which printed sheet was blown by bellows. Driven from 14.
11. Flywheel. Heavy flywheels were fitted for hand operation, but light, spring-spoked flywheels were better suited to power operation, their lower momentum tending to prevent accidents.
12. Flywheel sheave.
13. Sheet delivery fly.
14. Sheet delivery tape drive.
15. Power shaft with drive pinion.
16. Sheet delivery bellows weight.
17. Mainshaft, with bellows cam, fly cam, pins for impression pitman and carriage drive connecting rod.
18. Connecting rod for carriage drive, acting upon carriage alternator.
19. Carriage motion arm, one of two.
20. Carriage alternator, or "duckbill".
21. Impression pitman.
22. Impression alternaotr, or "gooseneck".
23. Impression throw-off slide, lifting pitman to suspend the impression. Operated by linkage from foot-pedal on feeder's stand.
24. Platen stabilizer bar, one of two.
25. Impression toggle roller, engaged by impression alternator to straighten toggle.
26. Impression adjusting screw and wedge.
27. Type-bed spring, easing motion.
28. Bottom bar, resisting downforce of toggle and upforce of platen bolts, which were threaded into the ends of the bottom bar.
29. Type-bed guide slide, one of two, attached to bed and reciprocating in heavy guides bolted to the side frames.
30. Ductor motion bar, with weight, actuated by bed movement.
31. Ink fountain and fountain roll.
32. Ductor roller.
33. Ink distributor drum.
34. Mouse roller assembly.
35. Type-bed and form.

through rollers which followed slots in the rocking lever actuating arms, keyed to the shaft at the base of the press to which the rocking levers were fixed.

The impression alternator allowed the bed to remain static in its lowered position while the frisket and rollers passed between bed and platen, even though the alternator was driven by a continuously rotating crankpin. The impression alternator's shape engaged the roller in the toggle center without shock. As the toggle was straightened, the toggle roller rode up into the slot of the alternator and, after the moment of impression, the alternator pulled the toggle off its center, eased the bed to its rest position, and then completed its motion without affecting the toggle. The distance between the fulcra of the alternator and the lower toggle limb effected the desired action. A notch in the top of the impression alternator engaged the pitman; the pitman was lifted from the notch by a foot-pedal at the feeder's position, working the impression throw-off slide to suspend the impression while allowing the press to run.

The elevation 20 clearly shows the impression-regulating wedge and its screw at the upper end of the toggle, between it and the type-bed. The stabilizer bar 24, duplicated on each side of the press, is part of the linkage preventing the platen from canting and jamming in its guides, much as did a similar arrangement in the 1830 Adams. The coil springs eased bed motion. The V-shaped assembly is one of the type-bed guide slides, running in machined guides bolted to the insides of the side frames.

Cams and millwork

There were but two rotary cams on the Adams, both lightly-loaded: One controlled the sheet-lifting bellows, a puff from which elevated the tail of the sheet from the frisket into the delivery tapes as the carriage came out (the first use of pneumatics in a press); the other operated the fly. Most other functions were derived from the alternators or from millwork actuated by the motions of carriage or type-bed. Tufts, Hoe (1847 project) and Morse (Ruggles) employed rotary cams for type-bed and carriage motions; and while they represented an "engineered" approach, they could not have matched the smooth precision or economy of power of the Adams arrangement. (Adams's alternators were very likely born of his experience with Treadwell's brutal cam designs.)

The delivery end of the press, at right in 20, comprised the mainshaft with its cams for bellows and fly, the nest of sheet delivery rollers and tapes, and the fly. The bellows, shown inflated, was compressed by the spherical weight when its cam follower dropped off the cam. The carriage alternators acted on rocking levers linked to the carriage by short reach rods. The delivery roller assembly rose with the pointing board when the latter was lifted to make way for rolling back the platen.

Carriage movement operated the points and grippers (*nippers*). The grippers were made like common door hinges, held by the gripper rod in the manner of a hinge pin. The upper grippers were fixed to the rod, the lower grippers loose on the rod but held firmly when closed against the upper grippers by spiral springs, as seen in 22. The gripper rod was free to rotate in its bushings, which fitted into slots in the carriage frame. The ends of the rod projected through the carriage frame. The slots in the carriage frame were long enough to allow the rod a small amount of fore-and-aft movement; the rod was held against the rear ends of the slots by small spring-loaded pistons. When the carriage, on its rearward stroke, came within about an inch of its point of reversal, the projecting gripper rod ends struck stops fixed to the

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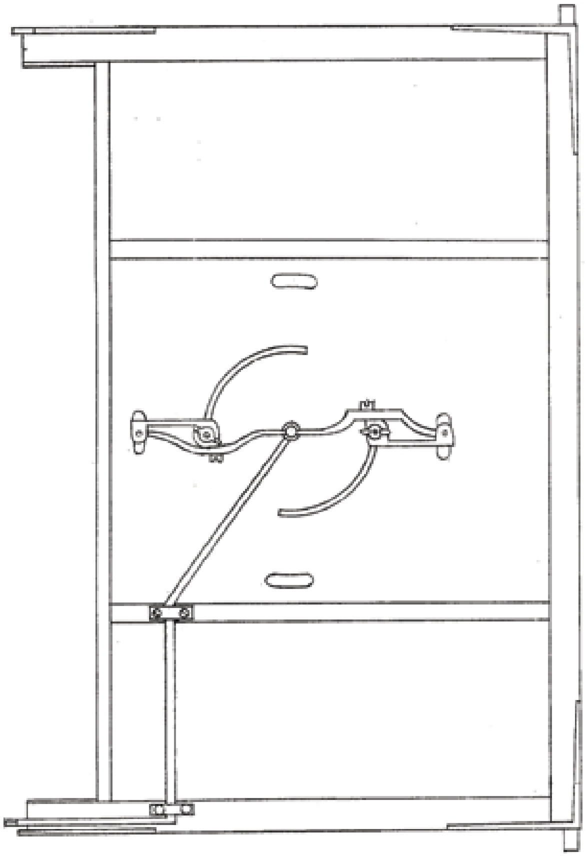
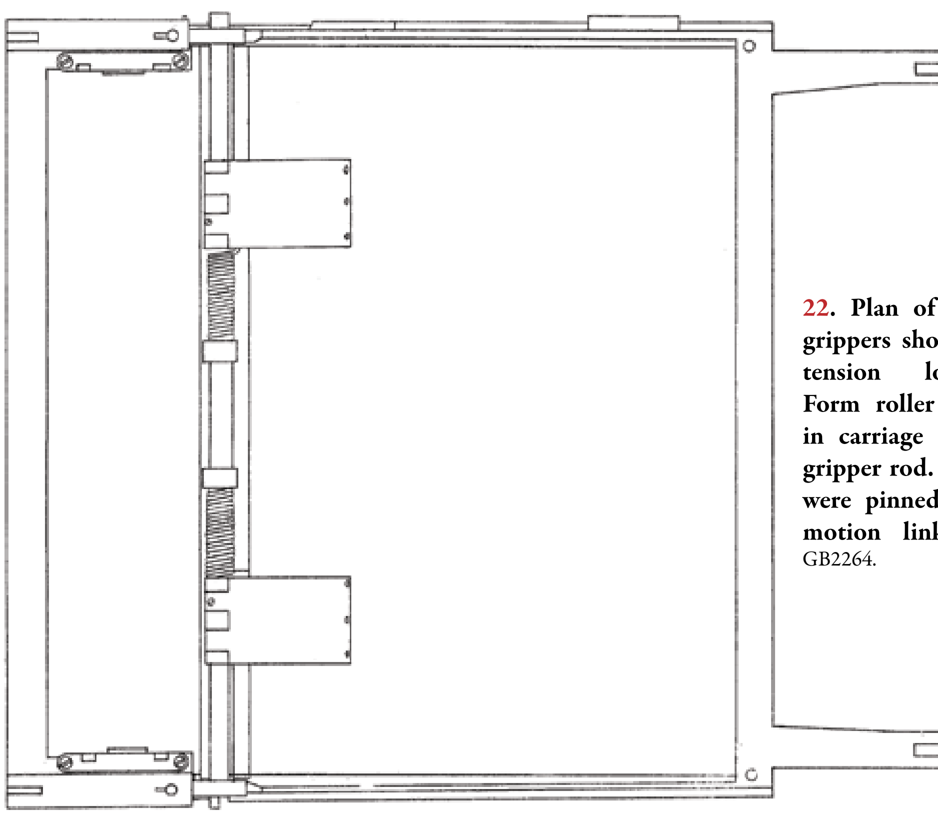
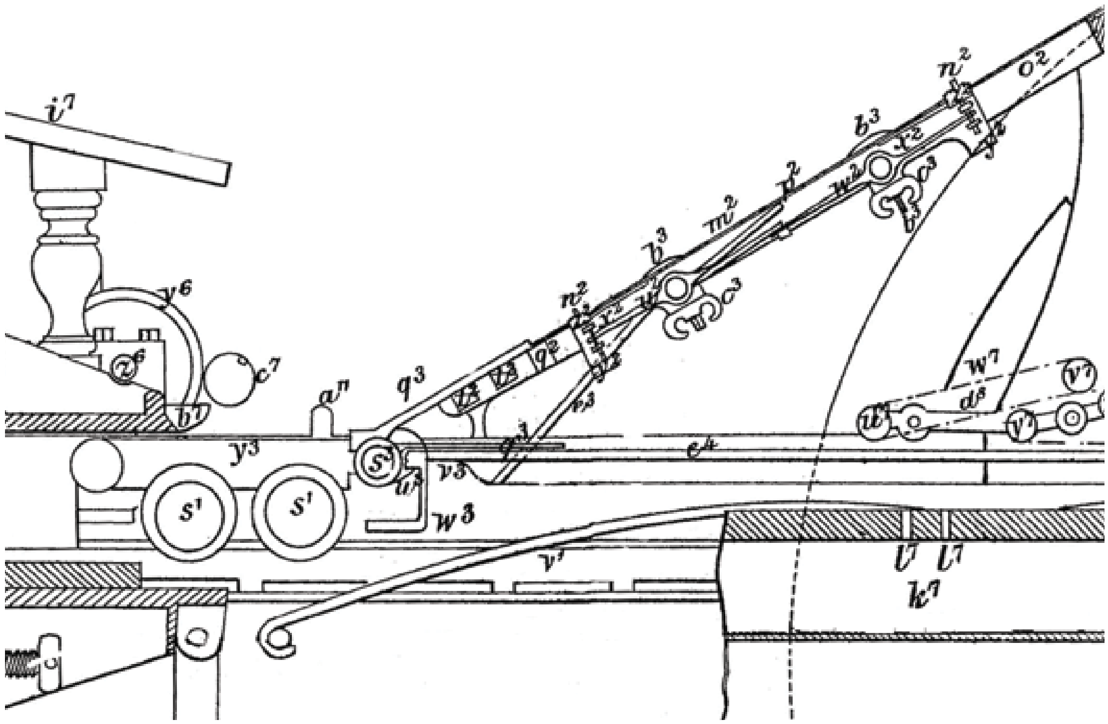


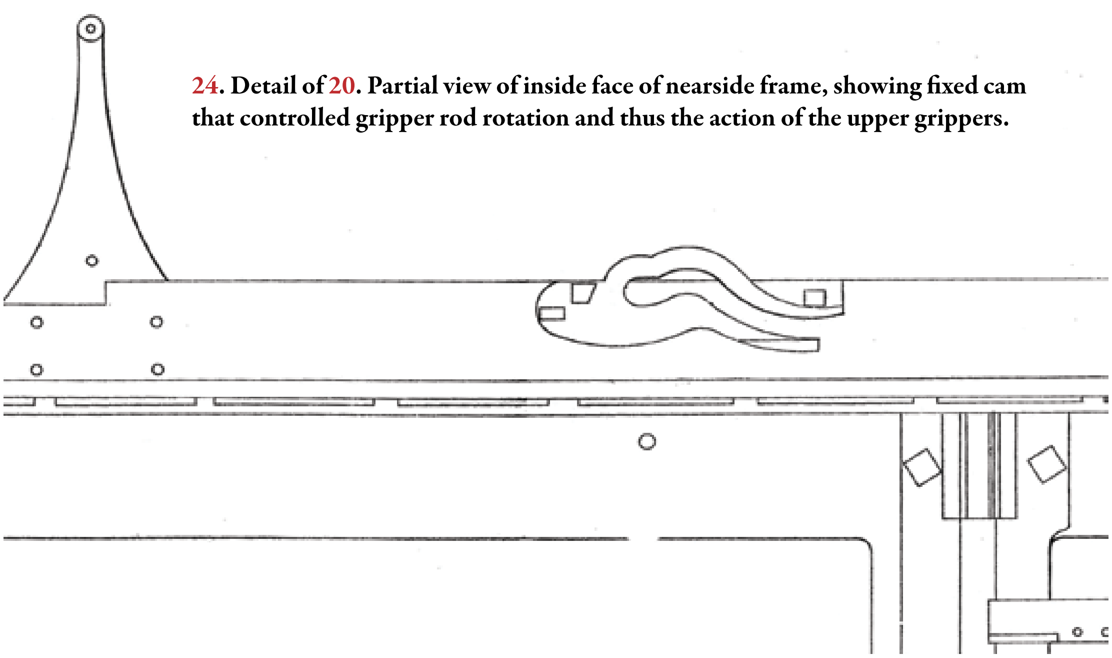
21. The underside of the sheet-metal pointing board, platen-facing edge at left. The points could be rotated to adjust their positions in the circumferential slots. The linkage off to the right actuated the points by contact with the moving carriage. The grippers (previous drawing) were arranged to come to a halt an inch or so before the carriage movement reversed, so that the grippers closed upon the sheet and the points dropped out of the sheet with the grippers stationary, ensuring good register, even though the carriage itself was in motion. From patent GB2264.



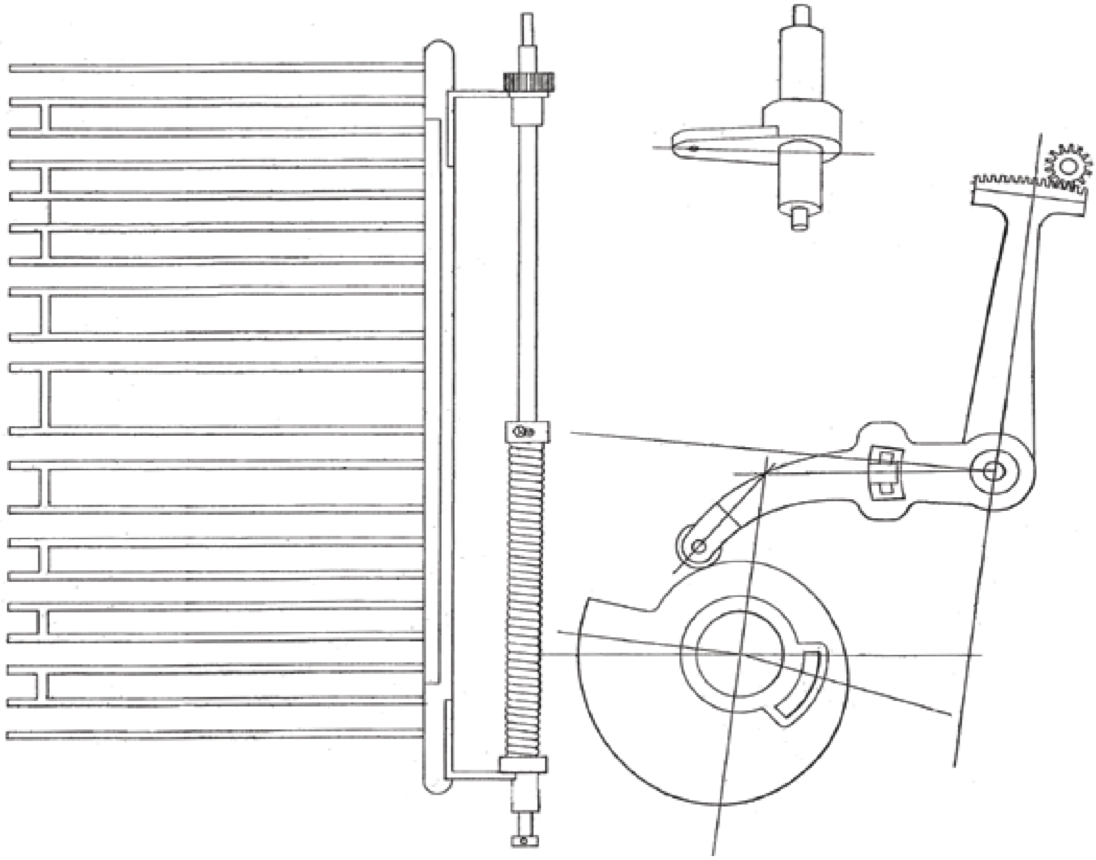
22. Plan of carriage. Upper grippers shown. Coil springs tension lower grippers. Form roller bearing sockets in carriage frame to left of gripper rod. Brackets at right were pinned to the carriage motion linkage. From patent GB2264.



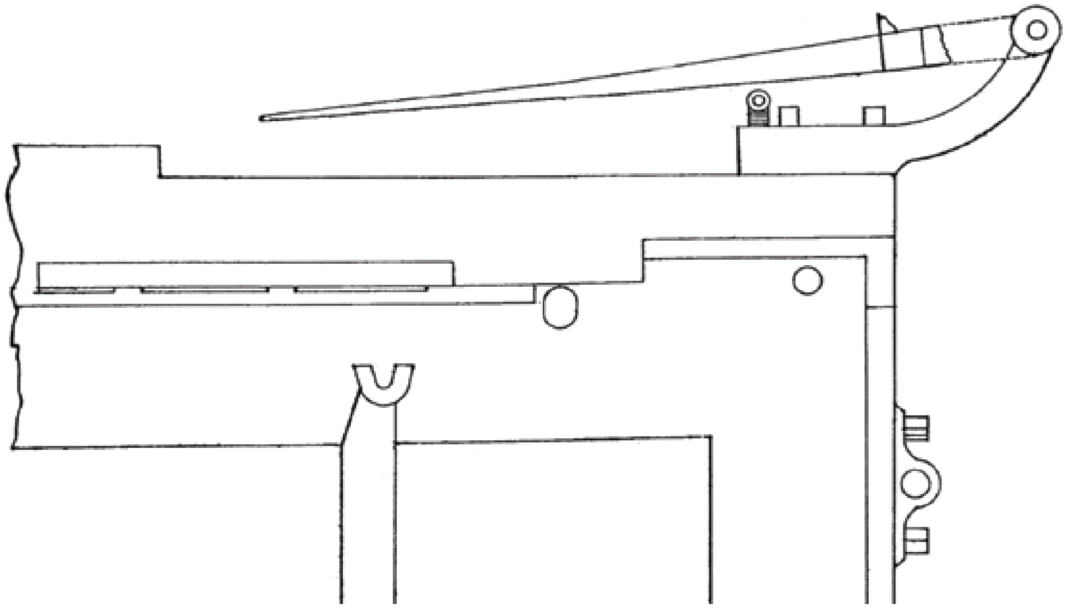
23. Detail of 20, showing carriage just prior to reversal, with grippers open, upper gripper q^3 resting on pointing board bar q^2, lower gripper on frisket about to spring upward to grasp pointed sheet. Two of the pointing board bars have been removed. The gripper rod is s^3, the gripper release bar is w^3, at n^2 is one of the points, c^3 one of the point set screws. A puff of air through the rows of holes l^7, l^7 from the bellows, k^7, lifted the tail of the sheet into the delivery tapes above. These conveyed it over the fly.



24. Detail of 20. Partial view of inside face of nearside frame, showing fixed cam that controlled gripper rod rotation and thus the action of the upper grippers.



25. Detail of 20. The sheet delivery fly and its actuating mechanism. The cam was adjustable on the mainshaft to time the fly. The sector engaged the pinion on the fly shaft. The normal, as opposed to the "sidewinder", type of fly is shown, the latter type not well adapted to the usual arrangement of presses in rows.



26. Detail of 20. The fly in its rest position, ready to receive a sheet. It turned through 180 degrees to lay the sheet upon the delivery board (not shown).

press frame, arresting the horizontal movement of the gripper assembly. Further movement of the carriage released the lower grippers by tipping a long catch bar. The lower grippers then sprang upward against their mates to seize the edge of the sheet. The catch bar was reset when the closed grippers and fresh sheet were drawn off the pointing board and laid flat upon the frisket as the carriage ran under the platen.

Motion of the upper grippers, as they rose from the frisket then descended upon the edge of the pointing board, was by means of a short lever fixed to one end of the gripper rod, fitted with a roller which followed the groove in a cam fixed to the top of the nearside frame, 24. The lower grippers were slightly shorter than their mates; they cleared the edge of the pointing board on their upward swing to grasp the sheet.

Interchangeable grippers were available in various lengths to accommodate sheets of different sizes. The sheet was pointed at or near the center of the pointing board. The edge of the board nearest the platen was made up of transverse bars, removable in order to clear longer grippers for smaller sheets. Three pairs of grippers were used for a full-sized sheet. The specification included several refinements of the gripper mechanism, including a unitized arrangement allowing quick changes from one gripper setup to another. The wording of Reissue 116 implies that many printers favored the unitized assembly over the basic, which required disassembly to change grippers.

Impression, inking

About tympans for the Adams, Ringwalt wrote, *The tympans in general use are composed of fuller's board, covered with packing or draughting paper; or several sheets of draughting paper, covered with fine muslin or billiard cloth.*[36] Reissue 116 also mentioned a parchment tympan, with packing between it and the platen face. Rubber blankets were often used for ordinary work. Overlays were applied to the face of the tympan, which was held tightly against the platen surface by a close-fitting frame (the drawer), over which was stretched the muslin top sheet. The drawer hooked over one edge of the platen and was held up to the other edge by slide-bolts. A traveling set-off sheet (traveling tympan), of paper or fine cloth, protected the tympan; the movement of the set-off sheet helped detach the damp, just-printed sheet from the tympan as the bed fell, just before the carriage began its outward run. The set-off sheet moved from a roller on the front edge of the platen to a similar roller on the rear edge, a ratchet operated by a long, light rod from the mainshaft pulling the set-off sheet a short distance for every impression.

To gain access to the type-bed and form, the delivery tape assembly and pointing board were turned up to a vertical position. The impression bolts were backed off to free the platen (they were indexed for exact re-setting) and the platen was rolled back into the space normally occupied by the pointing board. The gripper and frisket frames were then removed from the carriage. Bearers, frisketed-out, were placed in blank pages and, if the form had to be locked-up off-center to allow a narrow sheet to reach the grippers, bearers were required at the tail of the form to keep the center of pressure directly over the toggle. An impression adjustment wedge was fitted between the type-bed and the upper limb of the toggle.

Bed motion operated the fountain roll and ductor, supplying fresh ink to constantly-rotating distributing drum(s) and rollers upon which the form rollers rested during the impression. The fountain blade was provided with but three push-pull adjusting screws. A mouse roller ran against the distributing drum to aid distribution. The distributors were driven through bands or a bevel-geared shaft from the power-shaft; the shaft drive was fitted to four- and six-roller presses. Form rollers ran in spring-loaded adjustable boxes fixed to the carriage; they were not fitted with trucks. All form rollers covered a full form.

Hoe's improvements

R. Hoe & Co. purchased the Adams firm in 1859 and continued to build the machines at the old Adams works in South Boston until 1869, when they removed the operation to their New York facilities. The last Adams presses were made in 1882. In Hoe's 1881 catalog, the last in which the Adams was listed, the firm claimed, *The improvements we have added and patented during the last few years make it essentially a new machine. Two thousand pounds have been added to the weight of an average sized press . . . There are also important improvements in the distribution, by which two form rollers will now do the work almost equal to four upon one of the old machines. A fountain for expensive colored work has been constructed, in which the ink lies upon the knife in full view, so that very little is required to start the press.*[37]

In contrast to Hoe's earlier catalogs, offering fifty-four sizes and styles, the 1881 edition listed but seventeen, comprising two- and four-roller versions. To compare with the four-ton weight of a 26x42 mentioned in the 1852 article cited above, the 1881 catalog lists the No. 29, 27x41 two-roller at six tons, and the No. 30, 27x41 four-roller at six and a half tons. The No. 29 was thirteen feet long, six feet eight inches wide, ran 660-1020 iph, drew 1½ hp, and cost $2700. The No. 30 was a foot and a half longer, eight inches wider,[38] ran 480-840 iph, drew 2 hp, and cost $3000.

As well as the color fountain, Hoe's pre-1881 catalogs offered other accessories, including special friskets for jobwork, and an arm over the pointing board, fitted with coil springs spaced to drop over the points. The arm swung down to punch the sheet onto the points, sparing the feeder the need to lean out over the board to press the sheets onto the points on the white paper run.[39] Two feeders were employed on backup runs and other register work in which the sheets had to be placed accurately on the points.

EXTRACTS

From "Making the Magazine", in *Harper's Monthly Magazine*, December 1856, pp. 1-18: [The Adams Press] is the only kind now used in this establishment for the Magazine and for book-work. *Harper's Weekly*, for which still greater rapidity is required, being printed upon cylinder and rotary presses. ... An Adams Press will work 6000 sheets, each containing sixteen pages, in a day; thus, with one "feeder," doing the work of six [hand]presses and pressmen. The establishment contains 35 of these presses, of which at least eight are always at work on the Magazine, and twice as many in certain parts of the month. For executing fine work rapidly nothing has been produced that equals them. ... To "make ready" a form with many cuts requires the work of two men for from two to six days; and the press must stand idle during that time . ... As the time of a press is worth ten dollars a day, this expense—from thirty to a hundred dollars for a single sheet—can be afforded only when a very large number are to be printed, or when a high price is put upon the work. The general excellence of the printing of the illustrations in this Magazine is owing to the care bestowed upon making them ready.

From *An Address Delivered before the New York Typgraphical Society* by Peter C. Baker (Baker & Godwin, New York, 1861), in which Baker quotes from a letter written to him by Boston printer G.C. Rand, recently returned from a year's sojourn in Europe: The best power press work in Glasgow and Edinboro' is done upon our Boston press—incomparably the best printing press in the world ...

Harper's 1878 publication, *Harper & Brothers' Descriptive List of their Publications with Trade List Prices* included "A Visitors' Guide to Harper & Brothers' Establishment", in which it was stated that their lower pressroom contained one Hoe two-feeder rotary, one Hoe four-feeder rotary—both type-revolvers—and nine Hoe cylinders, all for printing *Harper's Weekly* and *Harper's Bazaar*. The upper pressroom housed two cylinders and twenty-six Adams presses for bookwork; an adjoining room contained ten Adams presses and four job presses. The article notes: To make ready a sheet with many engravings may require the labor of two men for several days. For the cylinder presses, cutting-out; for platen presses, overlaying is mainly used.

In 1885 and 1886 the pages of *The Inland Printer* were enlivened by a debate between writer Stephen McNamara and pressman C.W. Miller on the merits of the Adams press, in which Miller's defense of the old standby reveals a few of those small details of operation so difficult to find in the literature. It is significant that Miller reports "printing everything dry". The "blow" refers to the bellows. Excerpts are from Millar's letter to the Editor of Oct. 19, 1885: ... I believe the Adams press is adapted to all classes of work, for there are offices in this city [Philadelphia] in which no other press is used, which do work that cannot be surpassed. The days of damp paper seem to be, except in occasional instances, past, and we find little difficulty in printing everything dry ...

... All will agree that injury to type is, on this press, reduced to a minimum. The ink fountain, as Mr. McNamara in a former article says, permits of a line of ink being delivered evenly over the form ... not desirable where parts of the form require more ink than other parts do. Very true, but we get over this difficulty by using strips of tin, which we draw across the fountain where it is desired to be light, and the brayers which run on the inking cylinder take enough from the heavy parts to make the correct color. Some offices, however, use the thumb-screw fountain on this press the same as it is used on the cylinder [press]. ... The impression columns [bolts] on this press are very easily adjusted, so that, if you wish a soft impression for old and worn type or plates, it requires but a half a minute to take off the impression and insert either a blanket or a good number of soft sheets of paper. Should the job be fine, cover what is known as the drawer, with manila tympan paper, wet it, and it will draw up as tight as a drum, insuring a dead hit for the makeready when put in. I am told old hand-pressmen used to practice this twenty years ago. Of course, a small number of sheets are to be used on this class of work. In regulating the squeeze on this press, be careful not to go beyond what can be pulled over by hand. Should the work be illustrated, put the cuts nearest the blow, as then they do not slide over the bars of the frisket. Should it be impossible to place the cuts where I have indicated, and they seem to drag on the forward [rear, in our renderings] bars of the frisket, take a small piece of whalebone, about an inch and a half long, taper one end down, and glue the other end fast to the frisket bar, in the margin opposite where the smear is, and ... as soon as the impression is taken, the tapered end will spring up and elevate the sheet above the bar.

In dealing with slurs on this press, it is, of course, necessary to avoid a baggy tympan and frisket. Some pressmen use corks, which are glued underneath the frisket bars; others use paper barers. Some place the latter on top, and some put them under the bars, but experience seems to favor the paper bearers on top of the bars, because corks and bearers placed underneath will only prevent slurring when they have furniture to rest on, while the bearers on top seem to be effective without the rest. …

From "Our Philadelphia Letter", in the *Inland Printer*, August, 1886, p. 697: I understand that when Mr. Dornan, now located on Filbert street, moves into his commodious quarters, at Seventh and Arch streets, he will put in thirteen additional Adams' presses, being convinced that that style of press is best suited to miscellaneous bookwork. Mr. Dornan has a monopoly of the works of Henry C. Lea, the great medical book publisher.

From the *American Bookmaker*, July, 1887, p. 17, discussing the American Bible Society and the American Tract Society: Almost the only places in the city [New York} where Adams presses are now seen in operation are in these religious offices, competing printers being obliged to put in swifter presses.

