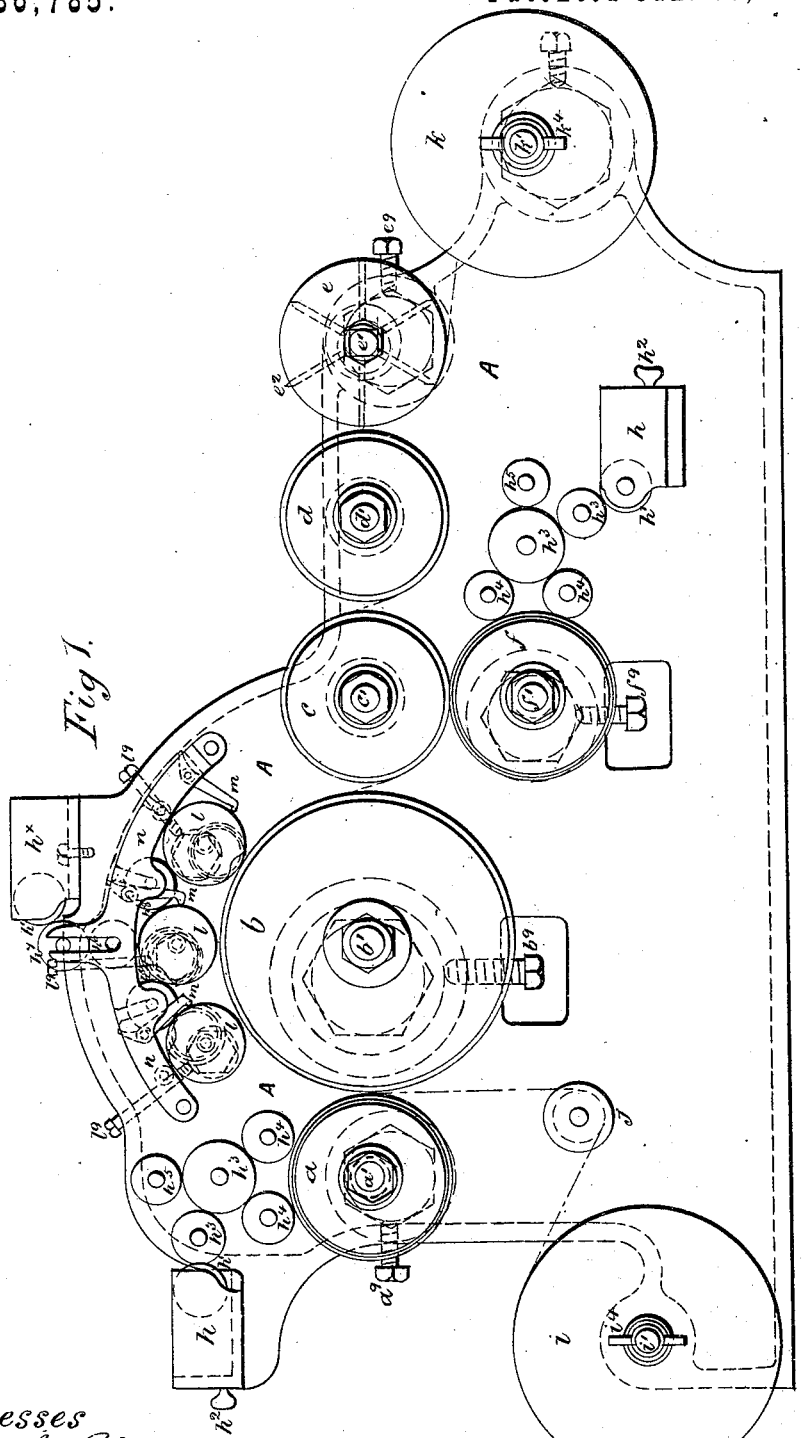
3 Sheets—Sheet 1.

E. BEECH.

PRINTING-PRESS.

No. 186,785. Patented Jan. 30, 1877.

Fig 1.



Witnesses
Peter J Livsey
Joanes Wood

Inventor
Elijah Beech.