From a brief in the *Superior Printer*, vol. 2, 1888-9, p. 104: The printing establishment of Rand, Avery & Co.,, Boston, founded in 1854, is a thing of the past. This immense establishment was sold by auction, and many of the presses brought very low prices, fourteen Adams presses having been sold at prices from $100 to $200.

From the *American Printer*, vol. 14, 1892, p. 48: The platen press cannot be made strong enough for the immense pressure required for modern forms. … The larger sizes of the Adams press frequently broke down, there being too much area to be covered at once.

From an "Old Tourer", *American Bookmaker*, vol. 14, 1892, p. 44: I am surprised to see so many of the old Adams presses still in constant use. I counted twelve in one establishment recently and ten of them were running. … It is true that they were only running at about 800 an hour … but as all of the presses were running on bookwork for publishers, and there were a good many works which only called for short editions printed from plates of plain type matter, the saving of time in making ready was sufficient to compensate for the loss of speed.

From the A*merican Bookmaker*, vol. 17, 1893, p. 65, on engraver Joseph Adams's role in producing *Harper's Illuminated Bible*: Mr. Adams … rendered valuable assistance to Mr. Lewis [later foreman at Harpers'] in his presswork. … they jointly experimented in … overlaying … and much of the perfection since attained in this process can be based on their original manipulations.

From Pasko (1894), p. 446: As late as 1875 the Adams press was regarded has highly desirable to purchase by men about beginning business. … It needed much power to make the impression, as on the larger presses twelve to fifteen hundred square inches were exposed to pressure at once. On the cylinder press a line a quarter of an inch wide by forty or fifty inches long only was needed. Thus while the Adams could successfully print double-medium forms each addition in size required much more power and much heavier castings. Ten years after the [Civil War] it was thought that the cylinder would do as good work as the Adams on everything except stereotype plates, then beginning to be superseded …

From the *American Bookmaker,* vol. 21-22, 1895-6, p. 162: While the majority of printers and publishers are calling for the latest improved presses and the most highly finished paper, and are doing their utmost to obtain the best results of hard packing from the finest of half-tone cuts, there are some who yet believe in the older methods and are using soft packing and wet paper, and are having their cuts made by wood engravers. The Adams is a favorite press with some of these, as they can get out small editions of books quicker and cheaper than on cylinders. In all probability there will have to be more Adams presses built to meet the demand. ... these same printers propose to return to the use of paper made from rags instead of the thousand and one other things which are at present converted into "pulp". These may appear to be backward movements, but at any rate the last one named is in the right direction.

From the *Inland Printer*, vol. 26, 1900-1, p. 623, article "Sale of the Bible House, New York": The Bible House ... has been one of the landmarks of [New York City] since its erection in 1853. Now the property is for sale ... In the pressroom are fifteen presses, seven Hoe stop-cylinder, three Campbell and seven of the old-fashioned Adams platen presses. Some of the latter are still in use and do wonderfully good work.

From the *Inland Printer*, vol. 28, 1901-2, p. 598: ADAMS PRESS WANTED—large size; state condition and lowest cash price.

From the *Inland Printer*, vol. 28, 1901-2, p. 530: In the city of Philadelphia ... For the past twenty years a huge printing-office, once a very hive of industry, has stood idle with twenty-two Adams presses in the deserted Pressroom ... This exhibit of the result of disbelief dates from the time of the introduction of the cylinder press ...

From the *American Printer*, vol. 35, 1902-3, p. 331, article by George French: Mr. [Bruce] Rogers believes in the hand-press, and he seeks to preserve in the machine work those qualities that he finds admirable in hand-presswork ... This effect is secured to much of the Riverside Press work through the continued use of a large battery of Adams presses, and by means of dampening the paper printed on the cylinders. This concern has never yielded to the fashion of impressing the type forms upon paper so delicately as to obviate the necessity of dry-pressing ... the sheets; and I am more than half persuaded that its policy in this respect is the right one.

From a letter written by "a well-known New York printer", printed in Oswald Publishing's *American Manual of Presswork* (New York, 1911), p. 34: When I first worked at my trade we used to work on the outside of the tympan of the Adams presses. We would draw a damp sheet on the tympan after we had the form leveled underneath and print a sheet with the proper amount of color, and then cut out the lights on the tight sheet on the face of the tympan, and overlay those portions that showed a lack of color or gradation. Sometimes we would repeat this with four or five sheets until the desired effect was secured, which would often take two men two weeks or more. The first illustrated book I worked on in this manner was "Harpers' Pictorial Bible." The original woodcuts were set in the type matter by means of sectional blocks. After the pressman had gone as far as his skill would warrant, the engraver, a Mr. Adams, would spend a day or more on the form with suggestions for improvement. The book stands today as a monument of good printing.

From a letter by "C.H.", in the *Inland Printer* issue for December, 1912 (p. 377): As I remember it, the first illustrated newspaper published in this country was that of Gleason's Pictorical, in Boston. ... Gleason's paper was printed on an Adams press, as was that of the Flag of Our Union, a story paper ... Cylinder presses, as built in the fifties, were very crude affairs. ... R. Hoe & Co. built a cylinder for Gleason, but after trial it was condemned ... the bed and cylinder not registering close enough, throwing the overlays off and on about a pica.

NOTES

1. The mechanism of the Adams press is clearly presented in the complete specification and superb drawings of British Patent No. 2264 of 1854, covering two-, four-, and six-roller presses, with two gripper arrangements and two types of fly. The U.S. patent of 1836 (specification and drawings) was reissued (with updated specification and re-arranged drawings) on June 13, 1848 as Reissue No. 116. (Adams's patent specifications often refer to the pointing board or feed board as the tympan, probably because the sheets were pointed upon the tympan in handpress practice.)

The U.S. National Archives in Washington, D.C., holds a collection of affidavits (in "Petition of Isaac Adams", House Committee on Patent Hearings, RG 233) from leading printers and pressbuilders supporting Adams's request for extension of the 1836 patent. They emphasized the vital importance of the Adams press to the American trade. The R. Hoe & Co. catalogs provided sectional plan view, specifications and putting-up instructions. The putting-up text was reprinted in MacKellar's American Printer, 1871.

Abbott (1855) placed the machine in its operational setting; his cut of the Harper pressroom was reproduced in Moran (1975). Ringwalt (1871) offered information on operation and makeready in the articles on: Joseph Adams, pp. 20-21; Adams Press, pp. 21-22; Making Ready, pp. 298-299; and Presswork, p. 361 (with an apparent lacuna after the last full paragraph). DeVinne (1880) pp. 36-37, related the deficiencies of the Adams and its eventual replacement by the cylinder, beginning in the 1860s. Howells (1896) pp. 13-16, offered a personal account of Adams experience.

Comparato (1979) presented a history of the firm's early days, pp. 19-23, and a detailed account of the Hoe purchase and the Adams Boston establishment on pp. 357-379. Wilkes (2004) described the Adams on pp. 235-236, with the sectional drawing from the 1836 patent, and cuts of the "sidewinder", the Abbott image of Harpers' pressroom, and a Jocelyn cut of a large two-roller. Wilkes treated the Hoe/Adams on p. 289, with a cross-section from Hoe's catalog of a four-roller press, and the catalog's decorative Jocelyn cut.

2. "Petition of Isaac Adams", House Committee on Patent Hearings, RG 233.

3. Raabe (1906), p. 121. On the same page, he said the last Hoe Adams was built in 1881. Raabe confused the British platens of D. Napier and those of J.M. Napier, pp. 119, 120, while repeating the mistaken notion that the Napier double was the most popular British platen.

4. *v*. British patent 5417 of 1826, granted to William Church. This arrangement is often termed a "shifting tympan".

5. *v*. British patent 4903 of 1824, granted to William Church.

6. Hoe (1902), p. 11.

7. Putnam (1852), p. 494.

8. Ringwalt (1871), p. 299.

9. DeVinne, in Sedgwick, et al. *The Nineteenth Century: A Review of Progress*. New York: G.P. Putnam's Sons, 1901, p. 7.

10. DeVinne (1879), pp. 69, 70, 437.

11. Trow: Putnam (1852), p. 493. American Bible Society: Wosh (1994), p. 243.

12. Wright (1894), p. 264.

13. Comparato (1979), p. 22. But see Exman (1967), p. 40: "... and by December, 1853, forty-one of them [Adams presses] were turning out an average of twenty-five volumes a minute, ten hours a day, six days a week."

14. Abbott (1855), p. 43. On p. 49 he mentioned a total of thirty-three printing machines in the entire building, five being on another floor.

15. Harpers (1865), p. 17.

16. Comparato (1979) p. 648.

17. Harrison (1961), p. 42.

18. *Specimens.* Boston: Geo. C. Rand & Avery Co., 1865.

19. Sutton (1961), pp. 74-76, 124-125. Sutton did not attempt a complete accounting.

20. Ritchie (1955), p. 28, quoting *The California Mountaineer* issue for March, 1955.

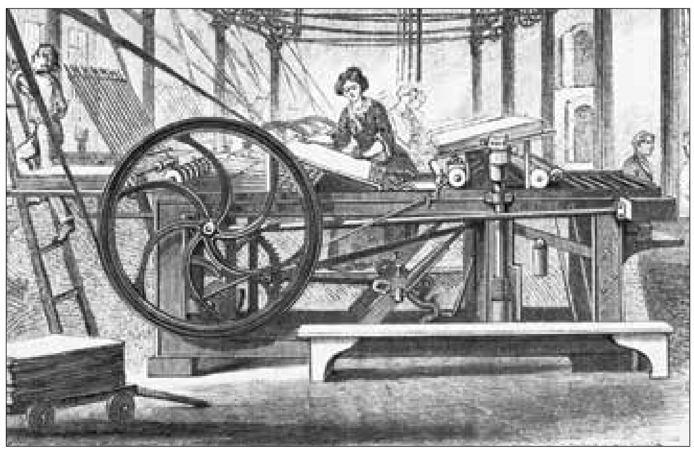
21. Carey Bliss, ed. *The Iron Sybil* in California. San Francisco: Zamorano Club, 1972.

22. Wosh (1979), p. 19.

23. Ringwalt (1871), p. 21.

24. Joyner (1895), p. 74.

25. Pasko (1894), p. 8.
26. Harpers (1865), p. 17.
27. Ibid., p. 17.
28. Some of the exported presses may have been of the 1830 patent.
29. Green (1951), p. 152.
30. Berwick (1909), p. 137. Here A.K.P. Welch seems to be credited with devising a stop cylinder. In fact, Welch cooperated with R. Hoe & Co. in development work on several presses, as noted in Comparato (1979), p. 377.
31. Pasko (1894), p. 9.
32. DeVinne (1880), p. 36.
33. Riverside (1911), p. 15.
34. Cubery (1900), p. 7.
35. Oxford: 1998, p. 106.
36. Ringwalt (1871), p. 299.
37. Hoe (1881), p. 19.
38. Added width due to ink distributing system driven by shaft and bevel gears outside the frame. The two-roller presses retained band drive.
39. One suspects this last item facilitated the employment of Girl Feeders too small to reach the points easily. For the white paper run, a girl need only reach far enough to take a sheet from the pile on the horse and place it to marks or guides on the pointing board, which she could do holding the near edge of the sheet.



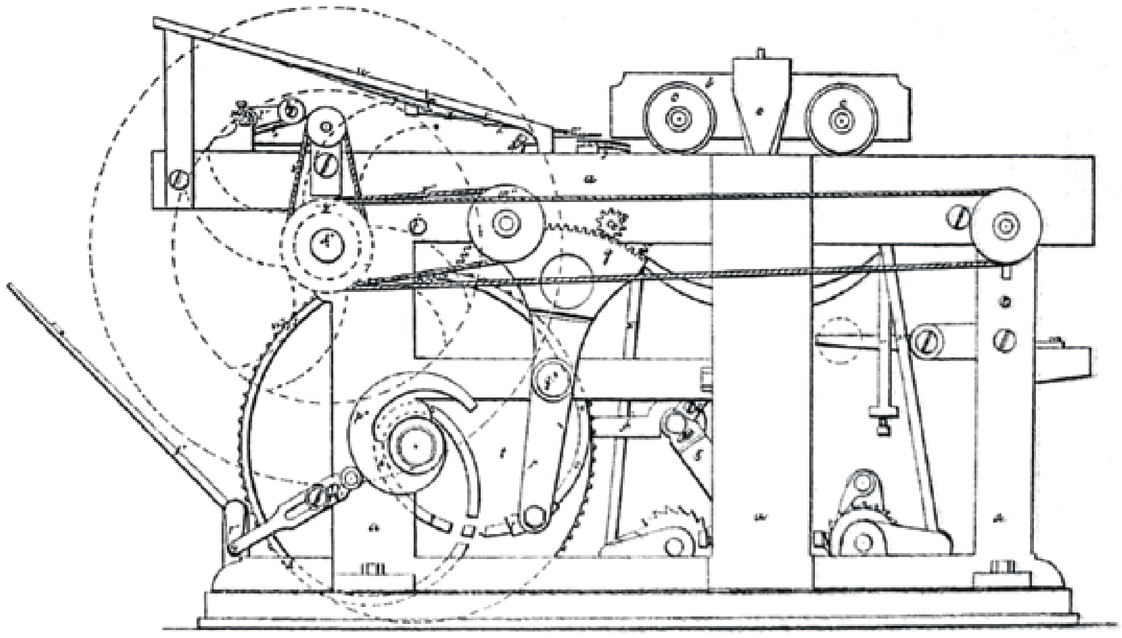
27. Six-roller Adams presses in the Harper & Bros. pressroom, c. 1855. Shaft and bevel drove the distributing rollers on four- and six-roller models. Overhead vertical levers controlled belt shifters. From Abbott (1855).

R. HOE & CO. 1847

Richard M. Hoe's U.S. patent No. 5188 of July 10, 1847, was evidently the basis for this press. Comparato (1979) pp. 358-359, recounts the origin of this machine at the hands of Hoe's R&D maven, Stephen D. Tucker, in 1846, its patenting in July 1847, and its employment at the American Bible Society until 1852. Wilkes (2004) pp. 259-263, reproduces five drawings and a block of text from the patent.

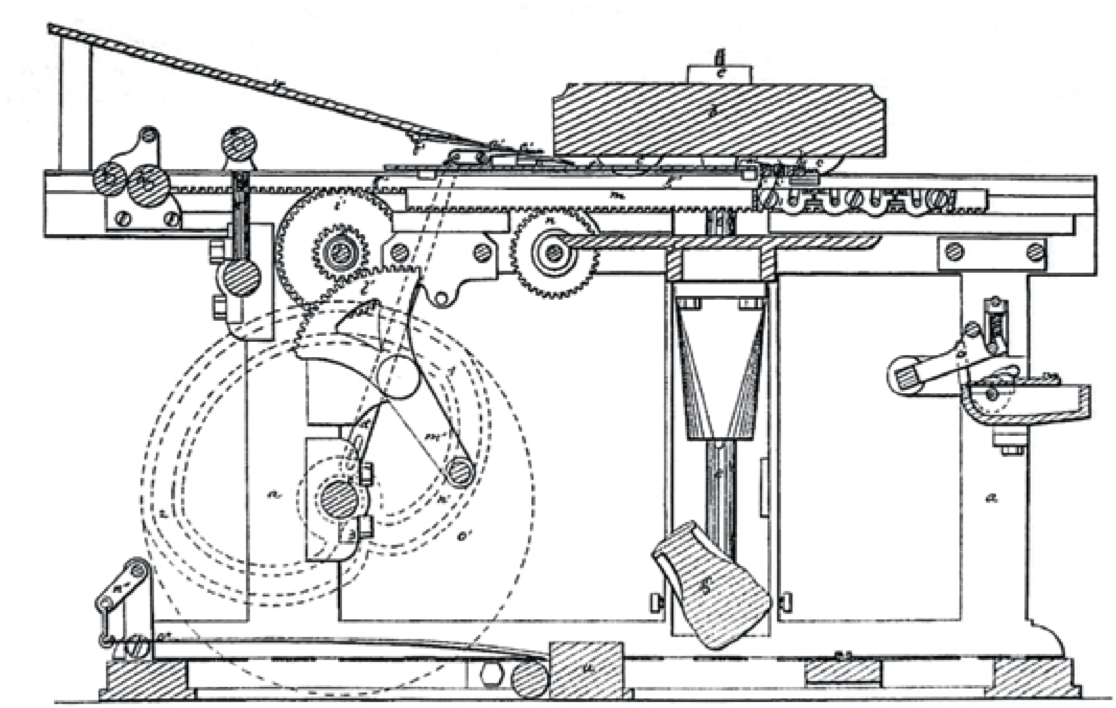
The presses, number unrecorded, were successfully employed at ABS, but further use was halted by their infringement of the Adams 1836 patent, for, like the earlier Tufts, their form rollers passed between bed and platen, a motion specifically protected in the Adams patent, and their sheet flyers continued a long-standing infringement. The press functioned through cams, racks, rack segments, pinions, and trains of gears in place of Adams's cranks and alternators, the camshaft carrying five cams.

The frisket carriage and form roller frame operated independently, four rollers covering the form. Both frisket carriage and roller frame were attached to racks; the racks were driven by small pinions; the pinions were driven by rocking levers with toothed segments engaging the pinions; the rocking levers' lower ends were driven by large grooved cams. A large cam impelled the impression connecting rod through a roller-follower atop a vertical rocking lever. The connecting rod rocked the entire massive bottombar, which acted as the lower limb of the impression toggle, and was carried in heavy bearings in the side frames.

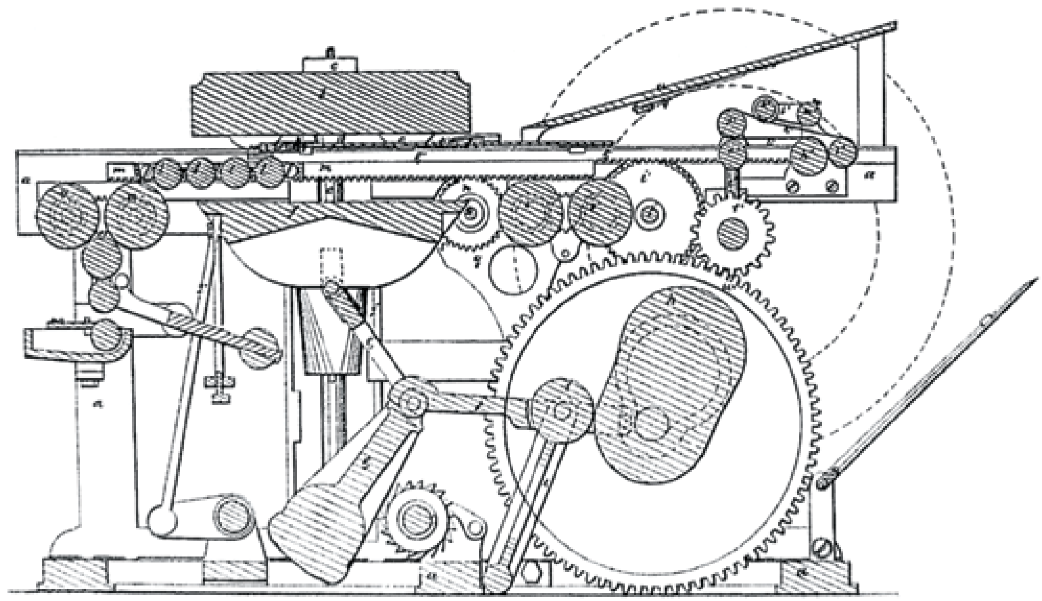


28. Drawing from U.S. patent 5188 of 1847, R. Hoe & Co., illustrating Hoe designer Stephen D. Tucker's ingenious attempts to avoid infringing the Adams patents. Here can be seen the enormous grooved cam and the toothed segment it drove to move the form-roller frame (via the small pinion on the outside of the press frame), and the fly delivery with its snail cam. Printed sheets were delivered almost at floor level.

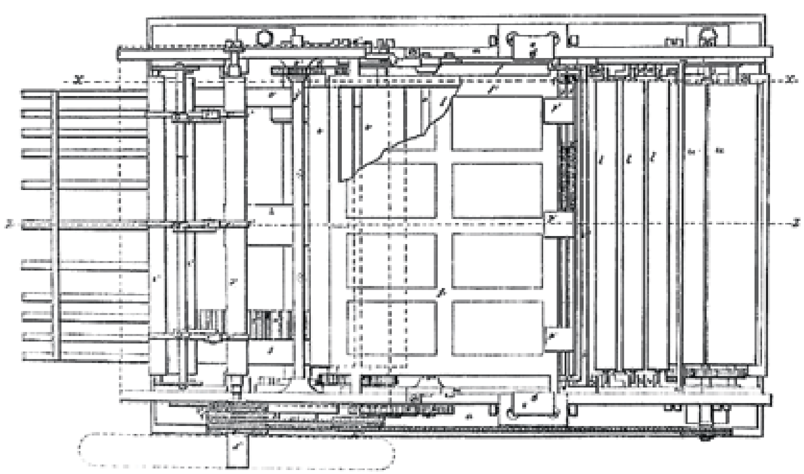
Ink distribution was simplified and improved over that of the Adams, and included a pair of distributors on the pointing board side of the bed which refreshed the form rollers, obviating ghosting and repeats. Mechanical sheet-lifters raised the tail of the printed sheet into the delivery tapes as the frisket carriage came out. The fresh sheet was taken by grippers on the frisket carriage, as per Adams practice. This machine was the Hoe firm's last attempt to invade the platen market with a proprietary unit; they purchased the Adams concern a decade later.



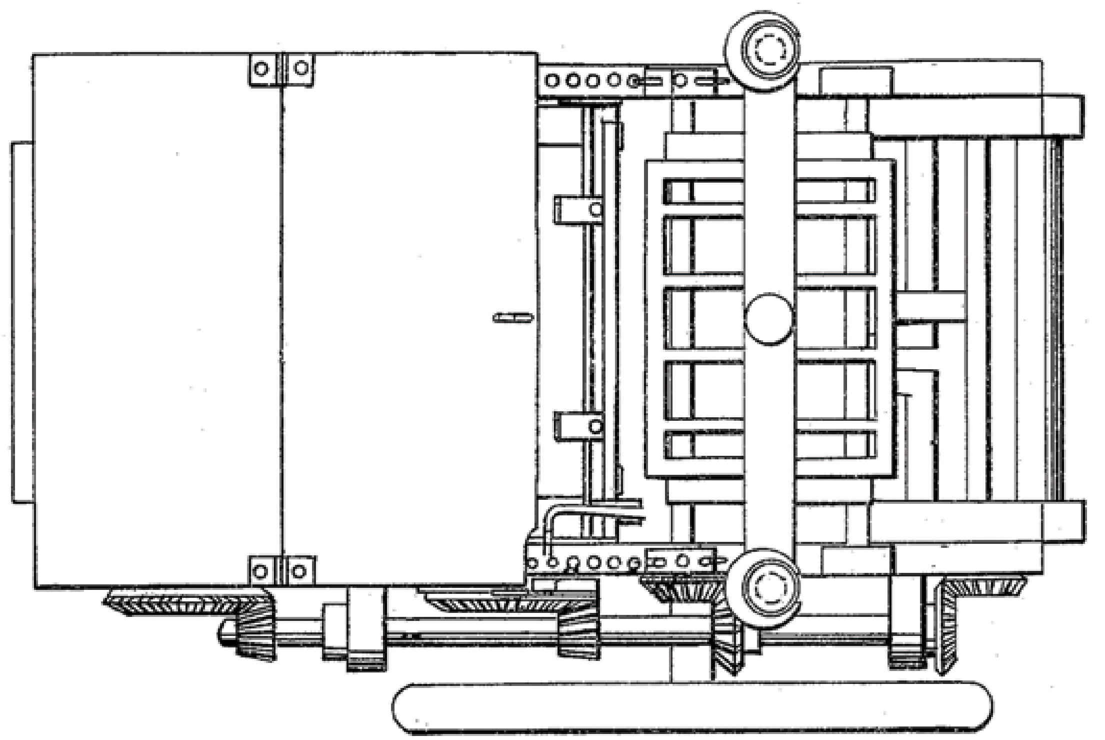
29. From U.S. patent 5188. The large grooved cam operated the segment *l'* which drove the small pinion on the shaft of the larger pinion engaging the carriage-motion rack. The gear *n* just below the right end of the feedboard engaged the rack *m* driving the form-roller frame. Its drive segment and cam are shown in 28. One of the two massive bed guides is seen on its vertical rod above the bottombar, which is in its tilted position, with the bed down and the form-roller frame partly over the bed. Near the floor at left is the long, slightly-curved spring for the sheet flyer, hooked to the short arm on the flyer shaft.



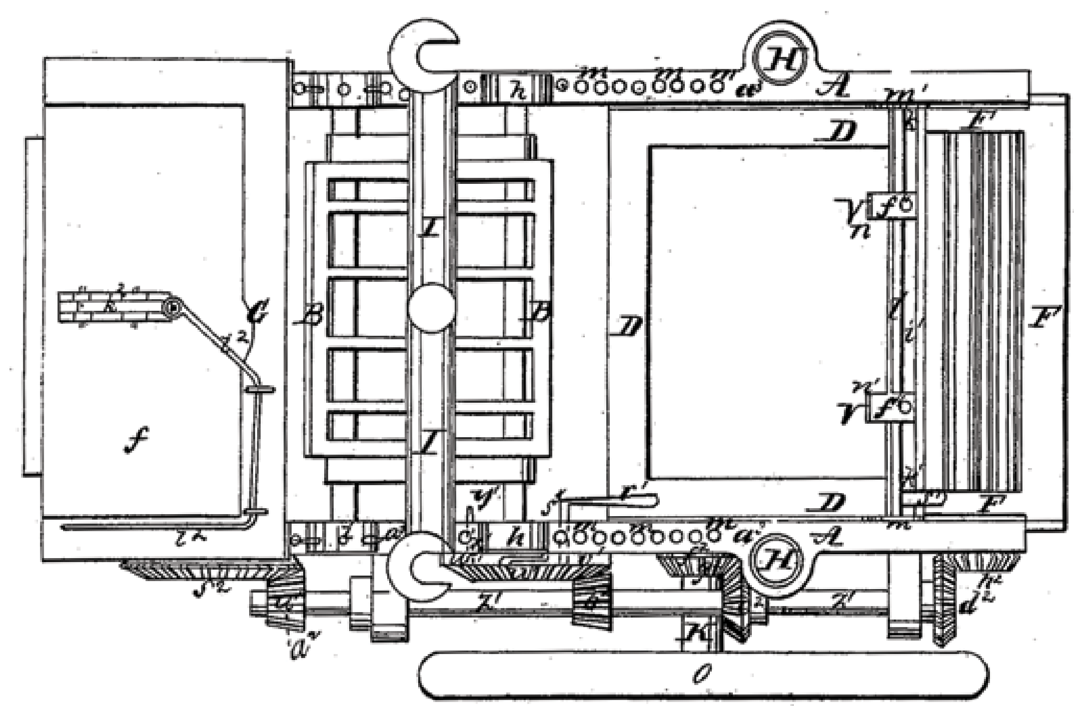
30. From U.S. patent 5188, the impression cam and its connection to the oscillating bottombar (serving as the lower toggle limb), and the inking system, with distributing drums on both sides of the type-bed. Impresssion cam *h* has a race cut in its side engaging an extension of the pitman, to pull the toggles off-center after the impression.



31. From U.S. patent 5188, plan view of press, fly at left, platen at center, inking system at right.



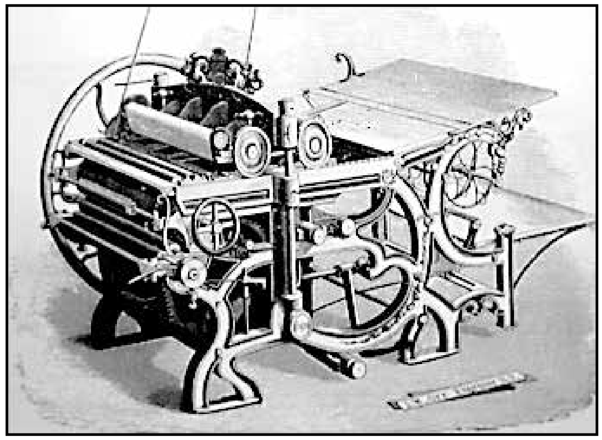
32. The Ruggles in plan, from U.S. patent 24357, with platen in operating positon. Holes in the side frames indexed with spurs on two of the platen wheels to obviate misalignment when moving the platen.



33. The Ruggles in plan, from U.S. patent 24357, with platen in makeready position, frisket over type-bed, and pointing board thrown back, revealing the pointing mechanism.

RUGGLES 1859

Jedediah Morse of Canton, Mass., received U.S. patents 17543 of June 9, 1857, and 24357 of June 7, 1859 (specification and drawings) for single-ended platen machines. They were assigned to the S.P. Ruggles Power Press Manufacturing Company of Boston. The cut inset shows the version offered to the trade and largely conforming to the 1859 patent specification. *The Engineer* of Dec. 16, 1859, printed drawings and a muddled description on pp. 429-430. Also in 1859, *Scientific American* published two articles announcing the 1859 machine, both illustrated with the same cut, but with the cut modified in its second appearance. The earlier version showed a reel-and-fly delivery similar to that patented by Hoe for use on cylinder presses; the fly was missing from the later version, perhaps after a word with R. Hoe & Co. attorneys.

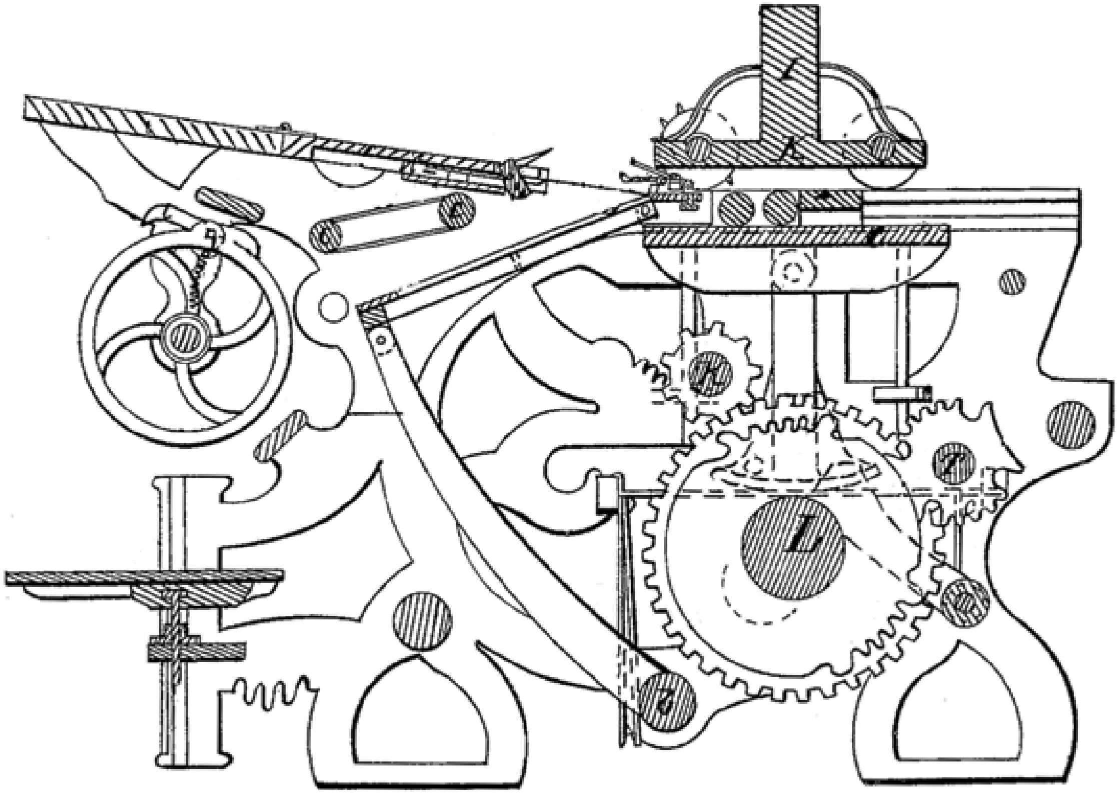


34. The Ruggles platen power press, depicted without the fly delivery shown in an earlier version of this cut. The ornate aspect of the press belied its inelegant mechanism. Courtesy Bill Elligett.

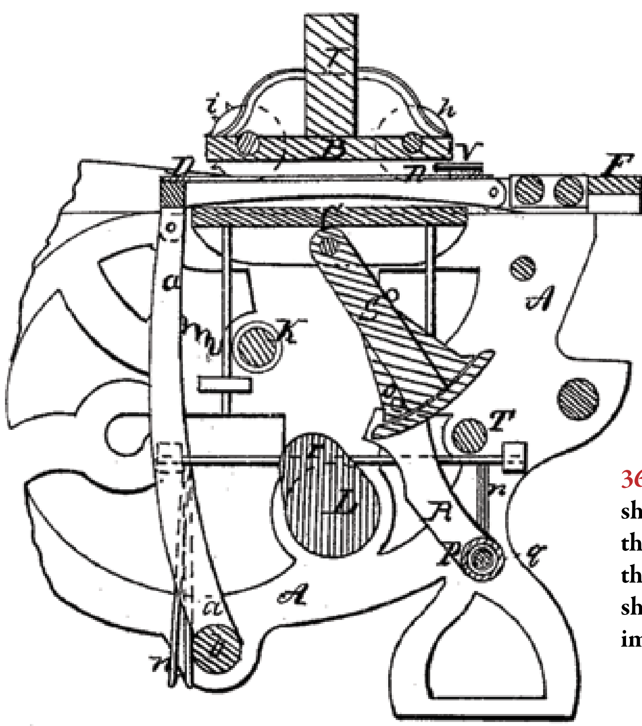
It seems that at least one example of this press was constructed, hardly a reason for its inclusion in this study if it weren't for the machine's appearance and the publicity generated. One wonders about the reasons for introducing a press that offered no advantages over the Adams except smaller footprint and perhaps price (for which no figures have emerged) while, *sans* fly, it required two operatives.

The Ruggles was another attempt, less skillful than Hoe's, to circumvent the Adams patents. Like the Adams, it employed a rising type-bed and roll-away platen, with rear delivery under the pointing board and fountain on the front of the frame. The reciprocating carriage with frisket and form rollers followed Adams practice, with different actuation and a tilt downward at the outer end of its stroke to make the press more compact and to assist sheet delivery. Points tilted forward to release the sheet when the sheet was taken by the grippers. The carriage was moved by connecting rods from an intermittently rotating gear with a variation of the *Geneva lock* familiar to horologists and Linotype machinists. To avoid the use of toggles, Morse devised a camshaft set across the lower frame, the two cams of which engaged swinging legs hanging from the bed. The legs' arc and time of swing were mechanically controlled, and could be interrupted to suspend the impression. Their action replicated that of a pair of unequal-limb toggles.

Stephen P. Ruggles's fascinating career as a pressbuilder was summarized by Comparato (pp. 174-176), according to whom Ruggles in the mid-1820s projected a large platen machine but was stymied by Boston's lack of machine tools. He had a prototype built in New York in 1827, said to have been a double-feeder with toggle impression mechanism, but possibility of success was torpedoed by "vicious rivalry". By 1859 Ruggles himself was not associated with the Ruggles P.P.M. Co. nor with its platen book press project. Ruggles is now remembered for his job presses, successful pioneers in their field.



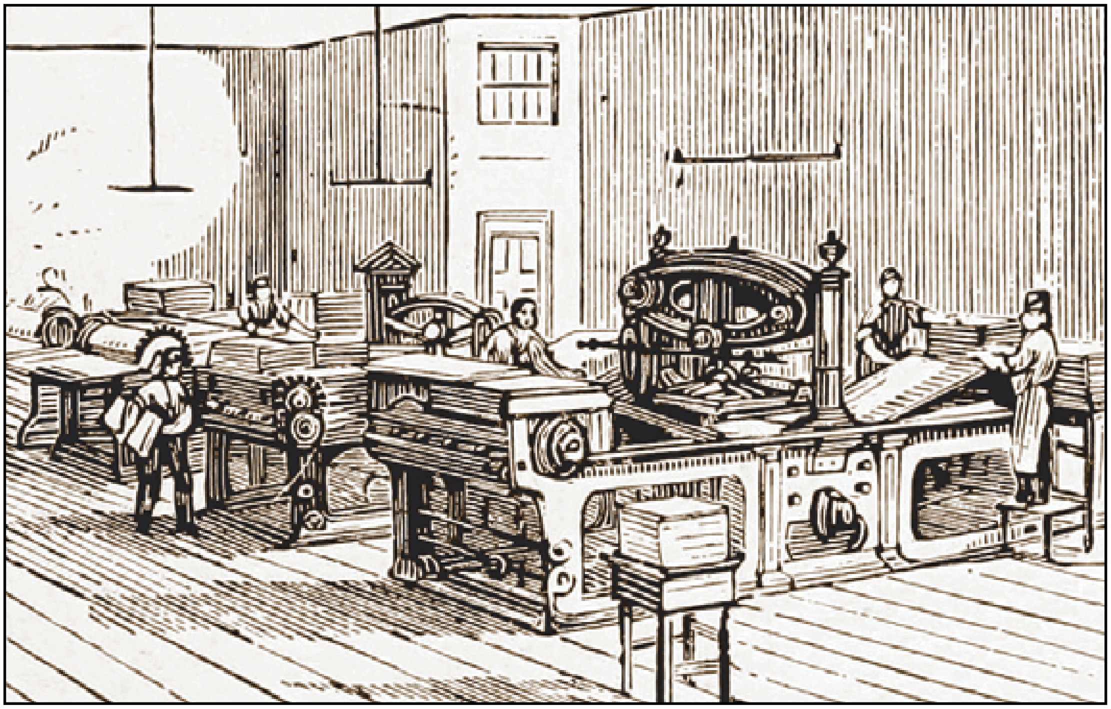
35. Section from U.S. patent 24357, showing frisket frame coming out at oblique angle, form rollers on form. The gearing incorporates a Geneva lock to provide the intermittent motion required to time the carriage. The carriage was articulated to allow the frisket section to dip without affecting the roller frame.



36. Partial section, from U.S. patent 24357, showing camshaft and cam at L and above them, the swinging arm that engaged with the cam to raise the type-bed. The arm is shown held out of engagement to suspend the impression.

BRITISH PLATENS

"Platen machines have long enjoyed the reputation of producing the finest work that can be done on a machine …" — Frederick John Farlow Wilson



37. **Double platens in the machine room at Jarrold & Sons, Norwich, 1860. The near machine has a head and double impression beams; the other has a single-piece impression beam, with the beam guides terminating in a classical pediment. Two cylinders appear in the background.** (Detail of p. 19, *The House of Jarrolds*, 1823-1923, Norwich: House of Jarrolds, 1924.)

The first practical British platen machine, according to Powell, was made in 1829 by "Mr. Andrew Spottiswoode and Mr. Brown"; Powell does not further identify Brown.[1] Hansard in 1825 said he had seen a platen machine "of new construction" in Spottiswoode's office doing good work at 600-700 iph.[2] In 1841 Hansard wrote, *A machine-press has long been at work in Mr. Spottiswoode's office, in which the impression is given by a self-acting platen, tables, rollers, friskets, and tympans. It does beautiful work, at the rate of 600 or 700 impressions per hour.*[3] An encyclopaedia article originally written in 1842 said the double platen was the invention of *a gentleman in London, whose machines have been working for some years in Mr. Spottiswoode's printing office*. It described their *upright frame and printing platen, resembling the common handpress, with a type carriage at each side. The carriages go below the platen alternately …* and noted that J. Brown, engineers, of Kirkcaldy had taken up their manufacture following expiry of the gentleman's patent.[4]

R. J. Courtney, former superintendent at Spottiswoode & Co.'s printing office, wrote in 1867: *The first successful application of steam … to printing presses with a platen and vertical pressure, was made in the establishment where this Dictionary is printed [Spottiswoode's]. Convinced of the superiority of the impression made by flat as compared with that of cylindrical* *pressure, the late Mr. Andrew Spottiswoode, assisted by his chief engineer, Mr. Brown, succeeded, after many experiments, in perfecting a machine which combines the excellence of work of the hand press with four times its speed, and with a uniformity of colour which can never be attained by inking by hand. The main point of the invention is the endless screw or drum which takes the carriage and type from each end under the platen, and after the impression is taken by means of a crank returns it to its original position. The frisket is attached to the tympan at the bottom near the tympan joints, so that when the tympan is lifted from the form by the machinery, the tympan and frisket open at the upper end, contrary to the usual way in presses worked by manual labor, and the printed sheet is left on the tympan resting on the frisket. These presses are called double platens; but they ought, in honour of their inventor, to be named Spottiswoode presses.*[5]

Jackson Gaskill offered some general background in his 1877 manual: *In the earlier days of printing machine invention and improvement, calico tympans with a thick blanket between them were used; the impressions were consequently not sharp, and the work had a thick and dirty appearance. The hand-press was resorted to whenever first class work was required. These were the pressmen's golden days; but machine managers became more enlightened, and soon found that by substituting parchment for calico tympans, and sheets of paper for blankets, and by regulating the number, size, and weight of the rollers, work could be produced equal in quality to the very best press-work at a wonderfully accelerated speed.*

Deficiencies of the cylinder

The disadvantages of the cylinder machine, including type wear and slurring, were set forth in a mid-century encyclopaedia article, which then continued: *... a more important defect is the time required to prepare a sheet of types, or forms, for the [cylinder] machine. A sheet, such as the present [referring to a typical form of* Chambers's Information for the People*] seldom requires less than four hours to make ready, and a sheet of stereotype plates two hours longer. The pressure of the cylinders is so searching, that the smallest defect in the levelness of the forms or of the blanket and printing surface is observable, and must be remedied by putting patches beneath the outer blanket. So much time is thus consumed in preparing a sheet for the cylinder machine, that it would be a positive loss to print anything at it, unless a very considerable number of copies were wanted. ... These deficiencies of the cylinder have led to numerous and expensive attempts to apply steam power to machines with flat printing surfaces. The most successful of the attempts has been one by an American and another by a gentleman in London, whose machines have been working for some years in Mr. Spottiswoode's printing office. The latter is by far the best, and is now coming into general use.*[6]

Advantages of the platen

The register of a cylinder machine was dependent upon a number of parts of the mechanism, but in the case of the platen only looseness in the pins of the knuckle joints attaching the tympan/frisket assembly to the carriage could seriously affect the mechanical register, since the sheets were fed to gauges or points on the frisket. The double platen offered the facilities of two machines with lower first cost and greater economy of space. Not actually misnamed, it was a double machine with one platen acting alternately upon each of two type-bed assemblies, or *ends*. Each *end* was treated as a separate machine. In full operation, a double platen required the services of two layers-on, two takers-off, and a minder. With time, output was increased to a maximum of about 1600 iph running both *ends*.

Known makers included John Brooks of London; James Brown of Kirkcaldy; Thomas Long of Edinburgh; and Charles Rich, Hopkinson & Cope, and Napier (all of London). The machines of Brown, Hopkinson & Cope, and Napier are treated more fully in the pages following; at present little is known of the others. Gaskill headed a section of his 1877 handbook, "Hopkinson & Cope's & Long's Double Platens", but described and illustrated only the H&C machine, suggesting that Long's was not very different. At least one writer has dated the introduction of Hopkinson & Cope's double platen to 1830; evidence for this early date remains obscure.[7]

Oxford, Cambridge

The first platen at Oxford University Press was a Rich double, in place by March 1835, according to historian Simon Eliot, who speculated that two were purchased, Rich receiving £705. A January 1837 inventory listed four Rich machines. The Press's Bible Side Accounts of 1845-6 recorded seventeen platen machines. In 1864-6 five were purchased; by 1884 seven more had been added. A list thought to have been made in the late 1870s recorded four Napier, ten Brown and twelve Rich platens. Between 1886 and 1887 five more platens were acquired, and another was added in 1896-7; these included machines by Hopkinson & Cope and J.M. Napier.

OUP records showed that, on long runs, the weekly cost of a Rich machine totalled £5s10, a "Scotch" (Brown) machine £6 and a Napier £8s10. Platen minders were paid eighteen shillings a week in 1881; cylinder minders twenty-four. "Under the most favourable conditions" the production of a double was fifty-four reams per week. The Press traditionally ran bibles and other sacred texts on platens, although those machines were not restricted to such work. A film made in 1925 shows a large Brown running on the *New English Dictionary*.[8]

The first two platens used at the Cambridge University Press were installed in 1843; four more were added in 1845, according to historian David McKitterick.[9] An inventory of 1868 recorded seven Napiers, two Browns, two Hopkinson & Copes, one Long and one Brooks.[10] McKitterick noted the retirement of a Long in 1886.[11] He was perhaps misled in writing, *The most popular and reliable machine press available was the Napier double-feeder, which by the time that the Syndics came to consider the matter [1836-7] had been in use in the trade for seven or eight years; a number had been installed at Oxford in about 1837.*[12]

At both OUP and CUP the machine roster was mixed, the number of cylinders, both perfecting and single-sided, growing steadily as the 19th century waned. In 1894, the OUP was running "about fifty machines", including twenty-four Wharfedales and "a few" perfectors, the balance being double platens.[13] Commercial shops, too, gradually abandoned their platens as cylinder machines and their supporting technologies evolved. No platen machine is known to exist.[14]

Single platens

Carl Augustus Holm, of Sweden, devised a single platen, the Scandinavian. It was introduced into Britain in 1841 and manufactured in both Britain and Germany. In London, David Napier had designed a platen with some Scandinavian-like features in 1837. Although his patent mentioned double-feeding, the firm's landmark double platens were developed at mid-century by his son, James Murdoch Napier.

Little Jamie Fraser

Recalling the first machine acquired by Arthur King & Co., Aberdeen, a former apprentice wrote, *Steam was introduced in the last quarter of 1863 ... The first machine ... was a massive quad-crown [double] platen. ...[it] proved a terror to us all, for most of us were called upon to have a shot at feeding her, which we essayed to do at the imminent risk of having our hands nipped off by the sharp and sudden fall of the heavy iron-framed tympan as it was drawn under the great platen. Little Jamie Fraser alone succeeded in mastering the task. To see how deftly Jamie could not only feed the first side to 'gauges,' but lay on the second side to 'points,' and dextrously get clear to hand down the tympan in rhythmic time, was the admiration of all onlookers. But Fraser could only operate one of the two 'feeds,' and the efforts of all who tried to emulate him on the other side of the platen only resulted in spoiling good paper, until there came a man whom the makers had selected for the job. For practical purposes, however, that big platen was a white elephant.* Fortunately for the boys, subsequent machines installed at King's were cylinders.[15]

NOTES

1. Powell (1877), p. 46.

2. Hansard (1825), p. 709.

3. Hansard (1841), p. 162.

4. Chambers (1857), p. 720. The patent referred to remains elusive.

5. Brande (1867), p. 91. The sheet is actually left on the frisket when the *end* comes out. The taker-off lifts the tympan quickly, the momentary suction thus created helping to lift the printed sheet from the frisket.

6. Chambers (1857), p. 720.

7. Moran (1973), p. 119.

8. Information in this and the preceding paragraph was drawn largely from Eliot (2013), pp. 115-172, and personal examination at the Press (thanks to Dr. Martin Maw, Archivist) of documents referenced on those pages, especially OUP/PR/13-A/2/10, 12, 22, 36, 41, 42, 44, 46, 48, 168; OUP/PR/1/5/3/i/97, 122, 144, 154; OUP/PR/1/5/3/ii/7, 8, 23, 37, 159. From OUP/PR/10/19/1-2, Eliot notes that of five Rich platens listed in that 1847 inventory, one was made by Keir and two each by Swan and Rich, drawing attention to the evolution of handpress builders into machine makers. The film, *The Oxford University Press and the Making of a Book*, was made in 1925 for the Federation of British Industry (https://www.youtube.com/watch?v=sW7wsXuw2cI).

9. McKitterick (1998), p. 334.

10. Ibid. p. 476.

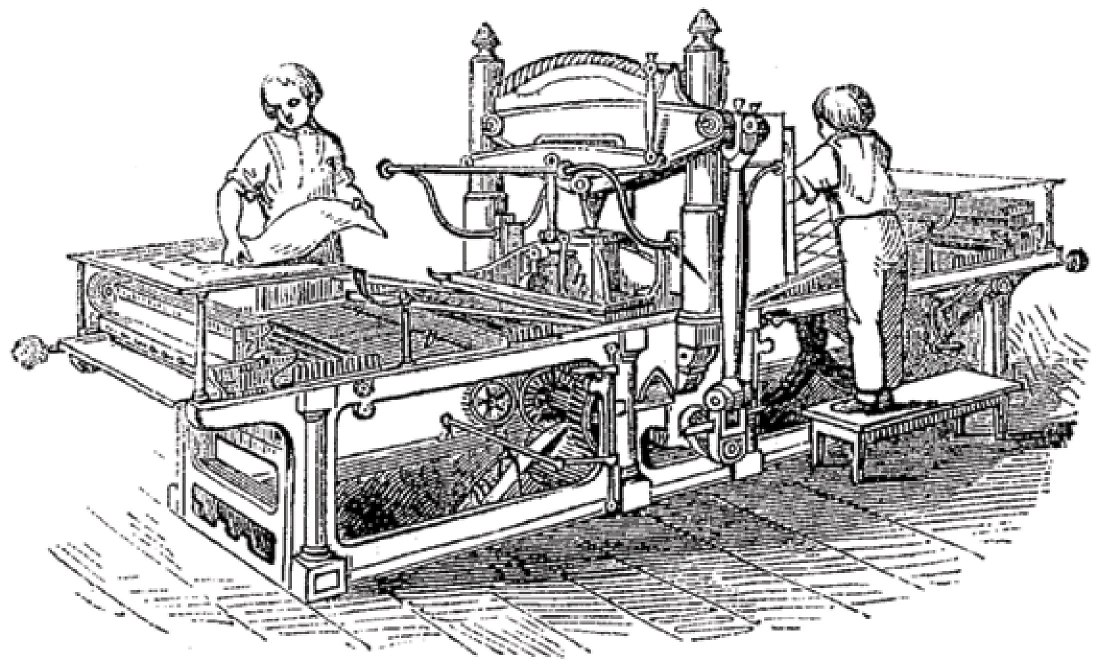
11. McKitterick (2004), p. 117.

12. McKitterick (1998), p. 333. The Napier double platen dates from 1853; its price and complexity ensured its employment only when its advantages were requisite; rather than "the most popular", it was the most capable. The 1837 Napier platen was probably not a double-feeder (*v*. p. 98). Oxford's 1837 double platens were by Rich, as noted above.

13. Oxford (1894), p. 8.

14. Of the 120 boys who served OUP's machines in 1865, Eliot (2013, p. 54) wrote, ... *the boys were on the premises from 6 a.m. to 6 p.m. on weekdays, and until 1 p.m. on Saturdays, working on average for 59 hours a week in the unchanging task of laying on and taking off paper for the machines.* That this was no sinecure may be seen from the film mentioned in n. 8 above. While laying to gauges may have been relatively easy, accurate pointing, and taking-off without tearing the point holes or otherwise marring the sheet, could not have been so simple.

15. From pp. 16, 17, of William Skea's *Memories of a Seven Years' Apprenticeship of Half a Century Ago*, a booklet privately printed for the author in 1920, held online at Internet Archive.



38. **Double platen by James Brown of Kirkcaldy, shown with but two of its four operatives for clarity. The upright columns are united by a handpress-like head. The overhead impression beam was actually a sandwich of two cast plates, one on each side of the head, pinned together at their fulcra on the offside of the head and at the nearside operating end by a rotatable spacer to which the connecting rod was pinned. The impression beams were cast with a triangular opening, presumably to save weight. The force exerted by the impression crank was somewhat more than doubled at the platen's impression cup.**

Flats on the sides of the nearside column guided the impression beams in the vertical plane. The platen was pressed down by a triangular *center bolt* pinned through the beams at their lower centers, and working against a hardened cup on the platen center. The platen was lifted by a pair of auxiliary beams, rotatably pinned at the offside of the head and lifted by links to the impression beams. Each auxiliary beam was linked to the platen in two places, providing four-point platen suspension. Slack in the platen lifting linkage allowed the center bolt to remain clear of the impression cup until the moment of impression. Between the lower legs of the visible platen lifting link is seen the head of the impression adjustment bolt.

Light horizontal rods with pulleys supported the tympans when thrown up; their curvy brackets lead the viewer's eye to the platen guides on platen and columns. The type-beds with their tympan-frisket assemblies (*ends*) were reciprocated by a skeletonized worm drum; it appears in front of the right-hand boy's legs. Ink fountains at each end fed three form rollers on each side of the platen via ink tables bolted to the type-bed assemblies; wavers smoothed the ink film.

At each end a spherical weight kept the ductor linkage in operating position; the ductor motion was disengaged when the striker was moved to disengage the *end*. The far end's striker is visible to the right of the boy's knee. The fountain rolls were driven by bands. On the shaft in the pit below the center of the machine is seen the bevel gear driving the worm drum, the drive belt running from tight-and-loose pulleys on the power shaft down into the pit, the belt shifting fork and its connected striker. The friskets ran up the light slanting rails affixed to the machine frame. The bed-motion worm drum is seen within the press frame at right. In the cut, the left *end* is under the platen, about to receive its impression; the right *end* is out for exchanging sheets. The potential for accident with such machines needs little comment. From Chambers (1857), p. 720. A nicely-finished Brown double at work on the *New English Dictionary* may be seen at www.youtube.com/watch?v=sW7wsXuw2cI.

The following description of a Brown double, as illustrated in 38, is from an 1857 encyclopaedia article, itself a near-verbatim copy of one written in 1842. *The best kind of flat-surface machine was the contrivance of a gentleman in London, and is now in general use in this country. It consists of an upright frame and printing-platen, resembling the common handpress, with a type-carriage at each side. The type-carriages go below the platen alternately; so that, in point of fact, the apparatus is two presses with one printing-surface to serve both. The movements to and fro of the type carriages, and the pull downwards of the platen, are effected by machinery beneath. The forms are also inked by an apparatus for the purpose. This machine requires a layer-on and taker-off of sheets at each end, besides a superintendent, and works about 700 sides per hour, ... Since the expiry of the patent, machines of this kind have been made by J. Brown & Co., engineers, Kirkcaldy. The machine is very beautiful and effective, answering every purpose of book-work in ordinary demand. ... The principal advance [in printing machine development] has been since the year 1832, when the printing of cheap literary sheets rose into importance, and by a fortunate coincidence, the patents of various machines having about the same time expired, a new impulse was given to the trade. ... The making of printing-machines has in itself become a great business.* [1]

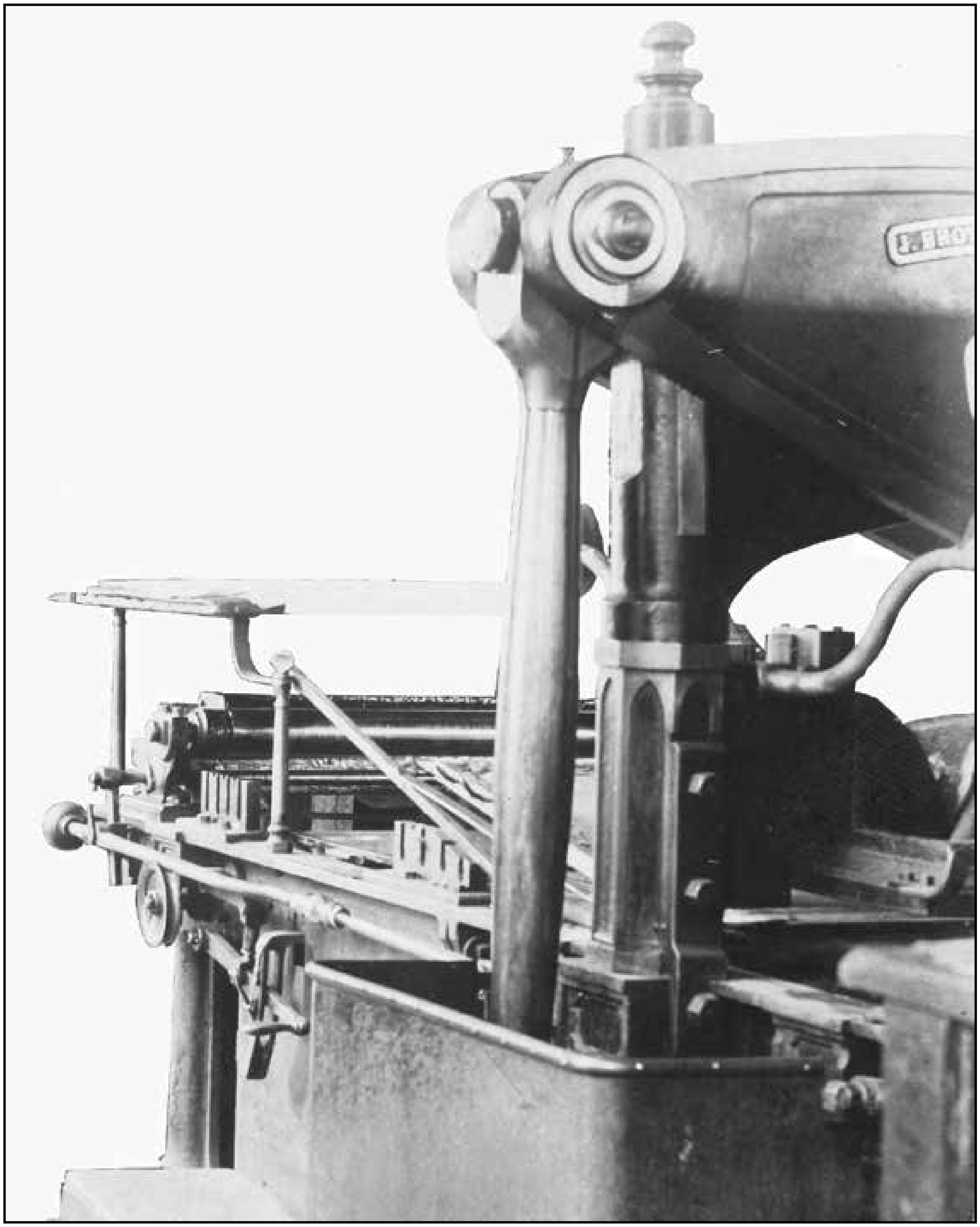
By mid-century, when the machine depicted in 39 was made, double platens were generally capable of up to 1600 iph, running both *ends*. Oxford University Press paid £293 for new Browns in 1867 and 1871 (both 37x26), but the heyday of the platen was dimming by 1874, when Sir Isaac Pitman paid £100 for a second hand double-crown (30x20) Brown.[2] The basic construction of the Brown double platen was much like that of Hopkinson & Cope's machine; construction details common to these "ordinary" platens are clarified in the section on Hopkinson & Cope, following.