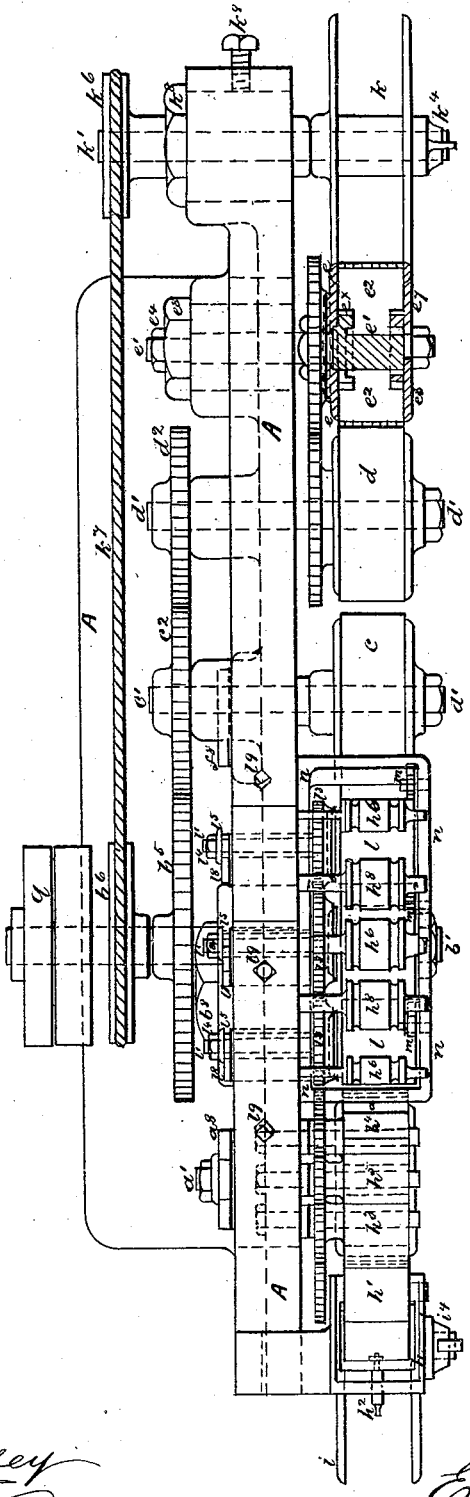
3 Sheets—Sheet 2.

E. BEECH.

PRINTING-PRESS.

No. 186,785. Patented Jan. 30, 1877.

Fig 2



Witnesses
Peter J Livsey
James Wood

Inventor
Elijah Beech.

3 Sheets—Sheet 3.

E. BEECH.

PRINTING-PRESS.

No. 186,785. Patented Jan. 30, 1877.

Fig 4.

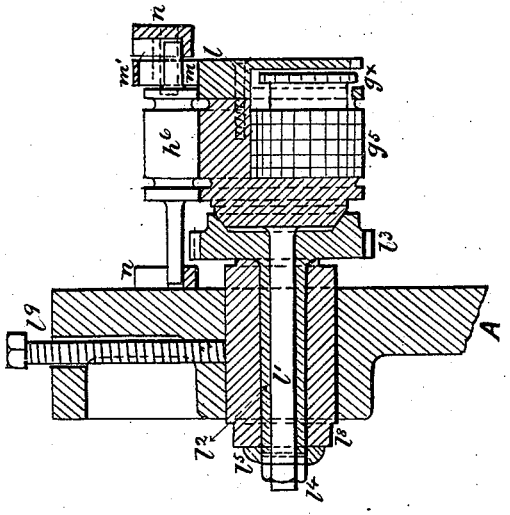


Fig 3.

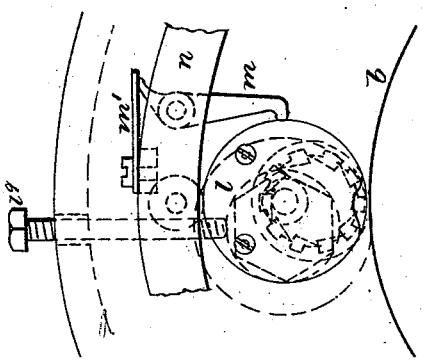
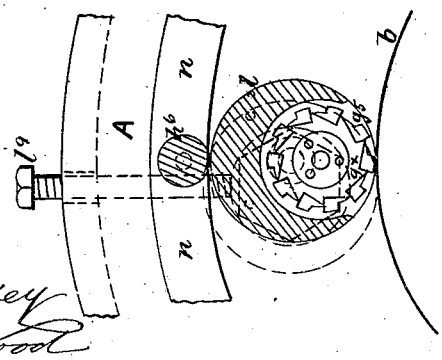


Fig 5.