NOTES

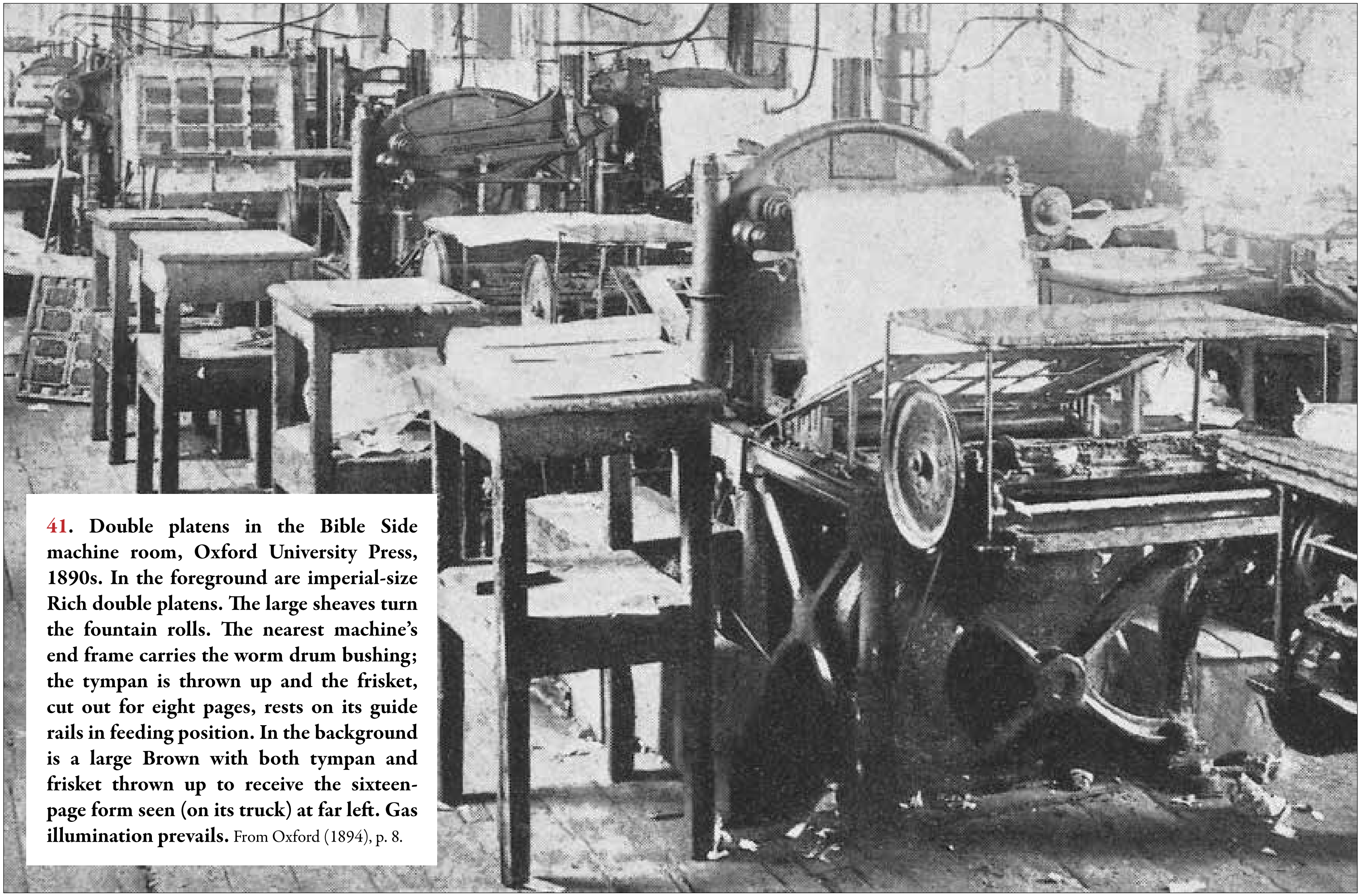
1. Chambers (1857), p. 720. At this time the Chambers's printing was done in a plant comprising three Brown double platens and seven "large-cylinder" perfecting machines, but the 1867 edition noted a change in the mix to eleven cylinders and two double platens, and asserted that 40 to 50 tons of impression were required for a large form on a platen machine.

2. Oxford University Press Archive OUP/PR/1/5/3/1, p. 97; *The Phonetic Journal*, Nov. 3, 1877, p. 520.

39. With his left hand still upon the just-raised tympan, the taker-off flies a printed sheet as the layer-on slips a fresh one onto the frisket. The far end's layer-on is glimpsed upper right. The boys stand on slightly elevated platforms. Browns at Oxford University Press ranged in size from 36x26.25 to 40x28.5. The one pictured was said to be seventy years old when filmed in 1925. The impression beams of the larger Browns were cast without the triangular opening seen in 38 and 41. 39 is a screen shot from the silent film *Oxford University Press and the Making of a Book*, 1925, Federation of British Industry. Courtesy Oxford University Press Archive.



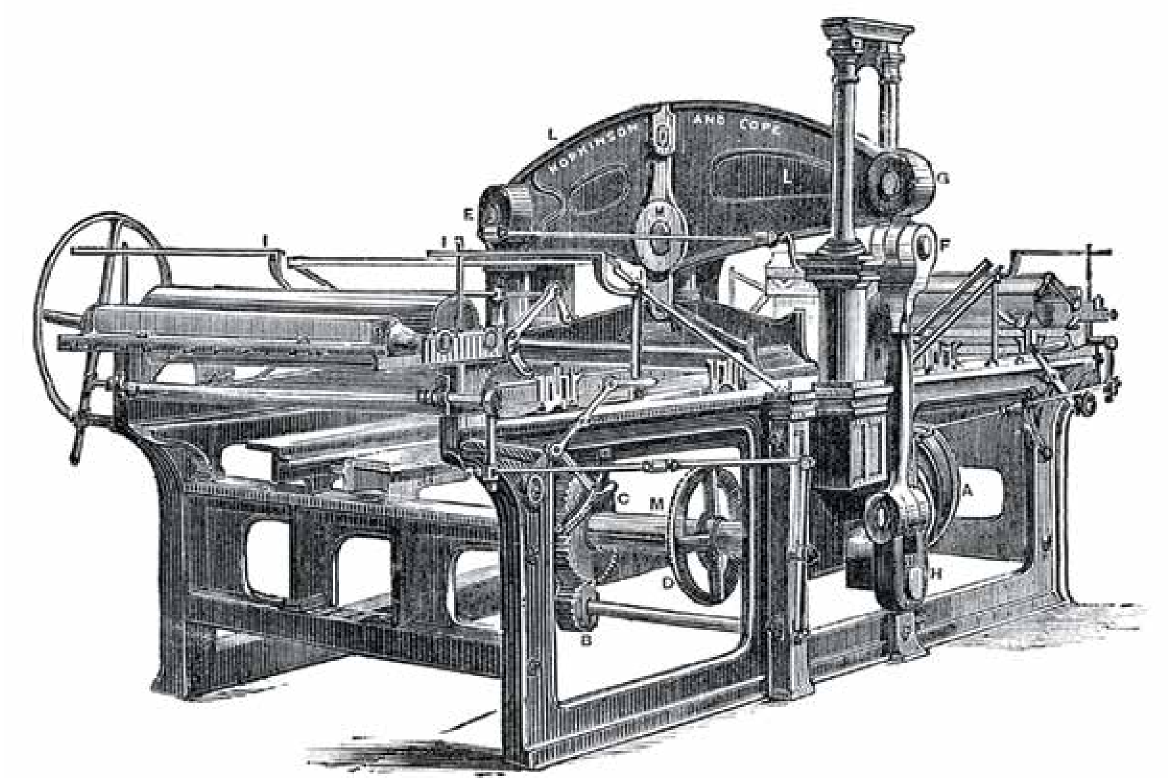
40. Large Brown at Oxford University Press, operating side, with the *ends* stopped in mid-stroke, showing fountain, waver forks, and inker forks (rollers removed). Tympan and frisket are partly under the platen, with their upper corners on the slide rails. The sheave on the striker handle lifts the weighted ductor motion rod out of engagement with the ductor operating lever, stopping the ink feed, when the handle is depressed to disengage the *end*. A latch on the striker handle holds it in the disengaged position; pushing in the latch causes the table bolt to drop into the slider mortice, engaging the *end*. The striker shaft itself terminates in a short arm above and adjustably linked to the handle. The sheet-iron guard over the impression crank was made at the Press smithy. Beams and platen are in about their uppermost position; one of the planed beam guides is visible on the columnar section of the head casting. Platen-lifting linkage of the beam type is not seen here, perhaps supplanted by a simpler arrangement. Detail of photo "East Machine Room" (on reverse). Courtesy Oxford University Press Archive.



41. Double platens in the Bible Side machine room, Oxford University Press, 1890s. In the foreground are imperial-size Rich double platens. The large sheaves turn the fountain rolls. The nearest machine's end frame carries the worm drum bushing; the tympan is thrown up and the frisket, cut out for eight pages, rests on its guide rails in feeding position. In the background is a large Brown with both tympan and frisket thrown up to receive the sixteen-page form seen (on its truck) at far left. Gas illumination prevails. From Oxford (1894), p. 8.

HOPKINSON & COPE c. 1850[1]

These Machines produce the Finest Description of Book-work, and are in use in most of the large offices; the accuracy and solidity of their manufacture prevents those breakages which are so frequent with flat-surface machines.—Harrild (1860), p. 10.



42. **Hopkinson & Cope's double platen, with feedboards removed, tympans and friskets uncovered, and rollers removed. The near *end* is in, the far *end* is out, and the platen is down, as though taking an impression. Beneath the near ink fountain and distributing drum, can be seen the bed tracks and, inside them, the tracks for the bed motion slider. The large transverse shaft is the main shaft; geared to it is the lighter power shaft. The striker handles are seen on the nearside. A: Worm drum for bed motion. B: Drive pinion, engaged with C: Driven gear on mainshaft. D: Bevel gear driving worm drum. E: Pin at fulcrum end of impression beam. F: Connecting rod. G: Pin at nearside end of impression beam. H: Impression crank. I: Feedboard brackets. J: Frisket slides. K: Striker handles. L: Impression beam. M: Platen-lifting links. Another M marks the main shaft.** From Wilson (1879), p. 46.

Hopkinson & Cope, Finsbury, London, brought their double platen to market in time to exhibit one at the 1851 Crystal Palace exhibition. The machine differed from Brown's in having a single-piece impression beam which obviated the handpress-like head of the Kirkcaldy machines. At some time before 1860 the platen-lifting linkage was simplified into the form seen in 42, and the outboard mainshaft bearing, seen in the earlier renderings reproduced on pages 77-83, vanished.

According to Wilson, these machines were generally built in double-demy, sometimes double-royal, seldom as small as double-crown.[2] Harrild's in 1860 listed a price of £390 for the double-demy (35x22½ platen). An additional £35 was asked if both ends were to have the

Continued on page 84

KEY TO PLATES 43-48

PAGES 77-82

The plates following illustrate a Hopkinson & Cope double platen installed in a German office in 1854 to print bibles. The machine depicted is identical to that exhibited at the Crystal Palace exhbition of 1851, as shown in Dempsey (1852). They were fitted with outboard mainshaft bearing and the early-style platen-lifting linkage. The drawings show the machine with its bed-motion in mid-stroke and platen at its highest point. Drawing 48 clarifies the mechanism by which the *ends* are engaged or disengaged from the bed-motion, the lever 48 coming within reach of the striker 18 when the *end* was fully out (to the left). Moving the striker handle caused the striker to raise the lifting lever and, with it, the table bolt, freeing the *end* from the slider. From *Verhandlungen des Vereins zur Beforderung des Gewerbefleisses in Preussen*, Berlin, 1855, tables III-V.

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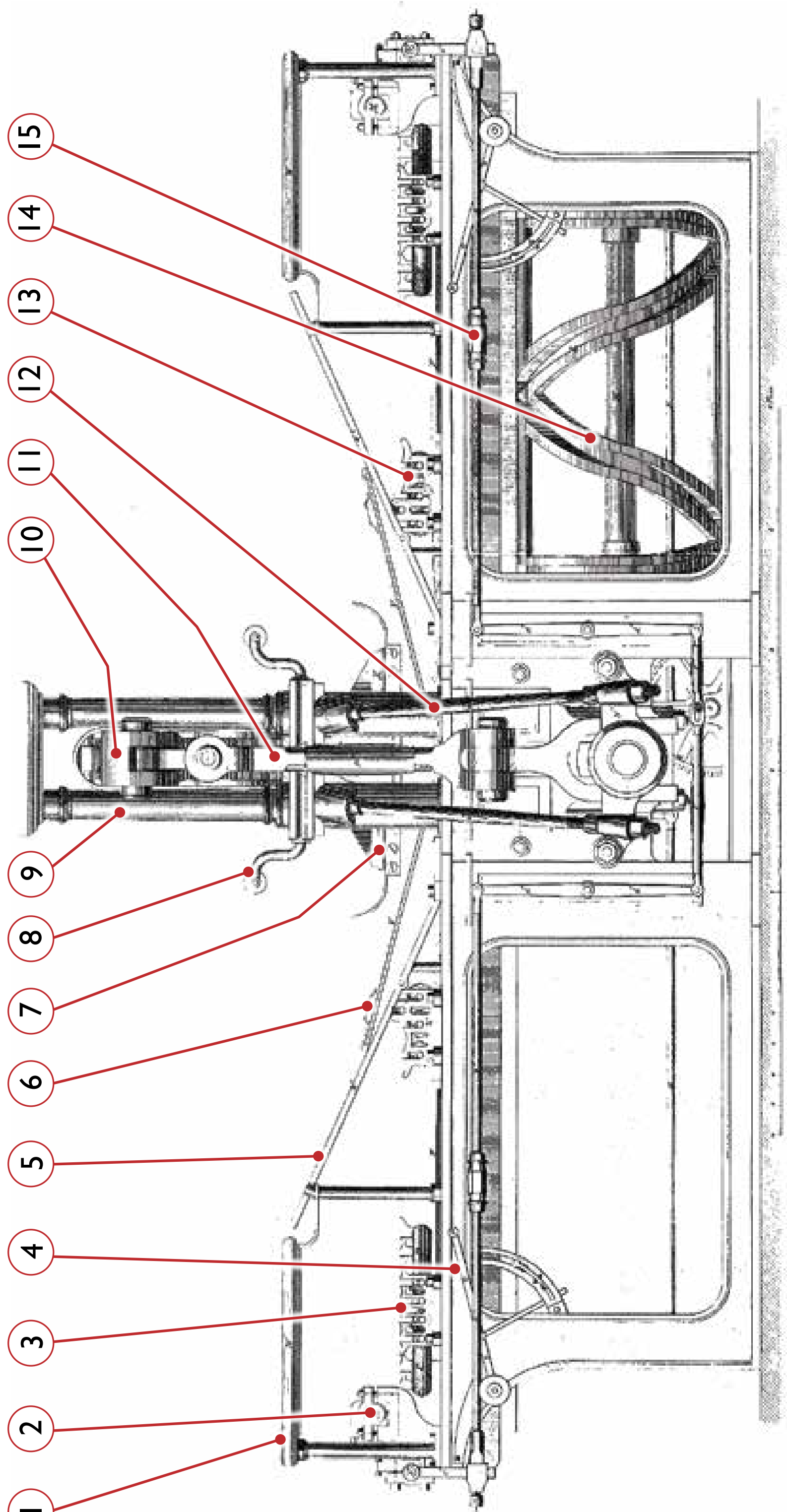
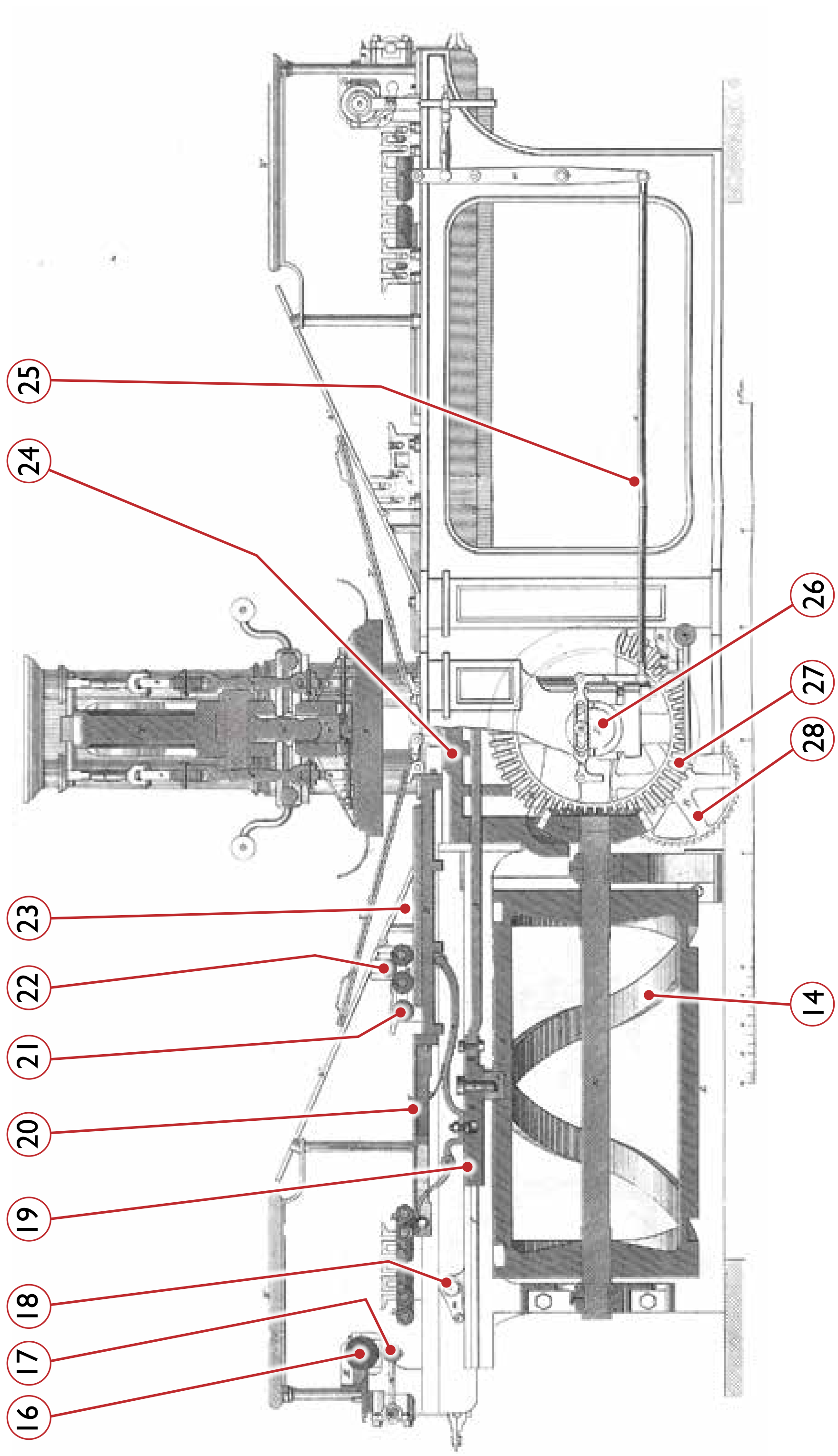
1. Feed table
2. Fountain
3. Distributors, Wavers
4. Striker handle
5. Frisket slide
6. Frisket/tympan assembly
7. Platen
8. Tympan rest
9. Beam guide
10. Impression beam
11. Connecting rod
12. Outboard bearing stay
13. From rollers, Inkers
14. Worm drum
15. Ductor motion rod
16. Fountain roll
17. Ductor
18. Striker
19. Slider
20. Ink plate, Ink table
21. Form roller, Inker
22. Rider
23. Type-bed with form
24. Impression-bed
25. Fountain roll motion rod
26. Mainshaft
27. Bevel wheel driving worm drum
28. Gear driving ductor motion
29. Platen lifting beam
30. Platen lifting linkage
31. Power shaft
32. Slider ways
33. Striker shaft
34. Type-bed track
35. Outboard bearing
36. Ductor motion shaft
37. Platen guides
38. Center bolt
39. Impression cup
40. Impression adjustment wedges
41. Platen guide adjusting bolts
42. Slider rod
43. Impression crank
44. Impression adjustment screw
45. Fountain roll motion pin
46. Tympan/frisket knuckle joints
47. Platen lifting bracket
48. Table bolt lifting lever
49. Table bolt
50. Table bolt spring
51. Table bolt arm
52. Slider traveler, Feather



43.



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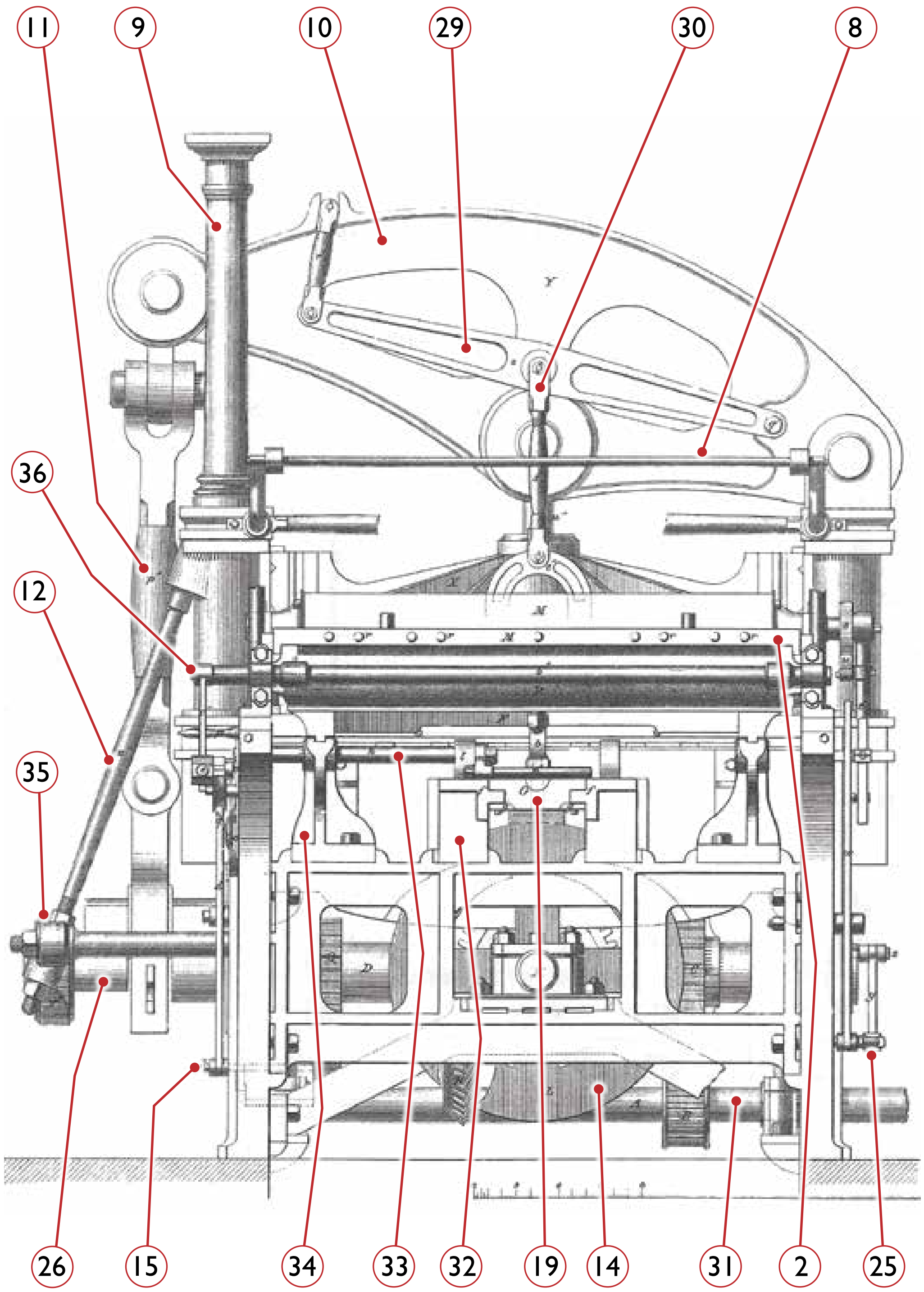

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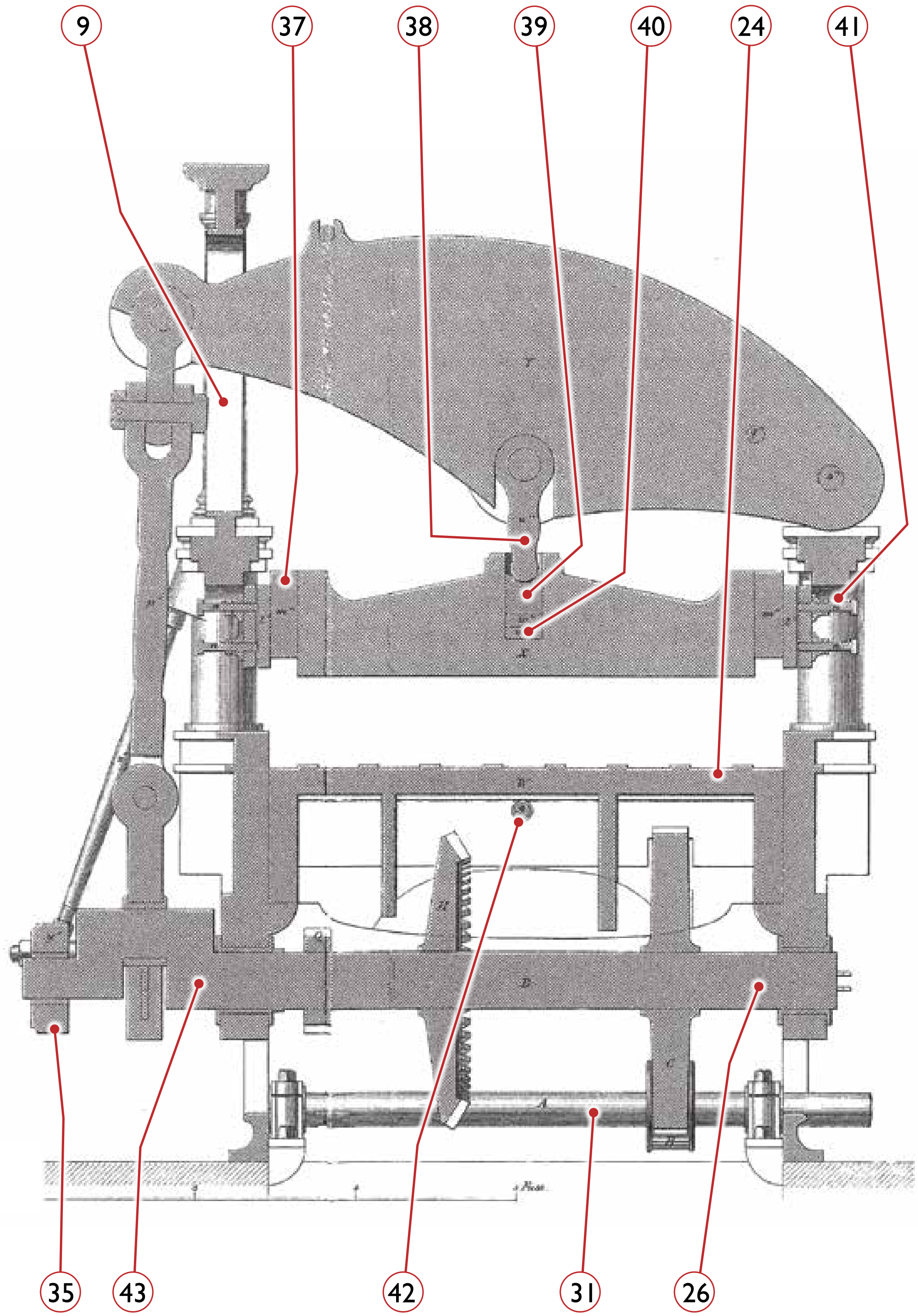

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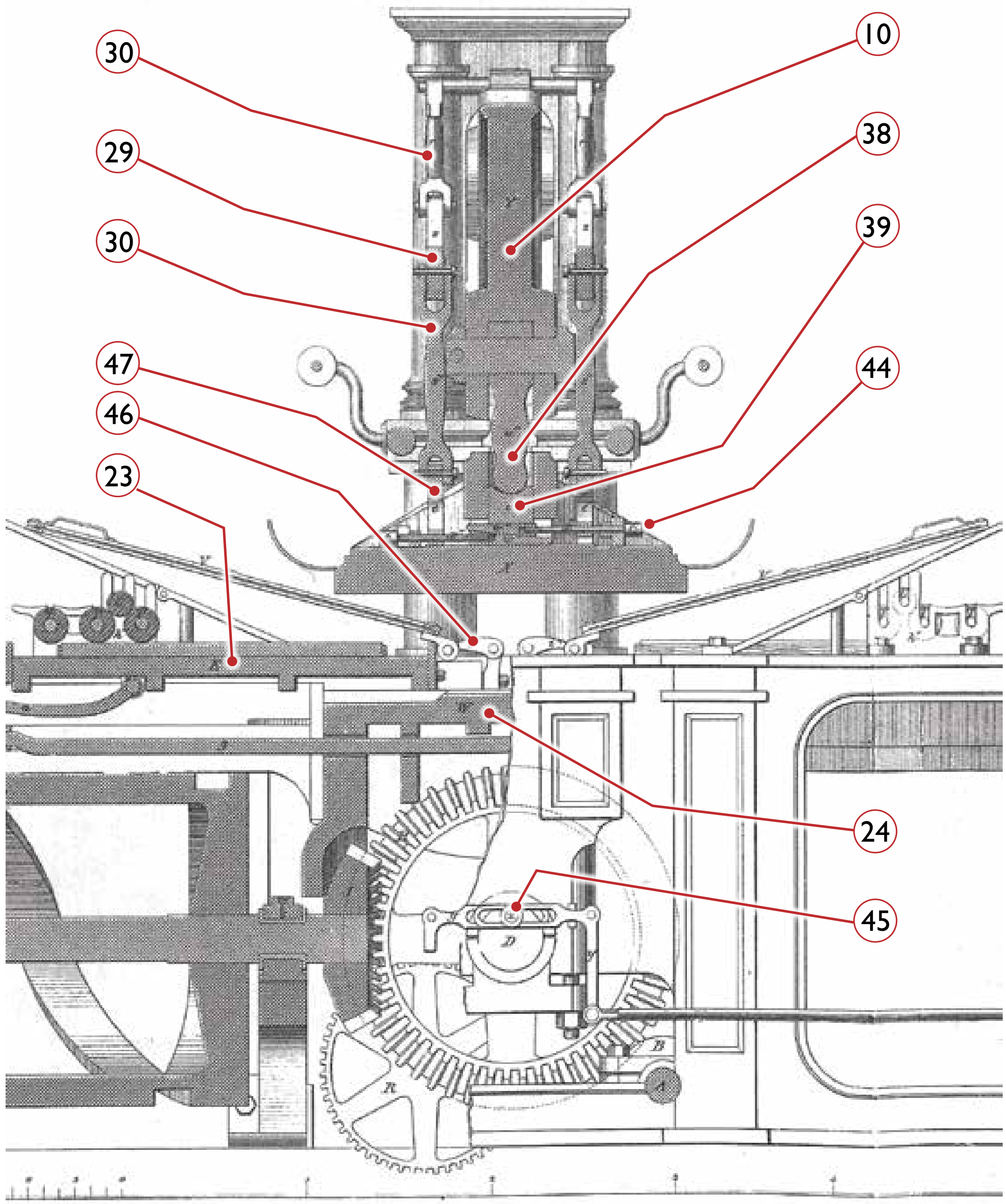

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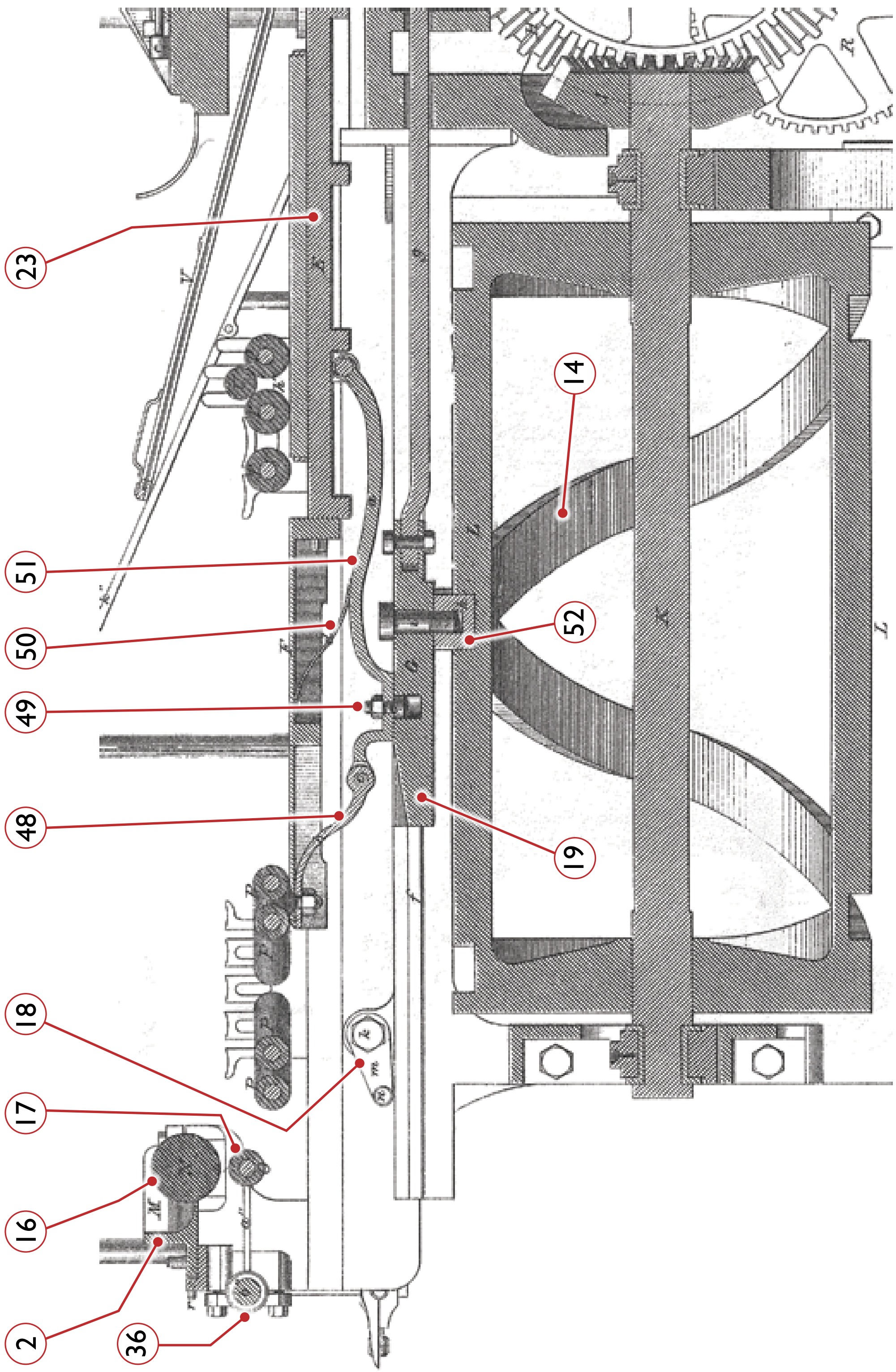

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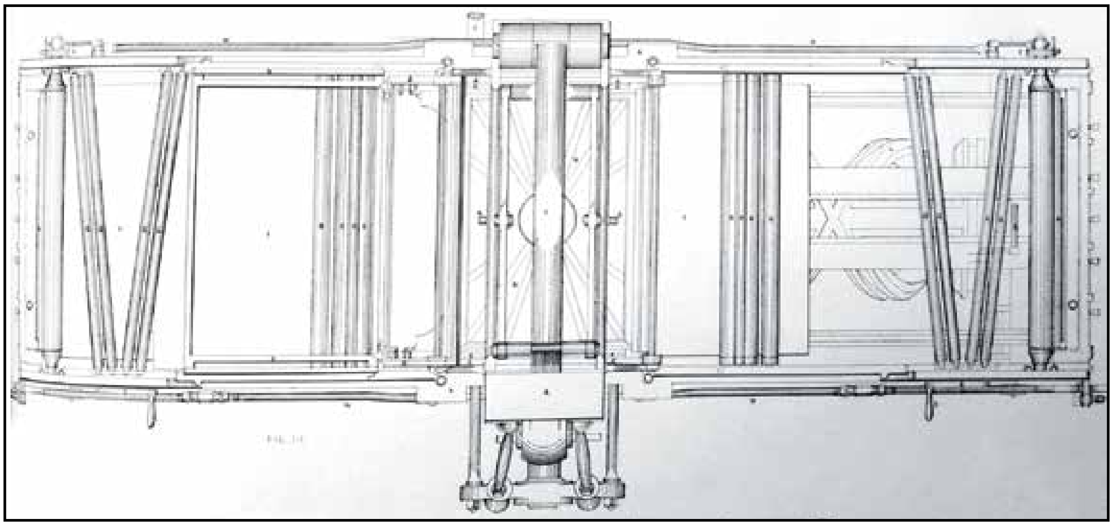
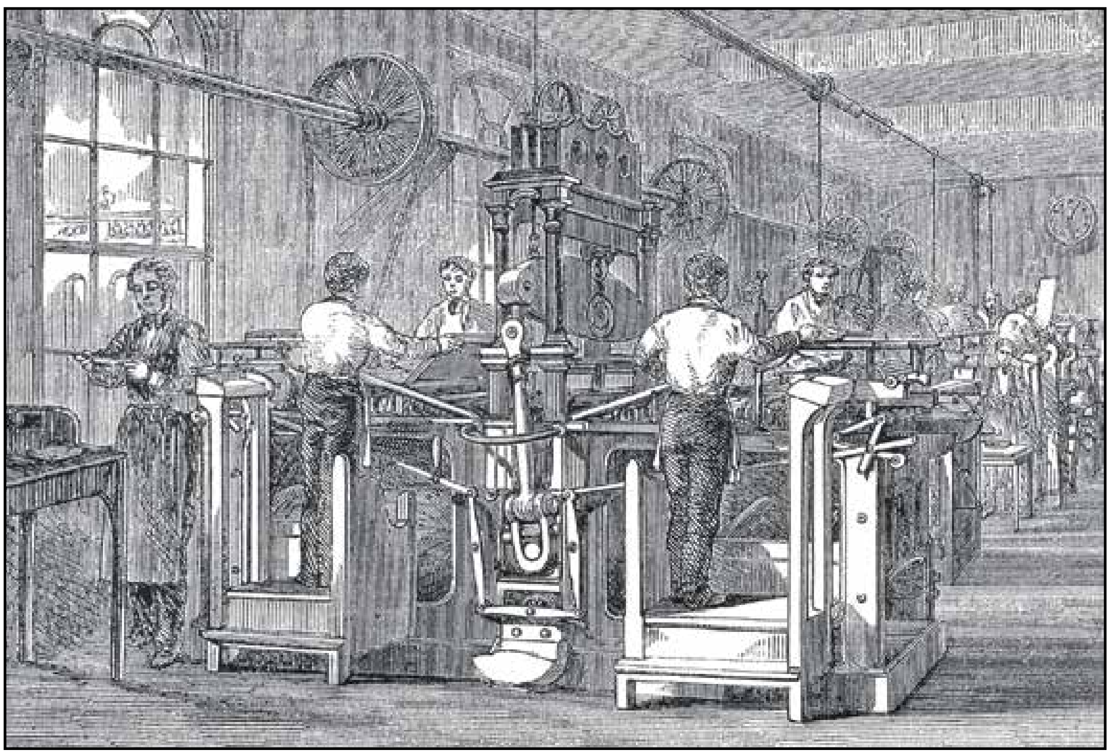


49. Top view, nearside at bottom, with left *end* out, right *end* in. Platen lifting beams are seen on each side of the main beam; the worm drum is shaded in below the bed tracks at right. The position of the left *end's* type-bed *vis-à-vis* its inkers shows that two rollers would turn on a full form. The right *end's* inkers rest on their ink plate. From Dempsey (1852-56), courtesy Peter Marsh.



50. Hopkinson & Cope double at work in the Bank of England printing room. They were used for printing banknotes from electrotypes between 1851 and 1854, but were replaced in the latter year by Napier double platens. This machine is without platen lifting beams or outboard bearing, has a counter mounted over the impression beam, a neat drip pan below the impression crank and nicely arranged pulpits for the boys. Distributing drums were fitted. From Guide (1863), p. 236.

mouse-roller traveling distributor. Advertised speed was 1200-1600 iph, running both ends.[3] For comparison, Harrilds offered their 35x23 Anglo-French for £345 and double-demy Main tumbler for £150.[4] Hopkinson & Cope's 1862 advertising copy claimed "most of the large offices" as customers. Their list of celebrity clients included the Bank of England, De La Rue, Petter & Galpin, and Spottiswoode, along with fourteen other firms. Oxford University Press installed its first Hopkinson & Cope, a double demy, in the 1870s; additional units were acquired from time to time thereafter.[5]

Hopkinson & Cope's double platen exemplifies the "ordinary" double platen, so called—regardless of maker or mechanical details—to distinguish it from Napier's improved type.[6] The machine consisted of a frame about thirteen feet long with a heavily-ribbed impression-bed at its center, above which was hung the platen. Tracks ran the length of the frame; upon them reciprocated the two type-beds, each with its own ink-table, tympan and frisket. Each end of the frame had its fountain, forks for wavers and inkers, and *striker* to engage or disengage the type-bed assembly (*end*) from the bed-motion mechanism. Each *end* was handled as a separate machine.

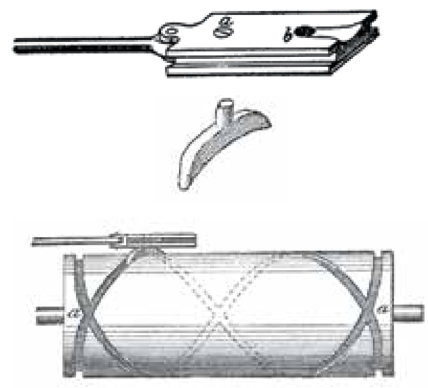
Tympans and friskets were hinged to the inner, platen-facing, sides of the type-beds. The frisket on each *end*, to which the points were attached, ran up inclined rails on the side frames as the *end* came out from beneath the platen; the tympan was thrown up against a rest to allow changing the sheets. Two boys were required for each *end*, a taker-off and a feeder. The platen was hung from a massive overhead beam, like that of the Columbian handpress, at the center of the machine. It rose and fell continuously while the machine was in operation, whether the *ends* were engaged or not.

The offside end of the beam was pinned to columns rising from the end of the impression bed; the nearside end was jointed to a heavy connecting rod working upon an overhung crankpin on the nearside end of a transverse mainshaft. The mainshaft turned in bearings beneath the impression-bed, the down-force of impression countered by the up-force of the mainshaft against the impression bed. The mainshaft derived its motion from a transverse power shaft with tight- and loose-pulleys on its offside end. A pinion on the power shaft engaged a larger gear on the mainshaft, which was also fitted with a gear engaging a short auxiliary shaft which operated the ductors. A bevel gear on the mainshaft drove the longitudinally-positioned worm-drum which controlled the bed motion.

Impression force was transmitted from beam to platen through a *centre bolt* attached to the beam, pressing upon a cup-shaped pressure-plate and adjustment-wedges on the platen. The center bolt was not attached to the platen; adjustable links on either side of the beam were attached at four points to the platen and raised it after the impression. The platen was guided by short vertical V-ways on either end sliding against adjustable guides fixed to the lower parts of the columns; the lifting links helped to keep the platen level.

Bed motion

The thirty-inch diameter worm drum rotated continuously. Filling most of the space under one end of the machine frame, it was provided with a circumferential groove around each of its ends, and two intersecting helical grooves running around it from end to end. A small *traveler* (*a*), pinned rotatably to the underside of a *slider* running on longitudinal tracks in the frame, followed the grooves, thus driving the slider to-and-fro the length of the drum,



with a pause at each end. The slider was connected to a similar slider at the other end of the machine by a long rod which passed through an opening in the central impression-bed. This second slider was without a traveler. Both sliders were mortised on their upper surfaces (*b* in the cut at right) to receive the *table bolts*. Each table bolt was actually a heavy pin at the end of a spring-loaded arm pinned to the underside of each type-bed. When an *end* was fully out, its table bolt was in contact with the striker at that end of the machine, and the layer-on could at that moment engage or disengage his *end* from the machine by moving the striker handle. Either *end* could thus be struck off—immobilized—for form changes or makeready while the other *end* continued in operation.

Numbers

The worm drum revolved one full turn while holding the slider at rest at either end, and one full turn while moving it from end to end. At 1200 iph—600 sheets per hour each end—the type-beds remained stationary for about a second and a half while one *end* was printed and the sheets were exchanged on the other. Total stroke of the slider (and thus the type-beds) was about 44 inches in the machine shown in 43-48, the motion occupying another second and a half, the platen descending every three seconds, the crankshaft turning 20 rpm, the worm drum 40 rpm, and the drive pulley about 70 rpm. In operation, the taker-off at each end lifted the tympan as quickly as possible, while the *end* was still coming out, and flew the printed sheet. The layer-on pointed the fresh sheet immediately and turned the tympan back down as the *end* began to move back under the platen.

The power shaft was positioned low in the frame, below the mainshaft to which it was geared, the tight- and loose-pulleys requiring a floor-pit. All writers recommended the use of countershafting to avoid transmitting the uneven motion of the machine to others on the shaft line. A tight drive-belt was essential. No flywheel was fitted, doubtless to prevent a jam-up from becoming a break-up.

Impression, inking

Parchment tympans and paper packing ensured a hard impression. Points were screwed to the frisket frame. Patch sheets and overlays were easily registered in the packing by simply laying them upon the points, which penetrated the parchment when the tympan was turned down, with the inner tympan removed and packing sheets thrown back. Overlays were made thin to minimize bear-off. Excessive impression was dangerous; the side frame at the point of attachment of the impression beam was most at risk. Gaskill warned, "Too much pressure will cause a 'bang' when taking the impression" and reminded operators that movement of the impression wedges affected both *ends* alike. He advised thin paper for overlays. "Oftentimes only three pieces will suffice, and these only partly on the shades that *really need bringing out*."[7]

Three form rollers were provided for each *end*; only one roller covered a full form. Riders could be placed on the inkers. At each end, four wavers could be run, and the machine could be fitted with optional, constantly-rotating distributing drums upon which mouse-rollers ran. Ink was transferred from the fountains to the distributing drums, and from them to the ink tables by ductors operated by the auxiliary shaft. The optional distributing drums were band-driven from the drive shaft. Pawls, actuated through reach-rods and rocking levers by an eccentric pin on the offside end of the mainshaft, turned the fountain rolls. Ink tables and wavers were elevated to prevent the wavers from touching the printing surface.

Styling

Hopkinson & Cope retained a kind of brand identity in this machine, its fluted columns and use of a *centre bolt* establishing a connection with the firm's well-known Albion handpress, although the center bolt served different functions on the two products. The overhead beam, often likened to that of the Columbian handpress, and the beautifully-machined connecting rod limbs, would also have reminded contemporary observers of the large marine and mill engines of the time, potent symbols of modernity and power.

The machine shown at the 1851 exhibition,[8] and one installed in 1854 at Buchdruckerei Hieronymus, Cologne, to print bibles for an English society[9] were provided with an outboard bearing to support the impression crank, which was formed as a full crank with stubshaft to serve as the outboard journal, instead of the overhung crank seen in the standard cut. This additional bearing was hung from two stout rods projecting downward and outward from the base of the columns, and countered any tendency of the crankpin to bend under impression.

In lieu of the platen-lifting links seen in the standard advertising cut, these earlier machines had small beams, pivoted at their ends upon each side of the main beam to which the platen lifting links were attached. The links were attached to the platen at four points to keep the platen level as it rose and fell. These machines were not equipped with distributing drums; the ductors placed ink directly onto the ink tables.

Operating instructions

(The following instructions have been adapted from three of the standard works, all written relatively late in the century.[10] It will be recalled that paper was dampened before printing and when dry was pressed or rolled to smooth the sheets.)

The sheet of parchment for covering the tympan should be about two inches larger than the frame all round. Paste the edges and strain round, tucking in the extemities on the underside. The smoother side of the skin should be outside. With scissors cut away those parts covering the hooks or pins that secure the inner tympan in its position. Also free the extensions on the inner tympan frame that fit into slots in the outer tympan frame. When the paste is set, sponge the whole; it will become taut as it dries. Cover the inner frame in a similar manner.

Cover the frisket frame with, preferably, cartridge paper. Attach tympan and frisket to the knuckle-joints on the outside edge of the type-bed, ensuring the pins are secured by pieces of stout copper wire. Lay about half a quire of thin sheets on the tympan, sewing them to it at the top end, then put the inner tympan on and secure it with the hooks.

The form is to be exactly centered on the type-bed, and an impression taken on the frisket, the form having been inked with a hand-roller. Throw up the tympan and frisket and cut out the impression of the pages on the frisket plus about a nonpareil all round. Strengthen the frisket by glueing, with melted composition, lengths of tape along the backs and gutters on the underside of the frisket. Small cubes of cork are glued on the tapes. They should be a nonpareil higher than the face of the printing surface and positioned so they will bear on furniture or chase. Thus the frisket is held clear of the form until the moment of impression.

The frisket is not cut out for blank pages, where type-high bearers should be placed in the form to prevent the platen cocking in its guides. Underlay the plates, if printing from stereos or electros, and put on the register points, one each on the top and bottom side of the frisket frame. Place rollers in position (roller bearers having been suitably packed) and run up ink.

Before pulling an impression of the form remove the inkers and place the overlays (already prepared) face down on their plates. Pull an impression for patching up, register the overlays to their impressions on the patch sheet, lift the inner tympan, throw back the packing sheets, place the slightly-pasted patch sheet face down on the points, which have pierced the parchment. Remove a packing sheet or two to keep tympan thickness constant, replace inner tympan and rollers, run a few waste sheets and then a good one to guide further makeready, if needed. Finally, fasten a dampened tympan sheet to the face of the tympan and allow it to dry taut.

Glue side and bottom lay marks onto the frisket, one on the nearside and two at the bottom of the frisket. The marks are made by folding pieces of thin glazeboard, about three-quarters of an inch wide, bent in concertina fashion. They are removed when perfecting, when the sheets are pointed. Paste a thin sheet on the tympan, to be replaced in case of a "miss". When perfecting, this sheet will require frequent renewal. If the printed sheet tends to crease, cut a few holes in the frisket to allow air to escape.

The platen machine is liable to accidents; the boys must be carefully selected. The tympan, with its accessories, may easily become doubled up if care is not taken in allowing it to fall immediately as the *end* begins to move toward the platen. Another cause of breakdown arises from the knuckle-joints not being securely fastened. If the wire breaks or comes out, allowing the pin to escape, the side of the tympan and frisket will slip down under the platen and a smash is sure to follow. The frisket slides, too, must be watched, as the bottom screws attaching them to the side frames can work loose. Layers-on must be instructed in the proper method of allowing the table bolt to drop into the slider—when the impression is being taken at the other end. In making ready, as little impression should be put on as possible, as there is great strain on the side-frame at the point where the beam is secured.

EXTRACTS

In Gaskill (1877), pp. 8-10, are hints to platen operators, including: ... If the forme contains a blank page, a type-high bearer should be wedged in at or near the side of such page to equalise the impression. This should be done before the overlays are cut. ... If the sheets crease or are drawn through the frisket, put a cork or piece of composition on the top corners of the frisket to break the fall of the tympan. The tympan should be allowed to fall upon the frisket very gently. ... The "centre bolt" passing through the beam, from which the whole of the impression is derived, should be especially well oiled. ... Only a certain amount of impression can be put upon the forme. Beyond that amount undue strain is put upon the machine, which, sooner or later, will show itself by a crack or breakage. ... In working a light forme one end and a heavy forme the other end, the impression is regulated by putting a less number of sheets in the tympans [of the *end* with the lighter form]. ... If the sheets jerk off the points, put glazed-board springs on the frisket, so as to secure the sheet and hold it in position. ... To prevent slurring, stick a piece of cork or a paper bearer on to one or more of the cross-bars of the frisket.

Wilson (1879), pp. 51, 52, adds: ... When it is necessary to run an end of the machine under the platen [to take a proof or start a run], care should be taken that the slide[r] is exactly under the pin [table bolt] before letting the spring [striker] down ... As the duty of starting the end devolves upon the laying-on or taking-off boy, he should be strictly enjoined to wait until the proper time before letting down the [striker handle]. ... [T]he inking on these machines is somewhat defective. Great care should therefore be taken in the regulation of the supply of ink from the duct [fountain]. Some platens are supplied with revolving ink-cylinders, with a mouse-roller ... fixed parallel with the duct. This we think a great advantage, although slightly more troublesome to the workman. In fact, we have know this motion to be discarded altogether, although the appliances have been fitted to the machine. ... It will be sometimes found that the paper will crease after a start is made. This is chiefly owing to the air getting between the sheet and the frisket, and may be remedies by the cutting of holes in the paper round the sides of the frisket, though which the air may escape.

From Wilson & Grey (1888) pp. 269, 270: There is, perhaps, even at the present time, a time-honoured prejudice with some, that the flat impression ... is necessarily superior to the cylindrical. But although we in no way wish to depreciate the capabilities of the platen machine, which prior to the present make of the Wharfedale [cylinder], was employed in almost every first-class London house for cut and superfine book-work, ... now it has been conclusively demonstrated that the single cylinder is capable, in the hands of a skilled man, of doing superior work, besides being quicker and more economical in its working.

... With regard to the driving power required, the old platen takes at least three times that of the Wharfedale. ... in the case of the latter the impression is given simply at a point [line] along the cylinder, which may be said to be a half-an-inch in width, while the whole "nip" is administered at once on the platen. This proves to be a severe strain, both upon the engine and shafting; and while counter-shafts are invariably adopted, or should be, so as to lessen the lug upon the main shafting, 4-inch driving-straps are used ... A workman may, with little effort, pull an impression by turning the fly-wheel of a Wharfedale by hand, but this is out of the question with the old platen machine.

Ibid, p. 312: In making ready, as little impression should be put on as possible, as there is a great strain always on the side-frame at the point where the beam is secured. A break may occur here, if the impression is excessive.

NOTES

1. Wilson & Grey (1888) pp. 307-313, and Wilson (1879) pp. 45-52, provide excellent descriptions and cuts, with makeready procedures. Gaskill (1877) pp. 1-10, offers a staccato version of same with some interesting additions. A large cut depicting H&C platens at work appears in Guide (1863) p. 236. The scene is the Bank of England printing room, where H&C doubles were tried, between 1851 and 1854, in producing banknotes by letterpress. The stock advertising cut appears in the first three works cited. The cut and catalog copy appear in Harrild (1860) and in H&C (1862). From *Verhandlungen des Vereins zur Beforderung des Gewerbfleisses in Preussen*, Berlin, 1855, Wilkes (2004) pp. 124-130, illustrates a machine installed in 1854 at Cologne. Similar

images appear in Dempsey (1852), depicting a machine exhibited in the 1851 Crystal Palace exhibition.

2. Wilson (1879), p. 45.

3. Harrild (1860), p. 10.

4. Ibid, p. xx, xx.

5. H&C (1862), p. 7, and n. 8, p. 70 herein.

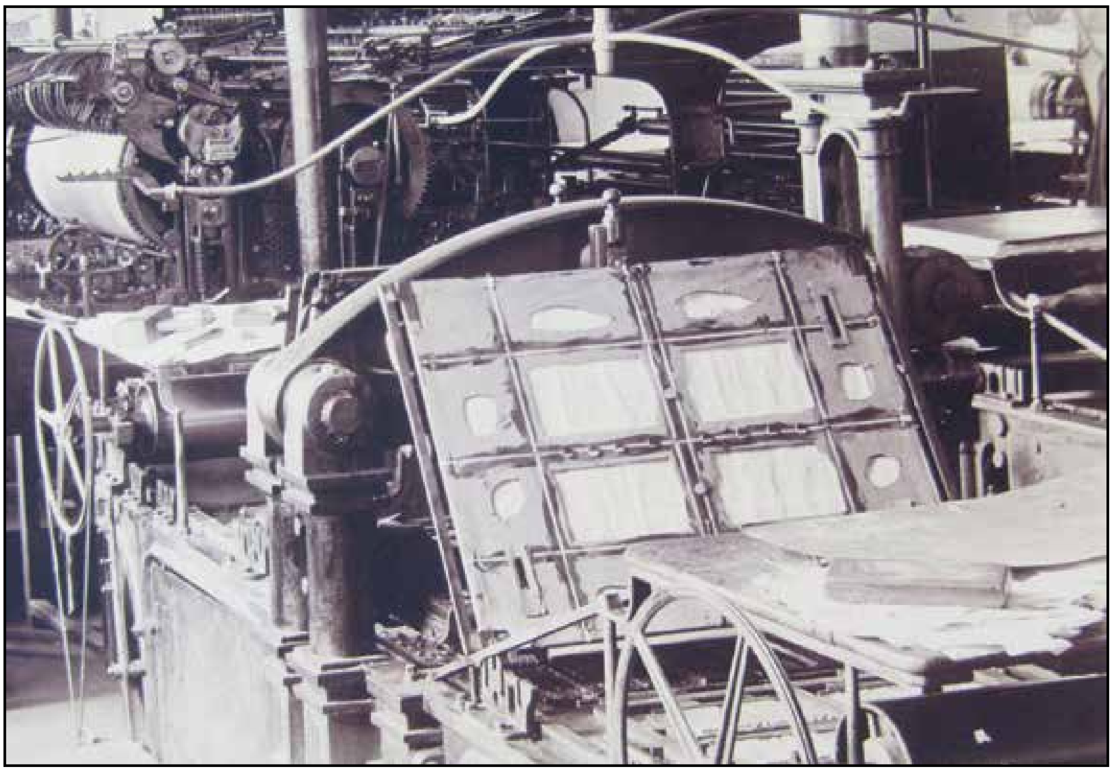
6. The following description is based on discussions in Wilson (1879) and Wilson & Grey (1888); the illustrations in the works cited below; and the standard cut.