Witnesses
Peter J. Livsey
James Wood

Inventor
Elijah Beech.

UNITED STATES PATENT OFFICE.

ELIJAH BEECH, OF MANCHESTER, GREAT BRITAIN.

IMPROVEMENT IN PRINTING-PRESSES.

Specification forming part of Letters Patent No. **186,785**, dated January 30, 1877; application filed April 4, 1876.

To all whom it may concern:

Be it known that I, ELIJAH BEECH, of the city of Manchester, in the county of Lancaster and Kingdom of Great Britain and Ireland, have invented an Improvement in Machines for Printing, Numbering Consecutively, and Perforating, of which the following is a specification:

My invention has for its object machinery whereby subject-matter and progressive numbers may be continuously printed upon rolls or strips of paper, card, or other suitable material, which may be also perforated or divided by the machinery into suitable lengths for checks or other documents.

The invention herein described is one of those for which Letters Patent were granted to me for Great Britain and Ireland, dated the 16th day of April, A. D. 1875.

My invention consists, principally, in the combination, with a numbering-drum, of a set of numerical disks or rings, mounted in said drum eccentric to its axis, and projecting through one side of the same; second, in the combination, with a numbering-drum having a cam-shaped outer edge, of numerical disks or rings, mounted eccentrically in said drum, and projecting through one side of the same, and the ratchet and pawl for moving the disks or rings in the drum; and, further, in the combination, with the main impression-drum, of the numbering-drums, the numerical disks or rings in the said numbering-drums, the subject-matter, impression, and perforating-drums, all as fully hereinafter explained.

I have designed to apply the first part of my invention by combining to work together several sets of the disks, each on a separate axis of rotation, so as to print upon the same strip or roll of paper or other material, as it passes round or partly round the same or a separate impression cylinder or cylinders, either numbers in consecutive, duplicate, or triplicate, or so on, order or series, and the disks are or may be arranged so that one will print, if three sets are used, say, numbers 1, 4, 7, 10, and so on, (every third number,) and another numbers 2, 5, 8, 11, and so on, and another numbers 3, 6, 9, 12, and so on, as well as duplicate and other numbers in the same manner. By this means several numbers can be consecutively printed on the length of strip or roll in the space between the numbers printed by one set of disks, and thus shorter documents may be made with sets of disks of comparatively large circumference, and the numbers can be arranged to come on any required part of the lengthway of the roll or strip being printed. When two, three, or more sets of disks are employed, as above described, the units-disks are moved two figures at a time when two sets of disks are employed, three figures at a time when three sets of disks are employed, and so on; but the units-disk need only be moved one figure at a time, if the figures are arranged in the following order, namely: for numbering consecutively with two sets of disks, the units-disk of one set is figured 1, 3, 5, 7, 9, 1, 3, 5, 7, 9, and the other 2, 4, 6, 8, 0, 2, 4, 6, 8, 0, and the tens-disk is moved twice during each revolution of the units-disk—that is, during that movement which takes place immediately after printing the figure 9 by one set of disks, and after printing the figure 8 by the other set of disks. When three sets of disks are used for consecutive printing, the units-disks are figured as follows: 1, 4, 7, 0, 3, 6, 9, 2, 5, 8, and in starting to number, one set of disks is set at 1, the next at 2, and the next at 3. The units-disk of each set is arranged in this case to move the tens-disk when the movement takes place immediately after printing the figures 7, 8, and 9. In numbering consecutively with four sets of disks, each set rotating on a separate axis, the units-disk of the first and third set of disks is figured in the following order: 1, 5, 9, 3, 7, 1, 5, 9, 3, 7, and the units-disk of the second and fourth sets of disks is figured 2, 6, 0, 4, 8, 2, 6, 0, 4, 8, and in commencing to number the first set of disks is set at the figure 1, the second set at the figure 2, the third set of disks at the figure 3, and the fourth set of disks at the figure 4, and the units-disk of each set of disks is arranged to move the tens-disk in the first and third set of disks at that movement taking place after printing the figures 7 and 9, and for the second and fourth sets of disks after printing the figures 6 and 8.