7. Gaskill (1877), pp. 1-10.

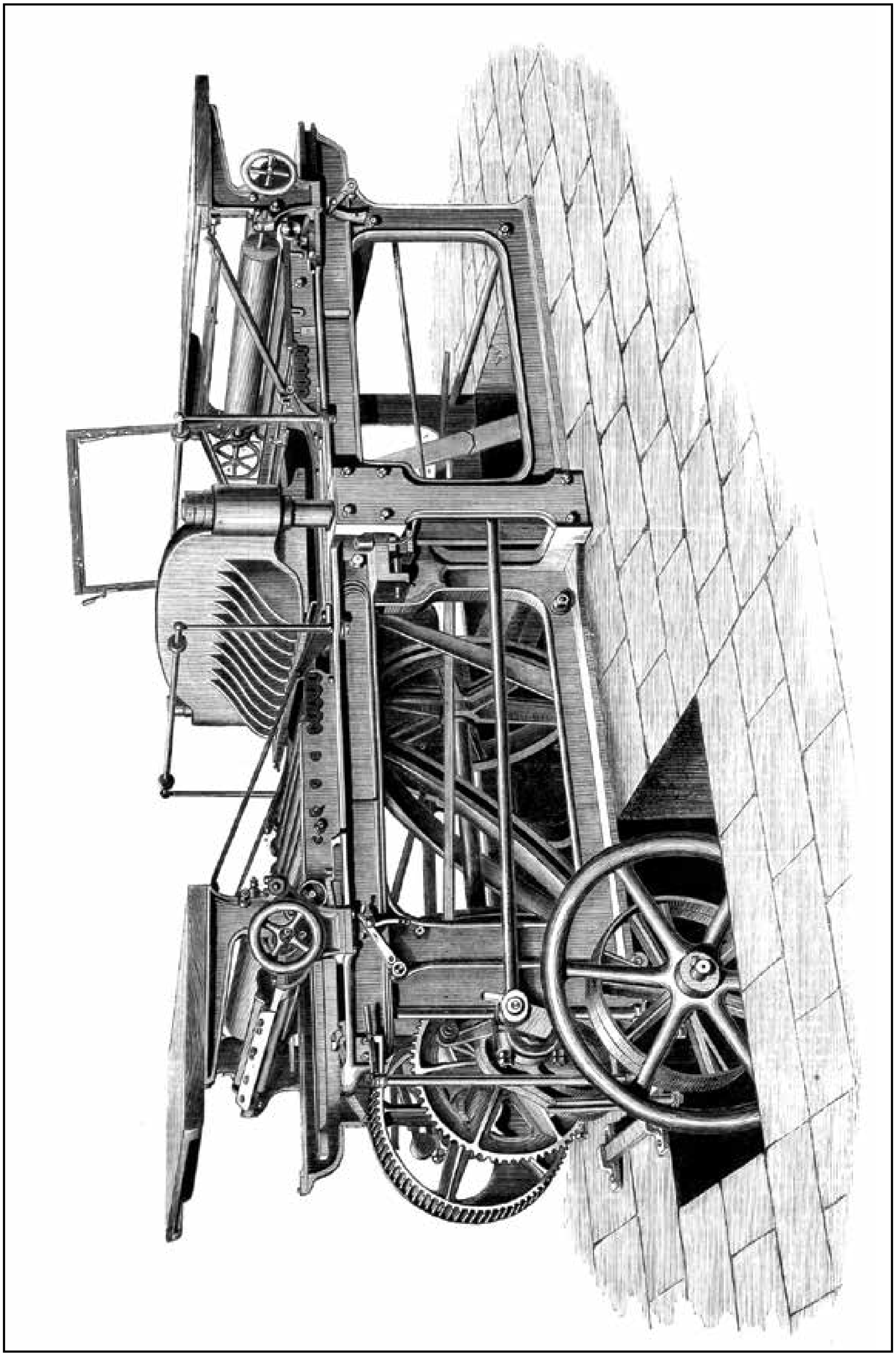
8. *Verhandlungen des Vereins zur Beforderung des Gewerbfleisses in Preussen*, Berlin, 1855, pp. 53-59, tables III-V; also in Wilkes (2004), pp.124-130.

9. Dempsey (1852).

10. Gaskill (1877), Wilson (1879), Wilson & Grey (1888). The works cited in n. 8 above proved equally useful.



51. Hopkinson & Cope double platen, offside, at Oxford Univesity Press, c. 1920. This machine was fitted with the simplified platen-lifting linkage, the adjustments for which are seen at the top of the beam, and band-driven distributing drums. Tympans and friskets have been thrown up together to allow access to the forms, providing a view of the underside of one frisket. The frisket has been prepared with strenthening tapes, cork and paper bearers, and air-relief holes round the perimeter. The far end frisket slide has been removed to ease changing that form. Drive is from lineshafting beneath the floor. Illuminating gas pipes snake overhead. Detail of photo "East Machine Room", courtesy Oxford University Press Archive.



NAPIER 1853[1]

James Murdoch Napier's double platen was designed to overcome the weakness and poor rolling of the ordinary double. It was the highest development of the type, made and finished to Napier's exacting standards. Like the ordinary double, the Napier comprised two independent ends reciprocated by a worm drum and served by a single, central platen. It differed in the mechanism of its drive, impression and inking mechanisms, as noted below.

The first two Napiers built were sold to the Bank of England for £2790 in 1854, according to Wilson & Reader.[2] Hansard wrote in 1861 that the Bank was then running two Napier doubles and one Hopkinson & Cope double to print banknotes, with Napier cylinders used for numbering the bills.[3] Napier platens were worked there until 1881, printing banknotes two-up, one-side, with black ink made for the Bank by Mr. Winstone especially to print on the dry paper used. Tympans for each denomination, with their overlays, were saved for re-use and the specially-treated electrotype plates were locked-up to one gauge, simplifying makeready.[4] The plates were said to be good for nearly a million impressions.[5] The forms, centered on the type-beds, received a complete rolling by all inkers. The sharpness and consistency of print allayed the Bank's concerns about counterfeiting, the Bank's engineer stating that use of the Napiers reduced the cost of banknote printing to one-twelfth that of the intaglio process previously used.[6]

Other printers of banknotes, postage stamps, playing cards, share certificates, and good bookwork acquired Napiers. According to the company history, Eyre & Spottiswoode had twenty-two for bible printing, and governments including Russia (who purchased ten at £400 each in 1865, and many more at other times), Italy, the German States, and Japan (two in 1874) bought them.[7] Cambridge University Press acquired seven Napiers between 1859 and 1864; Oxford University Press was running four in the 1870s.[8] The Chiswick Press possessed a Napier double as late as 1936.[9]

Styling

Napier's masterpiece directly conveyed, through its massive appearance and superb finish, the Napier ideal of precisely controlled but irresistible power. Entirely free of decorative touches at a time of general taste for the ornamental, it perfectly evoked the Machine Age. The effect of its appearance upon prospective purchasers, such as bankers and bureaucrats, was no doubt a factor in the Napier's commercial success.

52. At left, Napier double platen, drive side. The machine's impressive appearance mirrored its capability and cost. The skeletonized Napier worm drum is seen under the frame at left. One of the two grooved cams controlling the inking roller carriages is seen on the mainshaft. The horizontal rod outside the frame connects impression crank and toggle. The near impression toggle is hidden behind its piston guides, at center. The roller carriages are at their innermost positions, their vertically-slanting actuating arms inclined toward the platen. The right *end* is out, its frisket and tympan frames resting on the slides. Just right of the left fountain stand, atop the frame rail, can be seen one of the fixed cams onto which the end-most distributor rode to contact the distributing drum; in this view the distributor is on the cam. Below the center of the machine, in the floor pit, the large platen counterweight can be seen; above it looms the curved lower part of the impression bed. The counterweight was suspended from gut bands that passed over pulleys inside the frame. The bands were secured to the impression pistons; as the pistons were forced down for the impression the counterweight was lifted. From *The Engineer* (London), issue of August 16, 1872.

Napier-built machiness were made in double-royal as well as in smaller sizes more suitable for banknote and specialty work.[10] Koenig & Bauer built Napiers under license; their 1892 catalog (pp. 20-21) lists and illustrates the No. 32 in 21x16 for £445 and the No. 33 in 23x18 for £475.[11] K&B's 1901 catalog lists, in addition to the sizes noted above, the large K-IX in 39½x29½ (weight 11,500 kg), with halftone of same showing the worm drum placed at the opposite end from the crankshaft.[12] In France, Marinoni constructed Napiers for postage-stamp work.[13]

Mechanism

Napier grouped power shaft, mainshaft and bed-motion drum at one end of the machine. The power shaft carried tight- and loose-pulleys, band-pulley driving the ink drums, and a pinion engaging the mainshaft drive gear. Fitted to the mainshaft were its drive gear, a bevel gear impelling the bed-motion drum, and two cams controlling the motion of the inking roller frames. The mainshaft's ends were cranked, and straightened the impression toggles via connecting rods. Reach rods connected the ink-motion cams with the swinging arms that moved the roller frames; the rods could be lifted from engagement with their respective arms to suspend motion of the roller frames.

Inking

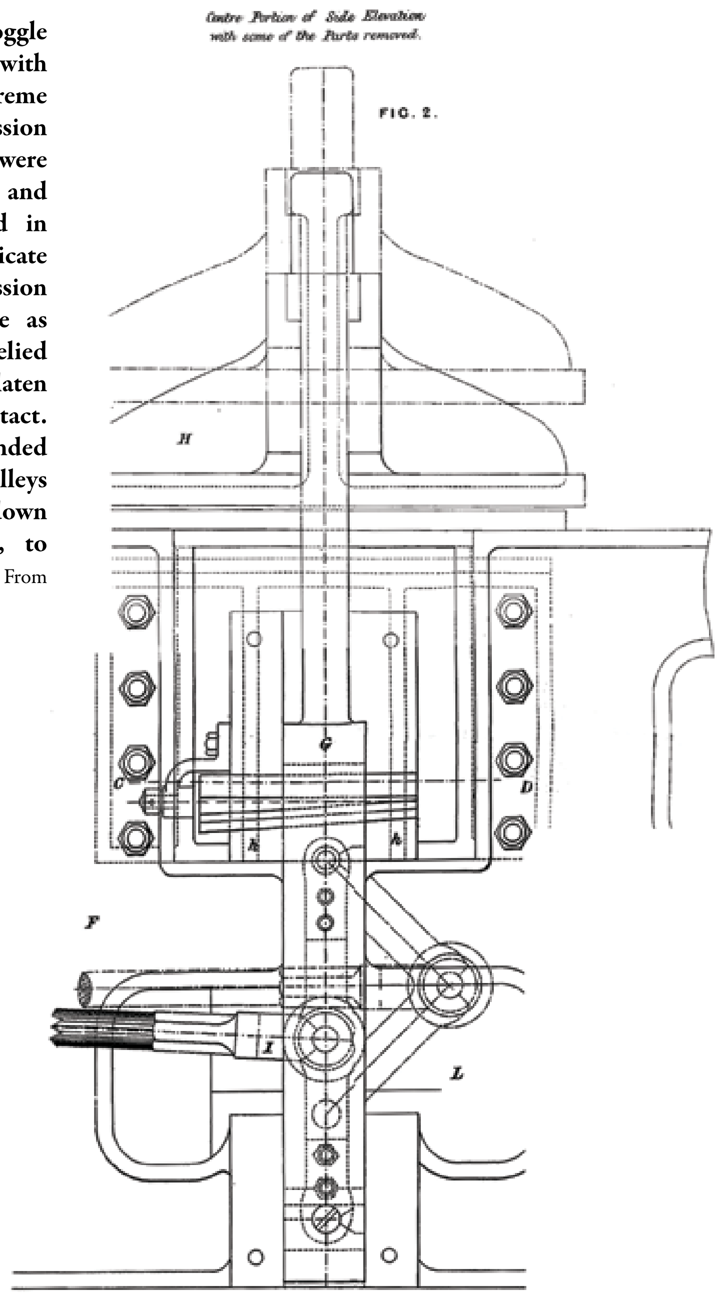
No account of the Napier appears without the phrase "equivalent to rolling with a single hand roller twenty different times" or something similar, in reference to Napier's traveling roller-carriages. The ink-roller carriage at each end cycled out and in once while the *end* was in, and once while the *end* was out. The *end* passed under the rollers on its way in and on its way out. The roller-carriage was stationary in its "in" position as the *end* was in motion in either direction. Close examination of the imagery available shows that, whether equipped with three large inkers or five smaller ones, only one or two entirely cleared a full form. A small form, such as a two-up banknote plate, was fully rolled. When an *end* was struck off or on, it was important that both type-bed and roller-carriage were at their outermost positions—the moment of impression upon the other *end*.

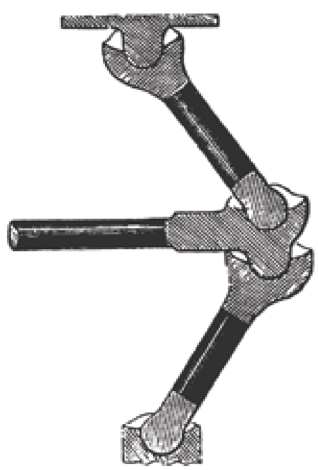
At each end, ink from the fountain was transferred by a ductor to the distributing drum, which was band-driven from the drive shaft and oscillated axially to aid distribution. The outer distributor in the roller-carriage was fitted with loose wheels (*pulleys*) on its ends, and these wheels rode up over cams fixed to the side frames when the roller-carriage was fully in, lifting the distributor into contact with the distributing drum. The distributor turned with the drum to gather a charge of fresh ink, then dropped off the fixed cam to roll the ink table as the roller-carriage moved out. Passage of the roller-carriage actuated the fountain roll pawl and the ductor. Ink table and distributors were higher than the form to prevent the distributors from touching the printing surface.

Restraint advised

Napier's worm drum, in his larger machines, had twice the pitch of the H&C drum and required but three turns for a complete cycle of the machine, as opposed to four for the H&C drum. Thus the time of the type-bed motion interval was but one-half that of the at-rest period. While affording a longer pause for the boys and the inking motion, the accelerated carriage travel was sufficiently violent that Wilson *et al.* urged lower operating speeds than Napier's advertising suggested. Wilson (1879) said 500 sheets per *end* (1000 iph)

53. At right, the Napier toggle E, plan view from outside with toggles and platen in their extreme positions. The en bloc impression piston G and platen rod were stabilized by the guides h, h, and the piston covers, removed in this view. Dotted lines indicate the position of the impression bed. Below left, the toggle as actually constructed. It relied upon the pressure of the platen counterweight to remain intact. The counterweight was suspended by gut bands running over pulleys (inside the press frame) and down to the impression pistons, to which they were attached. From GB2523.





was reasonable, citing wear and tear and the great stress upon the rollers.[14]

Wilson noted that the Napier drum's greater circumference allowed the platen to rise higher before the type-beds moved, than did that of the old-style press, thus preventing tympan frames from fouling the platen (evidently not a rare occurrence). The larger drum permitted a more gently-pitched motion groove, serving to reduce bending stress on the pin of the slider traveler.[15] In the case of small sheets such as banknotes the extended feeding time was not required, and the four-turn worm drum, with its gentler motion, was adopted.

Impression

Toggles increased the Napier's impressional power several times over that of the old-style platen, on which, unlike the Napier, it was impossible to pull an impression by hand. A boxlike piston enclosed each toggle, the platen rods were forged en bloc with the pistons. The pistons were driven downward as the toggles straightened, pulling the platen down with them. The upper ends of the toggles bore against pressure-plates and adjustment wedges in extensions of the impression-bed. Piston guides were machined into the side frames and piston covers.[16]

The impression toggles, pulled straight by connecting rods from the crankshaft to take an impression, produced a rapid initial descent of the platen, decelerating as the platen closed upon the form, and allowing a period of impression dwell, while greatly reducing the motive power required. A counterweight in the floor pit beneath the impression-bed was linked to the impression pistons in which the toggles worked. It kept the toggle joints under pressure and raised the platen after impression.

Occasionally, one of the gut bands linking counterweight and piston broke. Wilson suggested placing log supports in the floor-pit to catch the counterweight's fall and to ease re-attachment of the bands.[17]

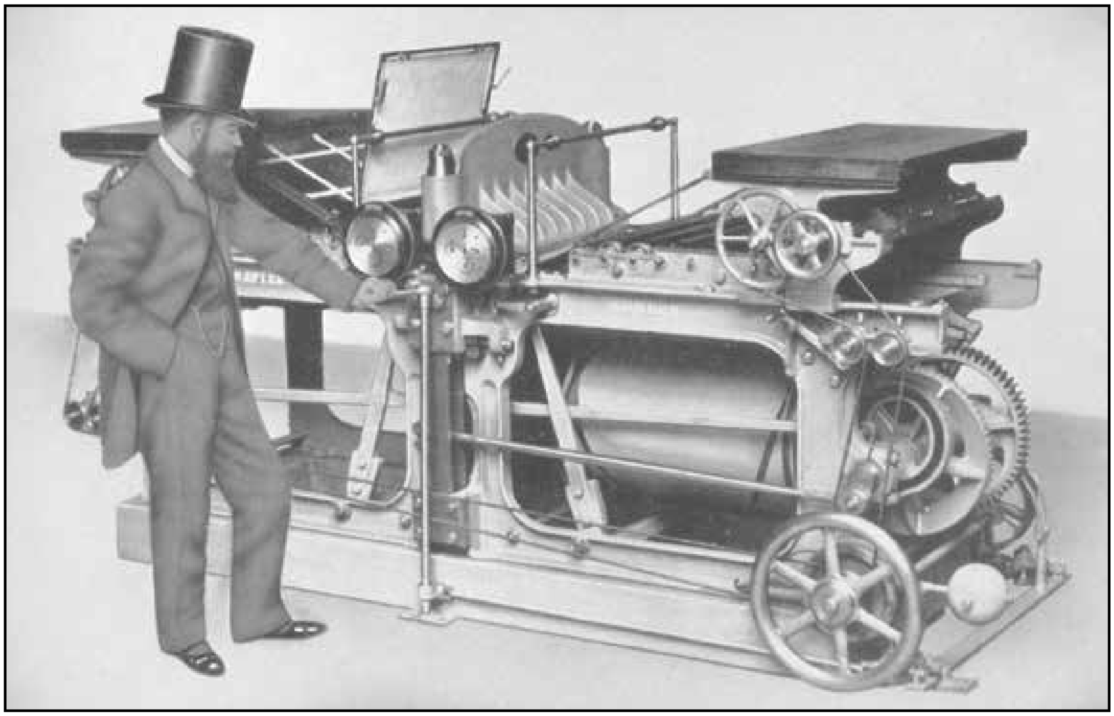
EXTRACTS

A paper by Alfred Smee, Surgeon to the Bank of England, describing the adoption and process of typographical banknote printing at the Bank, appeared in late 1854 in *The Journal of the Society of Arts* (Vol. III, No. 109, pp. 81-89). Passages relating to platen work include: ... For the cheques they considered that the double platten was the best machine which was in active operation at the time. ... a machine by Hopkinson and Cope was adopted, and the cheques were printed by it, as also some of the notes.

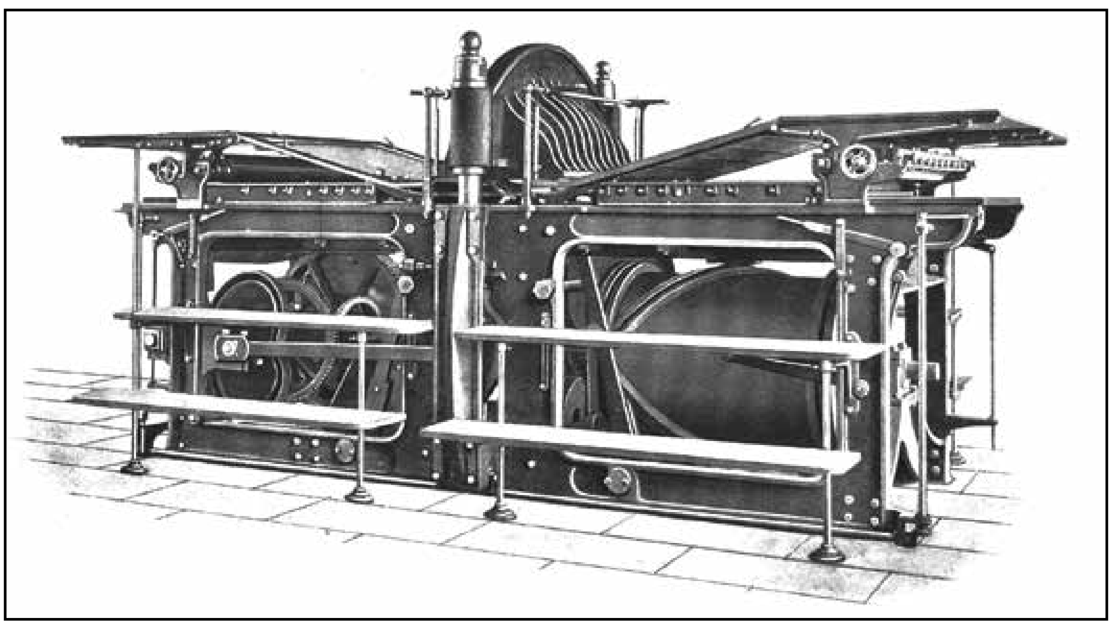
For the other bank-note[s] a new platten has been specially constructed by Messrs. Napier and Son, with contrivances for both the tables and the inking-rollers to traverse ... the form of every note is made to one gauge, and every denomination has its separate tympan and overlaying. ... when a note-plate is once made ready ... it is always ready at a moment's notice. ...

Counting machines are appended to each end of the machine, that no impression can be taken without being registered, and when 100 impressions are printed a bell strikes ... 3,000 notes [two on a sheet] are printed per hour ...

When the form is arranged in the printing machines, the first act of the printer is to obtain a perfectly level impression ... by filing the back of the blocks wherever he finds any elevation exists. This may be called a general picture ... without the lights and shadows which give beauty and excellence to the impression. [Then] four impressions are taken upon thin



54. James Murdoch Napier fondles the starting handle of one of his smaller creations, made for banknote work. Note four-turn worm drum and the large-dialed Cuthbertson's impression counters for each *end*. Light bands connect distributor drum sheaves with the power shaft. Far *end* is out, with tympan thrown up and frisket resting on the slides. Both roller-carriages are in. From Wilson & Reader (1958).



55. Koenig & Bauer model K-IX (Napier) double, 1901. The worm drum, of the original Napier style but not skeletonized, has been moved to the opposite end from the main shaft to allow room for the mainshaft, here positioned inside the machine frame. This was a platen for the heaviest work, with extra-long roller-carriages and massively reinforced impression piston guides. Koenig & Bauer, Katalog, 1901, p. 28. Courtesy Bill Elligett.

paper, and according to the gradations of tint required, the impression is cut away, so that in one place no thickness exists, in others one, two three, or all the thicknesses remain. For the darkest portion the four thicknesses are left, for the lighter none are allowed, and for the intermediate tints two or three thicknesses are left. The whole are then pasted together and placed [in register in the tympan] over the electrotypes and by the contrivance of the overlaying, those parts which are desired to be darkest, get the heavist pinch, … lighter tints are the least heavily pressed …

To give an idea of the extent of our operations … there are 66 kinds of bank-notes, and about 50 varieties of cheques … 25 kinds of bank-bills, 60 day-bills, and [other jobs] … to show that the Bank has not merely adopted surface-printing to a bank-note, but to all similar documents …

From Wyman (1879), p. 57: … the machine-minder must constantly watch his rollers, especially in hot weather, as the rapidity with which they necessarily travel over the form soon renders them useless if they are not in fit condition. …

It is almost unnecessary to say that these machines are models of good workmanship and fitting. Although they cannot be classed amongst the most economical of machines, either as to original cost or in the working, it is undeniable that they are particularly suited to the finest class of cut-work.

From A.D. MacKenzie's *The Bank of England Note: A History of Its Printing* (The Syndics of the Cambridge University Press, 1953), pp. 103, 104: One of the first problems that had emerged from the early experiments in the [letterpress] method had been the difficulty of producing on the hard bank-note paper, 'fine' printing which would bear comparison with an impression from an engraved plate. It will be remembered that the pressure exerted by a surface printing press is firm but slight—the type is, in fact, said only to 'kiss' the paper—and, if too great a pressure is used, the impression, though clear, is sunk into the paper by the excessive pressure of the type. The problem of how to use the maximum pressure without incurring this disadvantage was solved by the use of a special 'overlay', a device, which in its simplest form consists of the pasting of successive pieces of paper upon the tympan … at places where a greater pressure is required … The overlay that was used for the printing of the bank-notes was, however, a much more elaborate affair. It was not 'patched up' on the tympan, but was made separately of six pieces of moderately thick paper, each bearing an impression, one of which was used as a master sheet. From the remaining five sheets, certain portions of the print were cut out and pasted on the master, thereby producing a note, as it were built up in relief, which was fixed to the tympan at the exact place where the impression would be printed. Thus each note had this hard backing behind every line to be printed, permitting the use of considerable pressure, which would have resulted, especially where the lines were fine, in the print appearing in a deep valley. The elaborate nature of these overlays made them expensive in the matter of labour, for the cutting of overlays for one plate, that is to say two notes, employed one skilled craftsman for 137 hours.

NOTES

1. Wilson & Grey (1888) pp. 307-313, Wilson (1879) pp. 53-57, and Gaskill (1877) pp. 5-10, taken together, afford a clear understanding of the machines and their operation. James Murdoch Napier held two relevant patents: GB1740 of 1853 and GB2523 of 1857. Both present elements of the machines actually made, as well as of projects. Napier's standard cut appeared in the three works above and in Moran (1973). A halftone

of JMN standing by one of his creations was shown in Wilson & Reader (1958). Machines built under license by Koenig & Bauer were listed in their catalogs of 1892 and 1901. Wilkes (2004) reproduced the Napier standard cut (p. 121), a Koenig & Bauer cut (p. 297), and a cut of the version built by Marinoni (p. 556), with descriptions.

2. Wilson & Reader (1958), p. 44.

3. Hansard (1861), p. 125.

4. Guide (1863), p. 236; Ringwalt (1871), p. 52.

5. Hansard (1861), p. 125.

6. Wilson & Reader (1958), p. 44.

7. Ibid, p. 44.

8. See page 69 herein.

9. F.G. Kilgour, *The Evolution of the Book* (1998), p. 106.

10. Wilson (1879), p. 53.

11. Koenig & Bauer, *Katalog uber Flachform-Schnellpressen*, Kloster Oberzell, 1892, pp. 20,21.

12. Koenig & Bauer, *Katalog*, 1901, pp. 28, 29. A list of five sizes offered by D. Napier & Son appears in Moran (1978), p. 120; the largest printed a form 43x27, the smallest 21.5x16. Claimed speeds were 1300 and 2400 iph respectively.

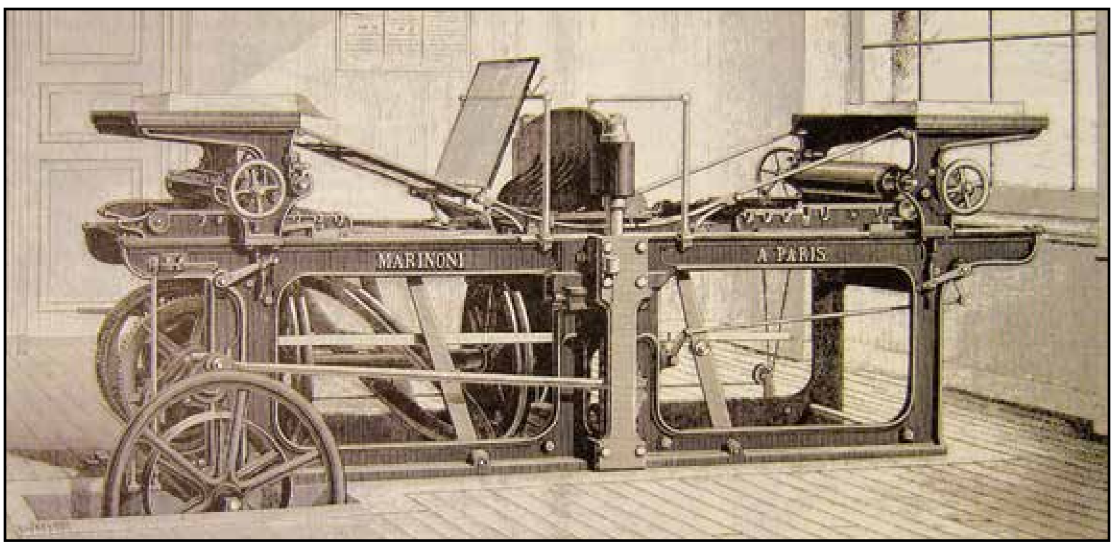
13. Wilkes (2004), p. 556, presents a superb cut of Marinoni's version.

14. Wilson (1879), p. 54.

15. Ibid, p. 53.

16. GB2523.

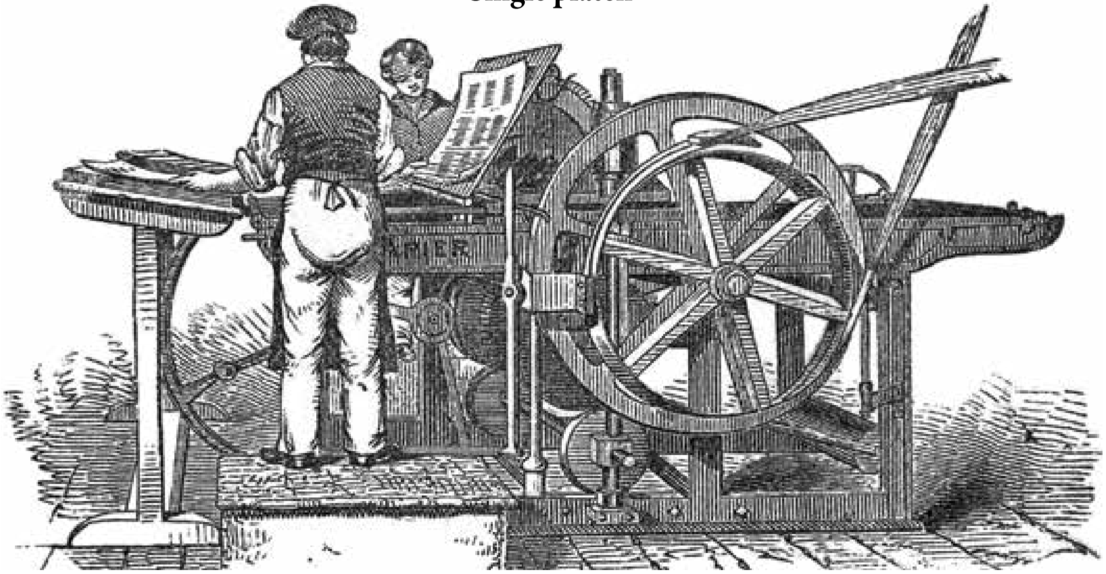
17. Wilson (1879), pp. 54, 56.



56. Marinoni's version of the Napier. The left roller carriage is near the outer limit of its travel, the right carriage near its inner limit, with its outer distributor roller riding on the stationary cam that lifted it into contact with the distributing drum to take fresh ink. Linkage from the strikers lifted the carriage motion rods from the motion levers, immobilizing the roller carriages when the ends were disengaged. Courtesy Herwig Kempenaers.

NAPIER 1837

Single platen



57. **David Napier's single platen, with reciprocating carriage and stationary bed. The curved lever at left was connected to a cam on the mainshaft and to the carriage, which it drove. The cylindrical weight, near the floor at right, returned the platen via levers, one of which is visible.** From Routledge (1891), p. 216.

Dated by the Napier firm's historians to the mid-1830s, David Napier's single-ended machine seems to have escaped close description.[1] Our discussion, then, must depend on interepretation of the oft-seen image reproduced above. The relevant patent is GB7343 of 1837, which covers only a form of carriage drive. The cut depicts a single-ended platen machine with an interesting means of drawing the platen down onto impression.

A heavy cross-shaft beneath the impression bed carried, in addition to the cam driving carriage motion, two large cams near its ends. These depressed rollers running in bearings fixed to the lower ends of the platen rods, drawing the platen down. A counterweight returned the platen to its upper position. The inking mechanism occupies the right-hand end of the machine illustrated; inkers and perhps wavers would have traveled with the carriage. Judging from the cut, only one or two inkers would cover a full form. Access to the form may have been gained by sliding the type-bed from under the platen, as in Holm's machine.

Patent GB7343 covers *obtaining from a continuously revolving shaft reciprocating action, and appropriate periods of rest for the frisket frame, by the action of a 'guide' (a wheel with excentric and concentric grooves upon the revolving shaft), upon a compound lever connected with the frisket frame. The frisket frame is double; and the sheet is thus changed at each end alternately while at rest for the impression, which is given by a platen …*, suggesting that a double-feeder was contemplated.[2] There is no evidence that such a machine was actually constructed, J.M. Napier's 1853 platen being a true double.

NOTES

1. Wilson & Reader (1958), p. 44.
2. *Abridgements of Specifications Relating to Printing*. London: Commissioner of Patents, 1859, p. 200

HOLM 1841[1]

Single platen

Savage noted the introduction of this machine in 1841: *A new press has just been introduced to public notice (August 1841), under the patronage of Count Rosen, a Swedish nobleman ... There are two of these presses now at work in the extensive establishment of Messrs. William Clowes and Sons, under the name of 'The Scandinavian Self-inking Press,' invented by Mr. C. A. Holm, of Stockholm, who has taken out a patent for it. It is a press with a platen which descends perpendicularly, and at its regular rate of working produced 550 impressions in an hour, which I have ascertained by personal inspection. It requires two boys to each press to lay on and take off the paper, and to turn down and raise the tympan, and one superintendent is fully competent to attend to two presses. By dispensing with woolen blankets in the tympans and substituting paper, it produces fine impressions, as the specimens published of large and finely executed engravings on wood testify.* [2]

Although Braithwaite, Milner & Co. of London constructed the first Scandinavian machines, "complaints of noisy working" shifted the job to Nasmith, Gaskell & Co. of Manchester. W. Clowes & Son of London purchased the first example. In Germany, the first builder was Hummel of Berlin. Later, Koenig & Bauer of Wurzburg and Sigl of Berlin produced them.[3]

Hopkinson & Cope's 1862 catalog offered the Scandinavian in super royal (platen 28x 21) and double crown (platen 31x22); the smaller could be supplied with Hand Apparatus for £4.10 extra. List prices (1862) were £125 and £155. Two attendants were required to feed and take-off. Hopkinson & Cope claimed speeds of 600-700 iph and said, "for woodcut printing it cannot be excelled", noting that nearly 100 were at work. "Where fine work is required, all the means of making ready are the same as at a Common Hand Press," they promised, and presented a list of thirty-seven purchasers in Great Britain and abroad.[4] The Scandinavian occupied little more room than a handpress of similar capacity.

The type-bed was positioned across the frame. It could be moved from under the platen to expose the form, but remained stationary upon the impression-bed during operation. The type-bed was composed of two layers, with about one inch separating them to provide a space for the insertion of resilient material which allowed a "soaking" impression with a measure of dwell. Frisket, tympan and rollers were attached to the reciprocating carriage; all three inkers, of differing diameters, cleared the form. The frisket was held above the face of the form by long springs at either side. The tympan frame was hinged to the inner edge of the frisket frame and was thrown up against rests on the platen when the carriage was out for feeding.

Like the inkers, the wavers were set in forks on the carriage, distributing ink upon a stationary ink-table at the rear of the bed. The two rear wavers were spring-loaded to force them to one side when they cleared the ink-table during the feeding interval, causing them to track across the table's entire surface. Wavers and ink-table were higher than the form, to prevent the wavers from touching the printing surface. The rearmost waver took ink directly from the fountain roll, resting upon it when the carriage was in its inner (impression) position. The fountain was affixed to the rear of the frame; the fountain roll was turned by a ratchet and pawl moved, through a reach-rod, by the descent of the platen.

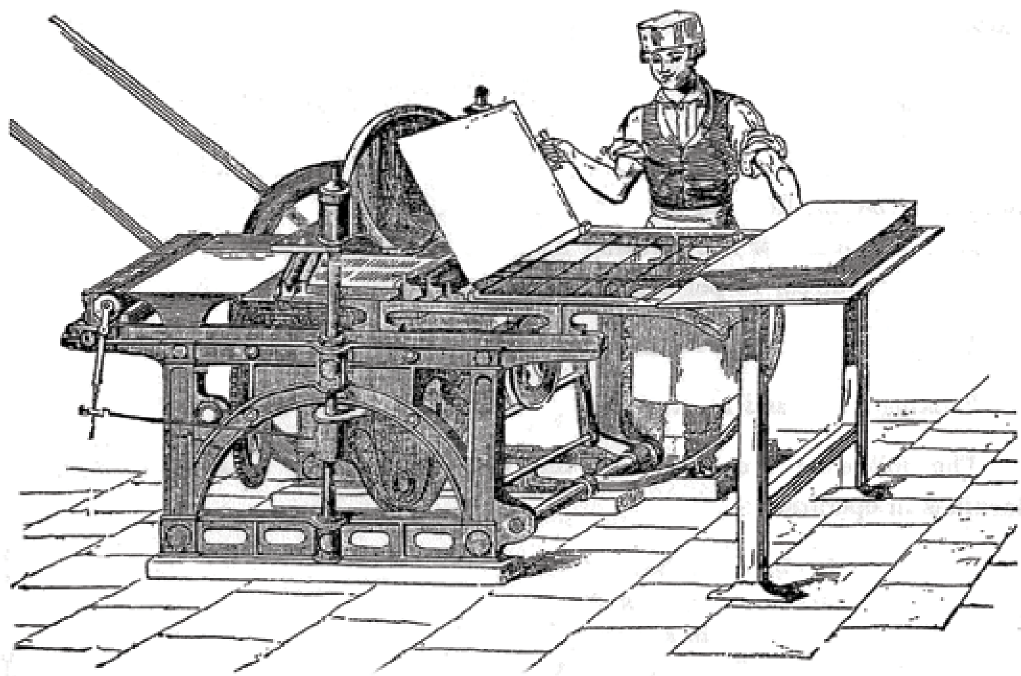
Continued on page 105

KEY TO PLATES 59-62

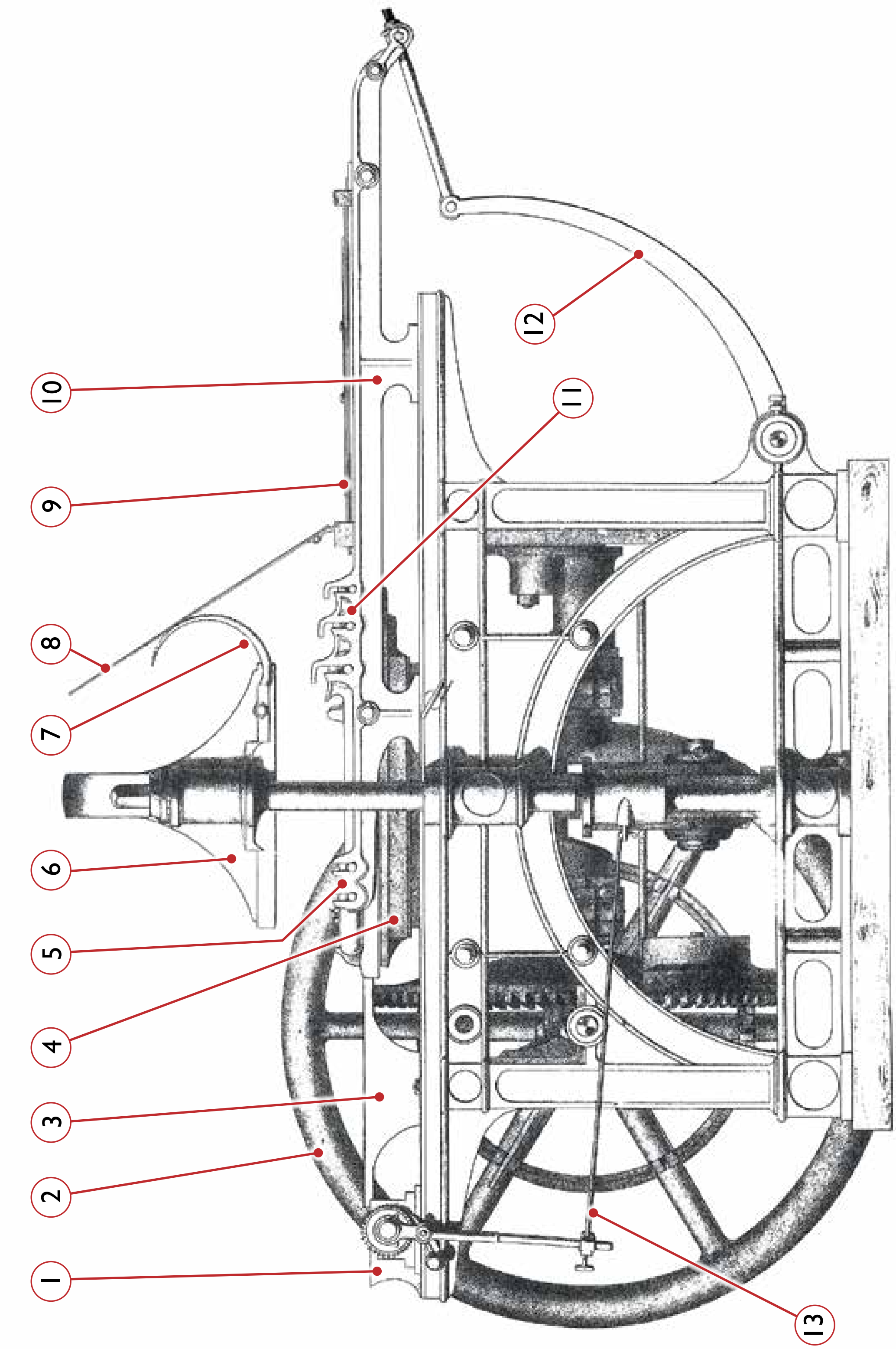
PAGES 101-104

Mechanical details of the Scandinavian machine are depicted on the following pages, showing the machine with platen raised, carriage out, and tympan thrown up, in position for changing sheets. In 61 the platen has been omitted to show the inkers and wavers. The outer waver acted as a ductor, resting on the fountain roll when the carriage was in. From *Journal fur Buchdruckerkunst*, Vol. 18, No. 15 (1851).

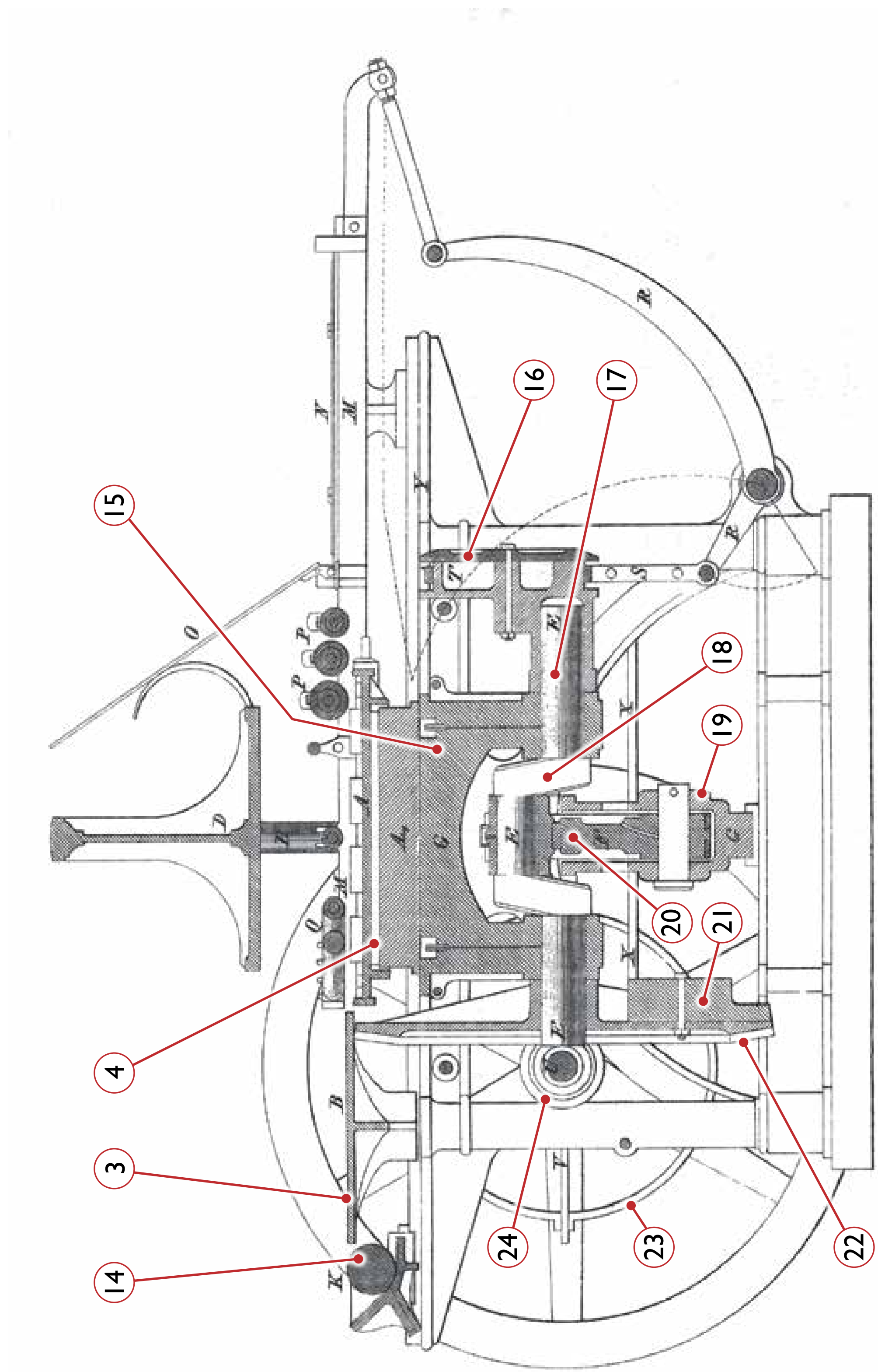
1. Fountain
2. Flywheel
3. Ink table
4. Type-bed
5. Waver forks
6. Platen
7. Tympan rest
8. Tympan
9. Frisket
10. Carriage
11. Inker forks
12. Carriage motion arm
13. Fountain motion linkage
14. Fountain roll
15. Impression bed
16. Carriage motion cam
17. Mainshaft
18. Impression crank
19. Impression beam
20. Impression connecting rod
21. Counterweight
22. Mainshaft bevel gear
23. Driving riggers
24. Power shaft bevel pinion
25. Type-bed upper plate
26. Impression nut
27. Form
28. Platen rod guide, upper
29. Platen rod guide, lower
30. Inkers
31. Wavers
32. Clutch
33. Frisket spring



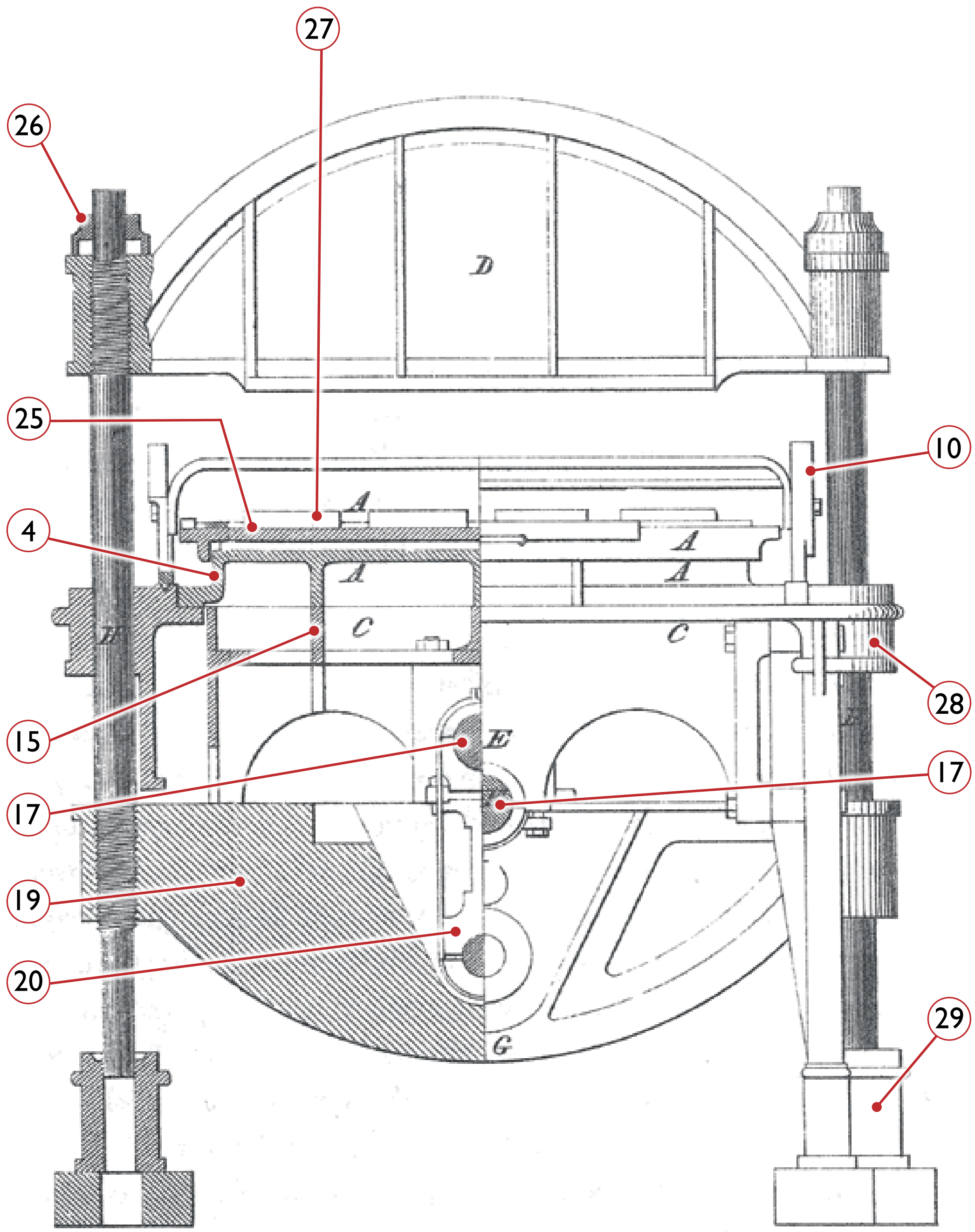
58. The Scandinavian single platen, with carriage out and tympan up, frisket ready to receive a fresh sheet. In operation two boys were required, one to feed fresh sheets and one to fly the printed sheets. Inkers and wavers were mounted on the reciprocating frisket carriage. The type-bed remained under the platen at all times during operation of the machine, but could be manually pulled out to the right upon slides on the side frames for form changes. The frisket was simply lifted off the carriage to allow access to the form.



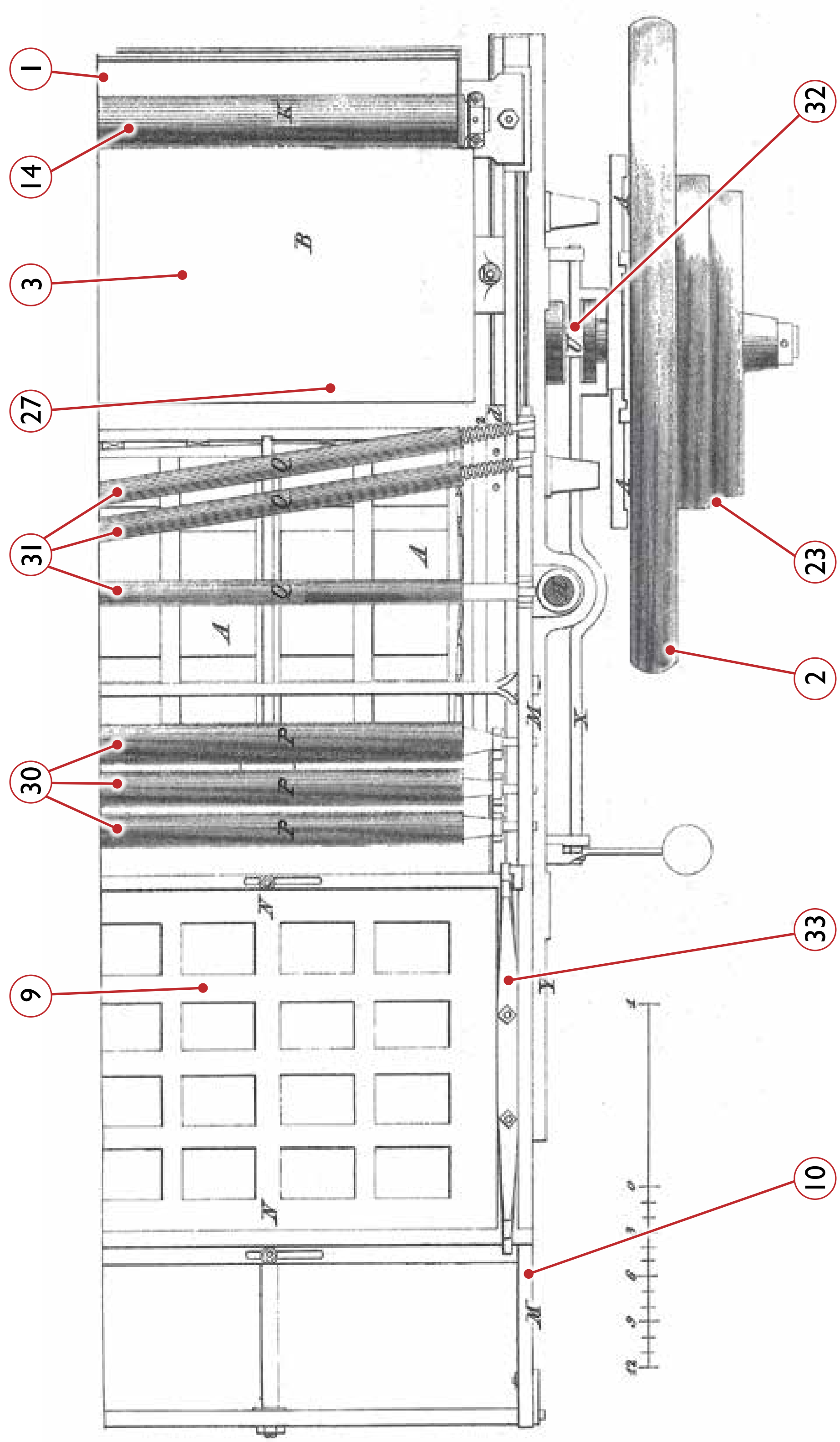
59.



60.



61.



62.

The platen was supported and drawn down upon the form to take the impression by two strong rods, one at each side of the press, which were attached to and pulled down by a stout crossbeam beneath the type-bed. The crossbeam rose and fell in response to a crank in the mainshaft, to which it was linked by a heavy connecting-rod. The platen rods projected below the attached crossbeam into guides cast into the lower side rails of the frame, and were held above in similar guides on the upper rails. As the platen was neither sprung nor counterweighted, it is easily seen that any play at all in the assembly of crank, connecting rod and crossbeam—the clearances necessary to their freedom of action—would be taken up with each impression. This was unquestionably a source of considerable noise, despite careful fitting.

The mainshaft ran longitudinally under the press in bearings below the impression-bed and above the crossbeam which it activated. Keyed to the rear end of the shaft was a large bevel wheel, geared to the power shaft upon which were tight-and-loose pulleys and flywheel. A cam fitted to the mainshaft's front end moved the carriage via links and a long curved lever. The mainshaft's mid-section was cranked. as noted above. A dog-clutch was fitted in the power shaft between flywheel and drive pinion. Accident-prevention was the taker-off's responsibility; the clutch lever was under his hand.

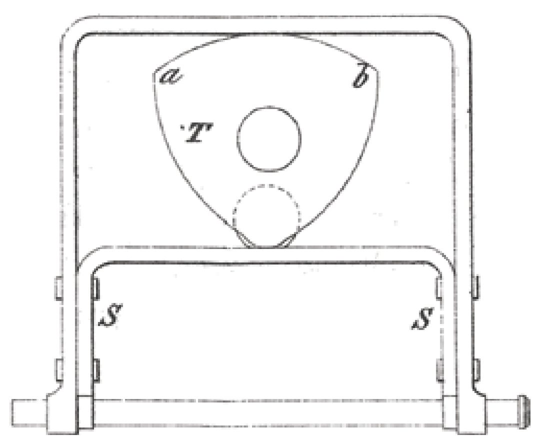
NOTES

1. Patent GB7918 of 1838 was granted to Charles Augustus Holm and John Barrett, patent GB12382 of 1848 to Holm. These show hypothetical machines having details applied to the as-built Scandinavian. An accurate draught of the Scandinavian appears on p. 10 of Harrild (1860). The stock advertising cut is well printed in H&C (1862), p. 4. Wilkes (2004), pp. 106-108, provides a full description and illustrations.

2. Savage (1841), p. 815.

3. Wilkes (2004), p. 106.

4. H&C (1852), pp. 4, 5.



63. Carriage-motion cam T (16 in 59) and its follower-frame S. The frame's vertical motion actuated the carriage-motion arm (12 in 58). From *Journal für Buchdruckerkunst*, Vol. 18, No. 15 (1851).

APPENDICES

Appendix A: Significant patents.

Daniel Treadwell, Boston, March 2, 1826. As-built, early single.

Jonas Booth, New York, September 1, 1829. Double printing press. Also James B., Thomas B., Jeremiah B., Jonas B. Jr. Not seen.

Isaac Adams, Boston, October 4, 1830. As-built, early version. This patent was extended seven years and again extended by Act of Congress from August 16, 1856 to March 2, 1864, and was reissued as Reissue No. 546, dated April 20, 1858. The reissue describes and illustrates early and late versions of the press and is available online at Google Patents. Model at NMAH Smithsonian, Washington, D.C., GA catalog 11,024, photos 77.654, 86.6338.

Otis Tufts, Boston, August 22, 1834. Manuscript specification (13 pp.) and drawings (5 shts.). (*Restored Patents* vol. XVIII pp. 347-360.) Perhaps as-built. Model at NMAH Smithsonian, Washington, D.C., GA catalog 11,025, photos 69.673, 69.675.

Isaac Adams, Boston, March 2, 1836. Specification and drawings. Thorough description and illustration. As-built. Reissued June 13, 1848 as Reissue No. 116, with updated specification and 3 sheets of rearranged drawings (available online at Google Patents). Also, GB2264 of October 24, 1854, with specification (36 pp.) and drawings (14 shts., 43 figs.) presents a thorough description and very comprehensive illustrations of contemporary machines, as-built, describing and illustrating four- and six-roller presses, as well as two styles of gripper arrangement and both types of fly.

David Napier, London, GB7343, 1837. Specification (4 pp.) and drawings (4 figs.). Covers a form of carriage drive, perhaps employed in D. Napier's single platen.

Carl Augustus Holm, John Barrett, London, GB7918, December 20, 1838. Specification (5 pp. *re.* platens) and drawings (shts. 1, 3, figs. 1, 2, 4, 5). Describes and depicts two forms of reciprocating carriage bearing rollers and frisket(s), and two arrangements of wavers; concepts used in modified form on the Scandinavian platen.

Carl Augustus Holm, London, GB12,382, 1848. Specification (5 pp. *re.* platen machines) and drawings (3 shts., 13 figs.). Describes and illustrates two forms of double machine with Scandinavian-like characteristics and cam-driven impression mechanism. One version has a carriage with form rollers mounted midway between the two friskets, with fountains and distribution drums under both ends; the other has a separate form-roller frame which cycles twice over the form, operating independently of the frisket carriage, and supplied from a fountain and distribution drum under one end only. Projects, showing some features of the Scandinavian.

James Murdoch Napier, London, GB1740, July 23, 1853. Specification (9 pp.) and drawings (1 sht., 2 figs.). Covers a traveling carriage mechanism used on Napier's doubles. Only the description and depiction of the operating cams are applicable to the as-built machine.

James Murdoch Napier, London, GB2523, October 1, 1857. Specification (6 pp.) and drawings (3 shts., 17 figs.). Sheet 1 and its description presents the forms of the toggles, toggle pistons, and counterweight arrangement of the Napier double as-built. Sheet 3, Figure 1 depicts a conceptual double but shows the form of impression bed, slider, and table clutch probably applied to the as-built doubles. A key passage from page 1 of the specification: ... *the* *improvements consist in the arrangement of knuckle joints actuated by a crank or excentric action, by means of which the necessary rising and falling motion is imparted to the platten, and the friction and torsional strain common to the machines now in use are very much reduced. I employ a weight to balance the platten, and place it underneath the impression table. The weight may exceed the weight of the platten, so as to raise it when the knuckle joints are released, in which case the knuckles will not require any provision for taking an upward strain; but I prefer to connect the knuckles so that they will not fall out if the weight should at any time prove insufficient to raise the platten with the necessary speed.*

Appendix B

Daniel Treadwell's patent of 1826, re-submitted after the U.S. Patent Office fire of 1836. Transcribed from a manuscript held by the British Library, photocopies of which were graciously provided by Mr. Ziaad Khan. The machine described dates from 1821, but Treadwell delayed patenting. His specification was worded to avoid the necessity for drawings.

... I the said Daniel Treadwell have invented, constructed and applied to use, a new useful improvement in printing whereby I obtain all the operations necessary for striking impressions from a single rotary motion which improved machine I call the Power Press and which I proceed to describe ...