I have also designed to use my invention in numbering duplicate or triplicate, and so on, by arranging so that the impressions are printed in the same line simultaneously, or

thereabout, which is accomplished by two or more sets of disks, arranged side by side, to revolve on the same axis or shaft, each set of disks in a different rotating plane, the figures of each set of disks being arranged the same as for consecutive numbering by a single set of disks.

My invention, as far as it relates to the arrangement of the figures of the numerical disks, and of actuating them, is carried into effect by arranging the sets of disks and engraving figures upon their rings, to accomplish the objects referred to, in the order hereinbefore described, and by arranging the ordinary spring and pin, or two or more springs and pins, to be carried by the units-disk, to move the tens in each case at the figures hereinbefore mentioned.

In some cases there need be only one spring-pin in each units-disk, (as in ordinary numerical disks;) but this spring-pin is acted upon by several separate cam-surfaces, (each of the ordinary form,) there being one cam-surface for each time the units-disk is to act upon the tens-disk during one revolution of the units-disk, such cam-surfaces being placed at those points in the revolution of the units-disk at which its spring-pin is to act upon the tens-disk. For instance, in numbering in consecutive order with two sets, duplicate order with four sets, and triplicate order with six sets of disks, when the units-disks of the set or sets of disks having odd figures are numbered 1, 3, 5, 7, 9, 1, 3, 5, 7, 9, and the units-disks of the set or sets of disks having even figures are numbered 2, 4, 6, 8, 0, 2, 4, 6, 8, 0, one spring-pin may be used and two cam-surfaces. For consecutive numbering, say with four sets of disks, with the units-disk of the set of disks with odd figures, viz., 1, 5, 9, 3, 7, 1, 5, 9, 3, 7, and the units-disks of the sets of disks having even figures, viz., 2, 6, 0, 4, 8, 2, 6, 0, 4, 8, one spring-pin only may be used with two cam-surfaces. But in using sets of disks with the units-disk numbered with both odd and even numbers, viz., 1, 4, 7, 0, 3, 6, 9, 2, 5, 8, three pins must be used in each units-disk, all actuated by passing one cam-surface.

The manner of carrying my invention into effect is illustrated by the drawings.

Figure 1 is a front elevation, and Fig. 2 is a plan view, of a machine according to my invention; and Fig. 3 is a front view, and Fig. 4 a longitudinal section, and Fig. 5 a cross-section, of parts detached, hereinafter described.

i is the drum for the web of paper or other material to be printed; *j*, guide-roller, under which the paper passes before going to the subject-matter drum; *a* a^1, shaft for same; *b*, large impression-drum, and b^1 its shaft; *c'*, shaft, and *c* second impression-drum; *d'*, shaft, and *d* elastic-surfaced drum for perforating-drum *e* to act against; f^1, shaft, and *f* drum for back subject-matter; k^1, shaft; k^4, screw, and *k* drum for winding up the printing and perforating web; and *h*, cistern; h^1, h^3, and h^4, inking-rollers, and h^5 lateral distributing inking-roller. All the parts above referred to, from the drum *i* to the last-named roller, are constructed, mounted, and arranged substantially as explained in the specification of another application for a patent of the same date as this application, except where modified as hereinafter described.

The axis of the drums *a*, *b*, *e*, *f*, and *k* are each fitted to rotate in a bearing formed in an eccentric fitted in the frame-plate, and the axis of the drums for the numerical disks are arranged in like manner. The eccentrics for these bearings are each formed at one end with six sides, so as to be turned, when adjustment is required, by a screw-key, and are secured when adjusted, in each case, by a set-screw. The eccentrics are marked a^8, b^8, e^8, f^8, and k^8, respectively, and their set-screws a^9, b^9, e^9, f^9, and k^9, respectively. Three sets of numerical disks, carried by drums *l*, are shown; but one, two, or more may be used. The axis upon which the numerical disks rotate is placed parallel, but eccentric, to the axis by which they are carried round for printing.