I wish it to be borne in mind by the reader, that this machine has a general resemblance in many parts, such as the frames platen &c. to the common wooden press. As these constitute no part of my invention, no further description of them is necessary, than to show the manner in which they are altered, in form, to adapt them to my improvements. In order to make my invention more clearly understood, I shall describe the whole machine in divisions, made from the operations which are performed in the following order.—1st. The frame.—2d. The parts producing the impression. 3d. Parts connected with running the form of types from end to end of the rail way alternately inking & taking an impression.—4th. The parts by which the paper is conveyed on to the types and raised from them after it is printed.—5th. Inking apparatus.—6th. Throwing out of gear.

I use the terms East, West, North & South to designate the aspects of the parts or directions in which they are placed in regard to the centre of the whole, which is a vertical line drawn through the centre of the platen. I suppose the pressman or person who is to put on the sheets, to stand on the South side of the press looking to the North, having the East end of the press to his right hand & the West end to his left.—

1st. The body resembling that of the common press consists of two cheeks & two beams, which I call the top & bottom beams, properly secured to the cheeks. These beams answer to what are called the cap, the head, the summer & the winter in the com[mon] press. From the West side of each of the aforesaid beams I run out a plank (at right angles with the beams) 6 feet long, 1 foot wide, & 3 inches thick; the sides of the plank being parallel with the plane of the horizon; these are properly secured in the beams by bolts or tenons. I call them the tail pieces. They are supported from the floor of the room at their ends to keep them from sagging & 2 4/12 feet from the beams 2 studs are put in running vertically from one tail piece to the other. These studs are both an equal distance from the beams and 4 inches from each other.

2nd. I fit into these tail pieces, at the distance of 4 1/24 feet from the beams, a vertical shaft of cast iron, 4 inches square having gudgeons at each end, which turn in boxes fixed into the tail pieces, this I call the cam shaft.—The lower end of this shaft is coupled just below the lower tail piece to another cast iron shaft of the size of the former, which passes from a proper stop or box in the room immediately beneath that in which the presses are worked. This I call the main shaft.—I fix upon the same shaft between the tail pieces and at the distance of 9 inches from the under side of the upper tail piece, a cast iron cam, the face of which at its middle part is 13½ inches distant from the center of the shaft. The face of this cam is an arc of 120 degrees of a circle whose radius is 7¼ inches; hence the eccentricity of the cam is 2 inches.—A horizontal slide of cast iron (in the end of which next to the cam, is a friction roller) passes from the face of the cam over a cross piece fixed between the studs before described (as placed between the tail pieces) to a point directly over the platen & under the top beam; and equally distant from both.

There the slide is united to a toggle joint.—This joint is made of two pieces of cast iron, the lower end of one of which is united to the top of the platen, by a joint, & the top end of the other is united by a joint, with a cast iron plate placed upon the under side of the top beam.—The two pieces are united at their other ends by a joint, & are there connected with the slide before described.—When the slide falls back (the cam having passed it) the toggle joint crooks Westwards, the two pieces of which it is composed pointing in some degree towards the cam. This permits the platen to rise (as will hereafter be described.) But when the cam presses the slide Eastward, the joint is brought nearly straight, and the platen is consequently made to descend upon the types to produce the impression. A pin is fixed in the slide which strikes the cross piece between the studs, to prevent it from passing Westward too far, when the cam leaves it.

The platen is hung between the cheeks of the body of the press in the following manner.—Two stout pieces of cast iron which I call the platen guides are bolted, horizontally one upon the inner side of each of the cheeks of the press frame. These guides are as long as the platen from East to West & their lower edges are nearly as low as the face of the platen. A small roller runs along the East edge of the platen, its gudgeons running in boxes fixed upon the East ends of the platen guides. This is to prevent the tympan from rubbing the edge of the platen.—Two cast steel arms or gudgeons 1½ inches in diameter are fixed to the platen near its face and near its West side, these arms pass from the platen into vertical slots or oblong holes, made in the sides near the West end of the platen guides. When the platen is in its place and drawn upwards by the counter-balances (to be hereafter described) its face is not intended to be horizontal, but to incline upwards from the West to the East about 4 degrees.

A common knowledge of the force required to produce an impression by a common press will show the dimensions required for the parts as here described.

The platen is counter balanced by weights fixed to levers upon the upper side of the top beam & connected with the platen by rods passing through holes in the top beam & united with the platen between the centre of gravity, and its arms or gudgeons. The weight of the counter-balance should be enough to keep the platen always pressed against the toggle joint.

The operation of these parts (concerned in producing the impression) is as follows.—The cam shaft being made to revolve from East to South the cam strikes the roller in the end of the slide which being prevented from passing Southward by a friction roller on the South stud between the tail pieces, the slide is wedged or pushed Eastward by the cam. This tends to straighten the toggle joint & consequently to make the platen descend, (the bed & types & sheet to be printed being by the general trimming of the press to be hereafter described now under the platen) the impression is made. From the manner of counter-balancing the platen (the weight acting between the centre of gravity of the platen & its gudgeons or arms at its West side) the East edge of the platen descends first, when this touches the types & is thereby resisted, the West side descends, the gudgeons slipping down into the slots, in which they are hung. The whole descent of the platen should be its East edge about 2 inches, and its West edge about ½ an inch. After the full part, or centre of the cam, has passed the slide, the reaction of the beam and other parts together with the counterbalance of the platen, causes the platen to rise as the cam passes onward, and the toggle joint to crook backwards; the slide following the eccentricity of the cam until the pin strikes the cross piece before described, between the two studs. This leaves the bed, types & printed sheet free to be passed from under the platen.

3rd. The coffin, stone & carriage, which together I call the bed on which the form of types is placed is put on proper ribs which I call rail ways & which answer to the carriage and the ribs of the common press, which are so placed as to direct the bed under the platen & from thence horizontally about 3½ feet to the Eastward.—The motion of the bed and types from East to West, & from West to East, is produced by the following machinery.—At the distance of 1½ feet West of the beams of the press, I place a round shaft vertically 4 8/12 feet long and 1½ inch diameter. This I call the verge, its lower end runs in a stop on the floor of the room, properly connected to the under part of the press frame.—The verge passes upwards, through the lower tail piece, a little to the North of its centre line, so as to clear the slide, and its top gudgeon runs in a box fixed in the upper tail piece.

It is necessary that this verge in the performance of its operations, should be turned about 2¼ revolutions in one direction, 2¼ revolutions in an opposite direction, and then stand motionless during a space of time equal to that previously taken up by the performance of revolutions. To accomplish this effect, I put two mitre cog wheels of 8 inches diameter upon the verge below the lower tail piece (the upper side of the upper wheel being two inches below the tail piece). These wheels are placed 8 inches apart, and gear, one into the upper limb and one into the lower limb, of a vertical wheel, which I call the jauns wheel, of like size with themselves, which is fixed upon a proper shaft which runs from this vertical wheel, in such a direction that if produced, it would pass through the centre of the main shaft.—The wheels upon the verge are prevented from moving up and down by proper collars; but they can move round freely upon the verge, until prevented by the means to be hereafter described. It will be seen that the jauns wheel turning in one direction, drives the wheels upon the verge, which are geared to it, in opposite directions. Upon the verge between the wheels before described, I put a chuck or clutch, occupying, within 2 inches, the whole space between the verge wheels. This chuck can be moved up & down upon the verge, but is fixed by wings to the verge, so that it cannot turn round without carrying the verge with it.—There are two pins in each of the verge wheels diametrically opposite to each other, and two inches from the center of the verge. The pins which are in the top wheels project from the wheel downwards, ¾ of an inch, & those in the bottom wheel project upwards ¾ of an inch. There are slots made in the top and in the bottom of the chuck to receive these pins. Round the middle of the chuck a groove is turned ½ an inch broad & ½ an inch deep, to receive two knobs or projections upon the end of a lever, (which I call the locking lever) by which the chuck may be moved up and down as shall be required.

This lever passes from the chuck horizontally 6 inches below the bottom of the under tail piece, in a South direction, curving toward the bearing of the shaft of the jauns wheel; from which it runs Westerly, to a point distant 3½ feet from the under beam, and 2¼ feet from the main shaft and ¾ of a foot from a vertical plane running East & West through the centre of the tail pieces.—The locking lever is made of cast iron, and is about 2 inches square at the fulcrum, but tapers towards its ends.—A crotched stud of cast iron is fixed to the under side of the bottom tail piece, & passes downwards, so as to embrace the locking lever on its two sides, at its middle. A pin passed through the legs of this stud and through the lever horizontally from North to South, serves as a fulcrum for the lever to act upon. A cast iron wheel of 18 inches diameter, and 4½ inches thick, is fixed upon the main shaft 6 inches below the bottom taiil piece.—A groove ¼ of an inch square is cut into the periphery of this wheel.—To understand the direction of this groove, it will be necessary to conceive the circumference of the wheel as divided into 360 degrees. Then supposing the first point of the division to be on the South side of the wheel; the groove commencing here in the middle of the wheel runs East in a horizontal direction round 55 degrees of the wheel. It then runs upwards at an angle of 45 degrees the distance of 1¼ inch and through 6 degrees of the division. It then runs horizontally to the North through 140 degrees more. It then turns down at an angle of 40 degrees and passes the distance of 2 inches running through 13 degrees of the division. It then runs horizontally around the wheel through 140 degrees when it turns upwards and unites to itself at the point from whence (in this description) I have supposed it to commence, making one uninterrupted, but crooked channel round the whole circumference of the wheel.

A lever which I call the groove lever lays along on the South side of the locking lever to which it is fixed by a proper joint 5 inches West of the fulcrum of the locking lever.—This joint permits the groove lever to move in the plane of the horizon about 8 degrees. The Western end of the groove lever passes by the Western end of the locking lever, turning at an angle directly across this last, towards the centre of the groove wheel, the groove of which it enters passing nearly to its bottom. The Eastern end of the groove lever is produced horizontally, under the lower tail piece, until it nearly meets the West side of the lower great beam. A small iron lever is fixed to the great beam in the horizontal plane of the grooved lever by a round pin through its middle part. This lever is crooked at its middle, and one arm points to the South, while the other points directly upwards. From this last part, a rod or chain passes to the North to attach it to the groove lever, and a weight is hung from its other arms, by this means the East end of the groove lever is always pulled by the weight to the South, and the West end kept in the groove.

Under the groove wheel, and fixed upon the main shaft, is a level cog-wheel, the cogs pointing upwards, 2 7/12 feet diameter, and having 132 teeth. This is a horizontal wheel and it drives a vertical jack having 22 teeth, which is fixed upon the West end of the shaft of the jauns wheel. The shaft of the jauns wheel runs in proper boxes fixed in studs of cast iron, depending from the under side of the lower tail piece to which they are bolted.—I fix upon the lower end of the verge, that is between the verge wheels and the floor, a piece of wood which I call the lower eccentric spiral pulley. Its use is to wind up a leather strap which draws the bed and types from West to East.—The length of this spiral pulley is about 6½ inches, so that a strap 2 inches wide, can make about 2¾ turns round it without winding one ply over the other. The form of the face of this spiral, or part which looks toward the horizon in all directions, and which is covered by the strap when wound up, is somewhat cylindrical, having generally a radius of about 3¼ inches. An exception however to this radius and, consequently to the cylindrical form happens at the parts which I call the dead points, which are, first, the lower North point (the spiral being in its place in the machine) & again 2¼ rounds of the spiral above this. At these points the spiral is cut away in an easy curve for about ¼ of a round, so that the strap when it is wound up approaches to within 1 inch of the centre of the verge.

An edging of sheet iron is put upon the spiral, between the turns, so as to prevent the different plies of the strap from interfering with each other. This iron looks somewhat like the head of a screw. A leather strap 2 inches wide and 12 feet long nearly, is fixed to the spiral at its lower dead point. The strap is then passed Eastward and upwards until it reaches a vertical pulley which I fix upon a horizontal shaft, the gudgeons of which run in boxes fixed to the inside of the rail ways near their East ends. The strap is passed from below upwards over this pulley from which it is passed horizontally to the West until it meets the bed (which is now supposed to be under the platen at the West end of the rail way.) The strap is then fastened to the East side of the bed. I likewise fix another eccentric spiral pulley upon the upper part of the verge between the two tail pieces. The lower part of this spiral is upon a horizontal line with the top of the lower beam. This spiral is of the same dimensions and shape as the lower one only that the dead points, or parts cut off so that the strap may approach near to the verge, are in the upper spiral (when it is fixed upon the verge) diametrically opposite to those of the lower spiral. A leather strap 2 inches wide is fixed to the upper spiral about one half of a turn above the upper dead point. It is then wound round the spiral down to its bottom, making about 2¾ turns. It is then passed from the South side of the spiral to the East, and fixed to the bed (which is understood to remain directly under the platen.)

With the preceding apparatus the motions which I have before declared were necessary for the verge to perform the moving of the bed from end to end of the rail way are performed as follows.—Let the mainshaft be turned in the direction from East to South. By the connexion of the wheel work the two wheels upon the verge are driven round, the top one from East to South and the bottom one from South to East. Suppose now, that the end of the groove lever is in the shortest of the horizontal parts of the groove, that the locking lever is therefore horizontal in direction, and the chuck between the verge wheels equidistant from each of these wheels and consequently not locked by the pins with either of them.—On the further revolution of the groove wheel, the part of the groove which crooks upwards, arrives at the end of the groove lever and forces the West end of the locking lever upwards and, consequently its East end downwards which carries the chuck with it.—The pins in the lower verge wheel, then fall into the slots in the chuck, the chuck is carried round by the lower verge wheel and carries with it the verge. This carries the lower dead point of the lower eccentric spiral pulley, to which the lower strap is fixed, from North to West, winding up the strap, and consequently pulling the bed from West to East, the upper spiral unwinding its own strap as fast as the lower spiral winds up. Having made 2¼ revolutions the groove will have arrived at the part which crooks downwards & passing on will force the West end of the locking lever downwards, & its East end upwards.—This carries the chuck on the verge up, releasing the pins of the lower wheel and locking into those of the upper one, which turning in an opposite direction, reverses the direction of the revolution of the verge. By this operation the winding and unwinding of the straps is also reversed so that the bed which has been carried about 3 9/12 feet to the East, is, now by the winding up of the upper strap returned from East to West & carried under the platen.—The verge having made 2¼ revolutions in this new direction, the last angle of the groove will have arrived at the end of the groove lever which will force the West end of the locking lever upwards & the East end downwards far enough to slip the chuck from the pins of the upper verge wheel. The verge then rests & also the bed and its appendages, until the shortest of the horizontal parts of the groove has passed over the end of the groove lever which by my divisions is equal to 55/360ths of a revolution of the groove wheel.—The same operations are then repeated.

All these motions have a certain relation to each other in the order of succession in which they take place, and likewise a relation to the time in which the impression is given.—In order to produce the motions in their regular times and relations it is necessary to place the groove wheel upon the main shaft in such a manner that the shortest horizontal part of the groove, may just arrive at the end of the groove lever at the moment that the cam first presses upon the impression slide. And it is likewise necessary to lock the teeth of the jauns wheel to those of the verge wheels, in such parts of their circumference, that the pins in the verge wheels shall be at the proper place to slip into the slots in the chuck of the verge when the chuck is moved up & down by the operation of the apparatus attached to it.—

4th. The paper is conveyed to its place for the impression by the following apparatus.—I make two slides, which I call the frisket slides, 4 11/12 feet long, 1 inch wide & 3/8 inch thick of iron. These I place horizontally with the edges looking up and down, one upon the North and one upon the South side of the bed. Two pieces of iron (having an oblong hole in each) being fixed to the bed to receive the slides. These slides can thus slip in the holes or boxes in which they are placed 2½ feet from East to West or contrary-wise. To the West end of each of these slides, I rivet two pieces of iron 3¼ inches long 1 inch wide and 3/8 inch thick. These pieces point upwards from the slides at a right angle, and their tops rise 1½ inch above the upper face of the bed. I make through each of these pieces 1 inch above the face of the bed, a hole ½ an inch in diameter.—Having made a frame of iron which I call the frisket and which is of the size & shape of the frisket of a common printing press, I fix to two of its corners on the same side, two gudgeons about 2 inches long. These I put into the holes before described in the ends of the slides.—If we now suppose the slides run to the East until their end pieces strike the irons on the West side of the bed, and (supposing the form of types to be in its place upon the bed) the frisket can now be let down so as just to cover the chase, the several sides of which are under and parallel to the corresponding sides of the frisket.

To each of the East corners of the frisket, I run out to the North & South a piece of iron 3 inches long and 3/8 inch square, which I call the lifting studs.—I likewise run from the East to the West sides of the frisket, across the middle of its open rectangle, a strip of iron to which I fix two points, which point upwards, of a proper size for register points. I fix to each cheek of the press frame upon the North [should read East] side and ¾ of an inch above the plane of the face of the bed, a bar of iron 2 3/12 feet long, 1 inch wide and 3/8 of an inch thick. These bars run North, [should read East] horizontally 6 inches, they then turn upwards, at an angle of 18 degrees & their North [should read East] ends rest upon the top of the roller jambs (which will be hereafter described). I unite these two bars together by two cross bars running from North to South upon their under sides. The most Westerly of these cross bars is at least 10 inches from the cheeks of the press. The rectangular space between the four bars, thus arranged, I cover by a sheet of iron rivetted to the upper sides of the cross bars.—The thing here described I call the apron. As it requires to be removed from the press sometimes, it is not fixed permanently to the cheeks, but so that it can be removed.

I connect to the West side of the frisket, a folded or doubled cloth of cotton or like fabric 26 inches square. The two corners of this which remain loose after it is fixed to the frisket, I raise vertically upwards, and stretch apart by a stick.—I then unite each corner to lines which are passed over pulleys near the ceiling of the room & their other ends tied to small weights 2½ feet below the pulleys. I put a blanket or blankets between the folds of the tympans. The frisket slides must be prevented from running to the East further than to bring their West ends clear of the East side of the platen, by two posts, which support the East end of the rails. These posts run up above the rails 4¼ inches, and near the top of each a vertical pulley is attached. I pass a line 2 8/12 feet long, over each of these pulleys, and having fixed the West end of each line to the East end of a frisket slide on the side of the press corresponding with the line I fix to the other end of each line a weight of 7 lbs. The weights hang near the floor when the frisket slides are in their most Easterly position to which the weights constantly tend to draw them. The frisket must be covered with stout paper and divided into pages in the usual way. The lifting studs (of the frisket) are made to run upon the top sides of the side pieces of the apron.—

From the preceeding description it will be perceived that when the frisket is in its most Easterly position and laying over the apron if a sheet of paper be laid upon it, when the bed is carried from East to West, it will carry the frisket and sheet to be printed with it under the platen, and the sheet will there, by the operation of the platen which has already been described, be printed or impressed, after which, when the bed returns from West to East, the weights attached to the frisket slides, will draw the slides together with the frisket and sheet, to the East until the East ends of the slides strike the posts before described, at the East end of the rails. The frisket as it slides Eastward on the top of the apron lifts the sheet from the types. The sheet being removed and an unprinted one put upon the frisket, the operations before described are repeated. The frisket moves from East to West 1 10/12 foot, but the bed moves 3 9/12 feet, consequently the frisket is left motionless upon the top of the apron a sufficient time to exchange the sheets.

5th. The inking apparatus.—I fix upon the outside of each rail 1 5/12 foot East of the lower beam a piece of cast iron which I call a jamb.—The rails being but 2 1/3 feet apart on their outsides it is necessary that the jambs should run out horizontally each way 2 inches, to permit the bed to pass between their upper parts. They then turn up at a right angle & rise vertically 12 inches. They are 12 inches wide from East to West, and ½ an inch thick. I put between the jambs (their axis running North and South.) four rollers, three of which are 3 inches in diameter & covered with skin, or with composition, such as is in common use for inking rollers in England, & the other is made of wood and 2¼ inches in diameter. Two of these soft rollers lay side by side, without touching each other, their under sides being at such a height in the jambs as just to press lightly upon the face of the types, when the bed & form are passed under them. The other soft roller is placed directly over the most Easterly of those before described, but so high as not to touch them. The wooden roller is placed directly over the space between the lower rollers so as to be in contact with all the soft rollers. The gudgeons of all the rollers run in proper boxes screwed to the jambs. The rollers occupy the Western part of the space between the jambs.

I fix upon the wooden roller nearest the North end a cog-wheel the diameter of which measured upon the dip line of the cogs is just equal to the diameter of the roller. This wheel is driven by another small spur wheel (nearly under it) which turns upon a pin fixed upon the inside of the North jamb. The last described wheel is turned by a rack 5 feet long, the teeth of which point upwards, fixed upon the North side of the bed. The rack is fixed by such a part of it to the bed, as to bring its East end nearly under the wooden roller, when the bed is under the platen, and its West end when the bed is in its most Easterly position.—The ink is supplied from a fountain which has the appearance of an iron box 2 1/6 feet long and 2 inches deep and 3 inches wide, the top and West side being taken off and an iron roller supplying the place of the West side.—This iron roller is 2 feet long between the gudgeons and 2 inches in diameter and it is placed against the iron box or body of the fountain so that a horizontal plane, passing through its axis, will intercept the bottom of the box or fountain. The gudgeons of the fountain roller here described revolve in the ends of the iron box or body of the fountain, a cap upon their West sides keeping them in place.

These ends pass downwards below the roller 4 inches & near the bottom of each, an arm is fixed passing outwards both ways. The ends of the arms are formed into gudgeons which are placed in holes, one in each jamb, & constitute the axis on which the fountain can be rolled through a small arc from East to West—thus the fountain occupies the space between the jambs East of the inking rollers, & it is put at such a height between the jambs, that a plane drawn horizontally through the axis of the uppermost inking roller, will pass through the axis of the fountain roller.—The space between the West side of the fountain roller, and the East side of the upper inking roller is (when the fountain is back or in its most Easterly position) about 1 inch, the rollers laying parallel to each other.—The fountain thus described is like those used upon the English printing machine invented by Mr. Rutt. I fix upon the South end of the gudgeon of the fountain roller (which projects beyond the end of the fountain to receive it) a ratchet or rag wheel. A proper pall or dog hand is fixed upon the South jamb so as to fall into the notches upon the top of the rag wheel. The standing parts of the notches upon the top of the rag wheel look towards the West, and the notches slant to the East in the direction of the chord of an arc.

An iron bar is firmly fixed to the arm which runs from the South end of the fountain to the South jamb; this bar runs from the arm downwards, nearly to the plane of the top of the rails. An iron slide passes from the above described bar at its West side and near its lower end, ["end" underlined and "stop" penned in the margin] Westerly through the lower South corner of the open rectangular space comprised between the cheeks and beams of the press frame, to the West side of the lower beam & projecting West of it about 2 inches. The West end of this slide is covered by another iron bar which I call the vertical hinge which passes from it downwards, & is fixed by a hinge joint to the press frame near the floor. Another iron bar which I call the horizontal hinge, is fixed by a screw bolt passing through its end, and likewise through the vertical hinge near its middle from whence the horizontal hinge passes Northerly over the top of the lower tail piece to near the end of the lower beam of the frame to which it is fixed by a hinge joint.—A slide runs from the West side of the horizontal hinge just over the upper side of the lower tail piece, until it almost reaches the cam shaft. A steel pin projects from the cam shaft in a line directly under the cam and at such a part that when the cam revolves the pin will push the last described slide to the East. The slides are prevented from moving laterally by proper boxes fixed upon the lower beam and the lower tail piece.

An important part of the inking apparatus is the revolving table. I fix to the East side of the bed, a light frame of iron which runs out from the bed 1¼ foot to the East.—The upper side of the frame is 2½ inches below the face of the bed from which it is properly braced. The revolving table is 28 inches in diameter. It is made of wood and its upper face is a circular disc. A round iron axis 1 inch in diameter passes downwards from its centre 6 inches. This axis passes through a vertical hole near the Easterly part of the frame just now described as fixed to the bed. A shoulder is turned upon the upper part of the axis which rests upon the upper side of the frame, & prevents the table from falling down too low. When the table is in place its upper face should be horizontal & just as high as the face of the types upon the bed. A light rag wheel 18 inches in diameter is fixed upon the under side of the revolving table. 1¼ inch below it and parallel and concentric with it. A dog hand or catch is fixed to one of the rails of the press frame by a hinge joint in such a place and position that it will catch into the teeth upon the side of the rag wheel when the bed and consequently the revolving table is brought into its most Easterly position. The dog hand or catch is brought so as to catch the teeth by a spring and prevented from passing too far by a stop screwed upon the press frame.

To understand the manner in which the inking apparatus operates, we will suppose that the fountain is filled with ink, that the rollers and top of the revolving table are covered with a thin coat of it, & that the cam shaft is made to revolve & consequently the bed & types, to take up a reciprocating motion upon the rail ways.—When the steel pin in the cam shaft, strikes the slide (belonging to the inking apparatus) and shoves it to the East. This brings the top of the inking fountain to the West, but as the pall upon the South jamb prevents the top of the rag wheel on the fountain roller from moving with the fountain, the fountain roller is constrained to run round a few degrees upon its axis.—By this means some of the ink which adheres to the roller, is carried with it out of the fountain in a thin sheet (the remainder being kept in the fountain by the iron bottom.) During this operation the fountain passes to the West, brings the fountain roller in contact with the uppermost inking roller & in this manner the inking rollers are supplied with ink.—When the bed begins to pass to the Eastward the inking rollers by reason of their connexion by the cog-wheels, as before described, with the rack, are made to revolve, the under sides of the two lowermost ones passing towards the East. They are at first in contact with the revolving table, but after the bed & table have passed over part of the rail way they come in contact with the types & impart some of the ink from their surface to the face of the letter, and a still further quantity when the bed passes from East to West. When the bed & table are at their most Easterly positions, the catch, which has been described as hinged to the rail way, catches into the rag-wheel fixed upon the under side of the revolving table and when the table returns to the West this causes it to revolve in a greater or less degree.—By this means when the table comes again in contact with the inking roller, the points which before came in contact with certain points of the roller, come now in contact with other points. By the above operations the ink is supplied and distributed evenly upon the types. To get a sufficient quantity of ink upon the roller, on commencing work it is necessary to let the press run awhile without taking impressions.—After this the fountain roller supplies each time it comes in contact with the inking rollers as much ink as is taken off by inking the types.—The fountain may be regulated to supply more or less ink at pleasure by screwing or unscrewing the caps which keep the fountain roller in its place to the fountain.

6th. Throwing out of gear. Upon the middle of the West side of the lower great beam, I fix a crotched piece of cast iron which I call the hold fast, the open part of which resembes in its appearance a boot jack.—It is so fixed upon the beam that the two horns point to the South, one being directly over the other. The Eastern end of the groove lever (as was said in a former part of this specification) approaches very near the West side of the great beam, and consequently it can be thrust to the North, so as to enter between the horns of the hold fast. I fix upon the West side of the South cheek of the frame vertically an iron lever 3 feet long, its fulcrum being a pin which is put through the middle into the frame, and which allows it a free revolving motion from North to South and the reverse. I fix by a moveable joint to the lower end of this lever (which is in the horizontal plane with the upper side of the hold fast) an iron bar which runs to the North, parallel with the lower great beam, and on the North end of the great beam a box is fixed in which the before described horizontal bar slides.—A bar of iron which I call the foot, which is about 8 inches long, firmly fixed to this horizontal bar, passes downwards from it at its middle part. The foot is curved a little, its concave side looking North, and it is always upon the South side of the groove lever, the hold fast being upon the North. It will be perceived that if the top of the vertical lever, first above described, be pulled towards the South, the slide bar & foot will be carried to the North, and carry before it the East end of the groove lever, the weight (described in a former place) rising at the same time. The East end of the groove lever will thus be thrust between the horns of the hold fast, and these are so fixed as to guide it to a horizontal position. By this means the West end is brought out of the groove and the chuck or clutch upon the verge is unlocked from the pins in the verge wheels. In this state of things the revolution of the cam shaft does not turn the verge nor move the bed. When it is desired to throw the groove lever into the groove, the bed should be drawn under the platen, and (watching the revolution of the cam shaft) the East end of the groove lever should be suffered to slip from the hold fast, just as the cam meets the slide to give an impression.

A lever is hung directly under the ceiling or roof of the room, by a moveable joint near its middle.—The West end of this lever is directly over the slide which passes from the cam to the toggle joint, and is fixed to it at a point 1 foot from its West end, by a rod or chain, the East end of the lever is brought directly over the left hand of the pressman.—A rod having a proper handle hangs down from this end of the lever—Nothing more is required than to pull the above rod downwards, (when it is desired to stop taking impressions) this raises the end of the slide higher than the face of the cam, which therefore passes under it without thrusting it forward. The slide is kept out of its working place by hooking the aforesaid rod to a pin in the South cheek of the press.

... I understand my invention to consist.—

1st of the combination and arrangement of the cam shaft, cam and slide, with the toggle joint & platen to produce the impression.

2nd I have taken the old combination of the verge, three wheels, chuck or clutch, pins & locking lever, and invented a combination of them with the eccentric spiral pulleys, and the bed. And ... a combination of these with the main shaft ... the peculiar groove wheel . . .

3rd I have invented the combination of the frisket with its slides … apron … and … manner of arranging the tympan and blankets with them.

4th … the combination of the rag-wheel with the fountain roller, and likewise that of the hinges and slides, by which the fountain roller is turned, and likewise brought into contact with the inking roller. . . . [and] combined with the inking rollers, the revolving table and its appendages.

5th I have invented [the throw-offs].

6th I have combined [all the various] combinations into a general combination, in which they all have a certain dependence upon, and relation to, each other, necessary for the due performance of the whole.

[January 28, 1826] Daniel Treadwell. Witnesses: Jason Braman, W. Whiting.

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The author is a retired
letterpress journeyman.
He resides in Alaska
and South Asia.

Plane Surface Press
Ketchikan Darjeeling Kathmandu