Fig. 3 is an end view; Fig. 4, a longitudinal section, and Fig. 5 a cross-section, showing the arrangement of one set of numerical disks. The disks g^5 are placed on an axis in the cavity of a drum, *l*, so that the line of figures to be printed will come in a line with the periphery of the drum *l*. The drum *l* has a shaft, l^1, which fits a hollow shaft, l^2, that has the driving-wheel l^3 upon one end, and the drum *l* and wheel l^3 are secured together by a screw, l^4, at the end of the shaft l^1, which screws against a washer, l^5, at the end of the hollow shaft l^2. By means of the screw l^4, a cone formed upon the drum *l* is drawn tightly into a cone-cavity formed into the wheel l^3. By this arrangement the drum *l* can be readily turned round, to adjust it exactly as required, without ungearing the wheel l^3. This arrangement for adjustment is also used for the two subject-matter cylinders *a* and *f*, and for the perforating-drum *e*, except that the hollow shaft, in that case, does not pass through the bearings. The ratchet-wheel $g^\times$ for each set of numerical disks is actuated by a pawl, *m*, jointed upon a frame, *n*, secured to the frame-plate A. One-half of the end of the pawl *m* is shaped like an ordinary pawl, to enter ratchet-teeth; the other half is rounded, to rest against the outer edge of the drum *l*, which is shaped to act as a cam. A spring, *m'*, secured to the frame *n*, and acting upon a tail from the pawl, keeps the round half of the end of the pawl against the cam-surface, which is shaped to allow the ratchet half of the pawl to approach and take hold of and turn the ratchet one or more teeth, as required, and then to withdraw it from the ratchet.

The periphery of the drum or partial drum *l* is either not cylindrical, or if a perfect circle, is not concentric with the axis of rota-

tion, but is either of smaller radius than the line in which the figures print, or is of smaller radius and eccentric, or of cam-like shape, so that no part of the drum-surface except the outside rings at the printing-line will touch the impression-drum *b* when rotating. It will be seen in Fig. 1 that the third numerical drum is supposed to be printing, and is shown in contact with the impression-drum *b;* but the first and second numerical drums do not touch the impression-drum, as they are not supposed to be printing at the same time as the third numerical drum.

The figures of the disks carried by the numerical drums *l* are supposed to be inked by a roller, h^7, which rests upon the numerical drum *l*. The middle part of the roller h^7 receives the ink, which is distributed evenly by contact with the middle portion of the drum *l*, the entire circumference of the middle part of which acts as a distributing-surface, except that segment which is cut away to make room for the numerical disks g^5. There are grooves cut in the numerical drums *l* and the inking-rollers h^7, as shown in Figs. 3 and 4, which grooves prevent the ink from accidentally spreading to the side on each side of the middle parts of the drums and rollers. The inking-rollers h^7 are carried by resting upon the surface of the drum *l;* but where this is cut away, the two end parts of the rollers rest upon the ring of the drum at each side of the numerical disks g^5, as shown, the surface of which is made slightly below the surface of the figures to be inked, so that the inking-surface of the roller will come fully in contact with the figures when they pass the inking-rollers. The inking-rollers, as shown, rotate in slotted bearings in the frame *n*, and are supposed to be rotated by frictional contact with the drum *l* and its end rings; but to make the driving positive, the rollers may be geared same as the inking-rollers for the subject-matter drum.

The ink is conveyed to the numerical drums and rollers from a cistern, $h^\times$. (Shown in Fig. 1, but which is not shown in plan, Fig. 2.) This cistern is fixed on the framing, as shown, and the ink is conveyed from the roller h^1, by the roller h^7, to a roller, h^6, which inks the figures and also inks the drum-surface, that gives it to the intermediate rollers h^8, placed between the drums, which rollers ink the figures of the drums *l*, with which they are in contact, and transmit the ink from such drums *l* and to their rollers h^6. The distributing-surface of the drums *l* may be dispensed with, and the inking-rollers may rotate in bearings or upon studs, and the ink may be conveyed to the inking-rollers shown in Fig. 1 by intermediate rollers or a separate inking-cistern, and carrying-rollers may be used for each numerical drum. With one numerical drum in use, consecutive numbers, or consecutive series of numbers with numbers omitted, such as 1, 3, 5, and 7, or 1, 4, 7, 10, and so on, may be printed at each rotation upon each length of web equal to the circumference in which the surface of the printing-line of figures rotate, and with two numerical drums, *l*, in use, duplicate numbers may be printed, and with three numerical drums triplicate numbers, and so on, may be repeated within the length of web above mentioned. But in the same length of web above mentioned, two, three, or more consecutive numbers may be printed, and in duplicate or triplicate, according to the number of numerical drums employed, giving their impression upon any desired part of the lengthway of web being printed. As shown by Figs. 1 and 2, the three numerical drums are supposed to be printing consecutive numbers, three numbers in a length of web equal to the circumference described by the face of the printing-line of figures at each rotation of the drum *l*, which length may thus be formed into three separate tickets or documents, which may be made as small as desired by using a sufficient number of numerical drums, which need not be of small diameter.

As shown in Fig. 1, the third numerical drum—that farthest from the entering side of the web being printed—is supposed to be in the act of printing, and by the time this drum is advanced one-third of a revolution the second drum *l* will be in the act of printing, and by the time the second third of a revolution of the third drum has been completed the first will have printed, and on completion of the revolution of the third drum *l* it will print again. The third drum *l* prints 1, 4, 7, and so on, the second 2, 5, 8, and so on, and the third 3, 6, 9, and so on. The axis of each numerical drum *l* rotates in a bearing formed in an eccentric, l^8, as described in reference to the drums *a* and *f*. By partly rotating this eccentric bearing the figures may be made to press more or less upon the web passing over the impression-drum *b;* or the numerical drum *l* may, when required, be withdrawn clear of the impression-drum *b*, which can also be withdrawn from all the numerical drums at the same time, if required.

Instead of rotating eccentric bearings, sliding bearings with screw adjustment may be used, if desired.

The studs for the inking-rollers for each subject-matter cylinder and the ink-cistern may all be secured to, or upon, or in, a plate or bracket, which may be secured, so as to be adjustable, to the frame-plate by a bolt or bolts passing through a hole or slot in the frame-plate.

The perforating-drum *e* is formed with a hollow center, and with radiating slots for thin pieces e^2 of steel, (one in each slot,) with the outer ends formed into teeth, and their inner ends to come against a cam-stud, e^1, and with projections at each side to come into cam-grooves. The groove is formed on one side in a collar, $e^\times$, upon the stud e^1, and for the other side into a groove formed between the stud e^1 and a disk, e^6, with a projecting

boss secured upon a square upon the end of the stud e^1 by a screw, e^7, as shown. The stud passes through the eccentric bearing e^3, and is secured to it by a screw-nut, e^4, and thus remains stationary, while the drum e rotates round the stud e^1, and the cam or eccentric shaped body of the stud pushes the ends of the slides outward when the perforators are coming toward the drum d, against which they act, and the cam-grooves draw the perforators inward. The disk e^6 keeps the perforators e^2 in their places in the drum e.

q are the fast and loose driving-pulleys for driving the machine by a belt. b^6 is a pulley upon the shaft b^1, for driving, by a band, k^7, the pulley k^6, secured on the winding-up drum-shaft k^1, by turning the eccentric bearing k^8, of which the tightness of the band k^7 may be regulated.

The web to be printed passes from the drum i, under the guide-roller j, between the subject-matter drum a, the numerical drums l, and the impression-drum b, under the impression-drum c, and between it and the second subject-matter drum, f, over the drum d, and between it and the perforating-drum e, and onto the winding-up drum k.

I claim as my invention—

1. The combination, with the drum l, of a set of numerical disks or rings, mounted in the said drum eccentric to its axis, and projecting through one side of the same, substantially as described and shown.

2. In a machine for printing, numbering, and perforating webs or rolls of paper, the combination, with the impression-drum b, of the drums l, the disks g^5 in the said drums, and the drums a, c, d, e, and f, all constructed and arranged substantially as described and shown.

3. The combination, with the drum l, having its outer edge cam-shaped, of a set of numerical disks or rings, g^5, mounted eccentrically in said drum, and projecting through one side of the same, the ratchet $g^\times$, and the pawl m, substantially as described and shown.

In witness whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ELIJAH BEECH.

Witnesses:

PETER J. LIVSEY,
Queen's Chambers, Market Street, Manchester.

JAMES WOOD,
Queen's Chambers, Market Street, Manchester.