(No Model.) 3 Sheets—Sheet 1.

J. M. BLACK.

NUMBERING MECHANISM.

No. 381,105. Patented Apr. 17, 1888.

FIG. 1

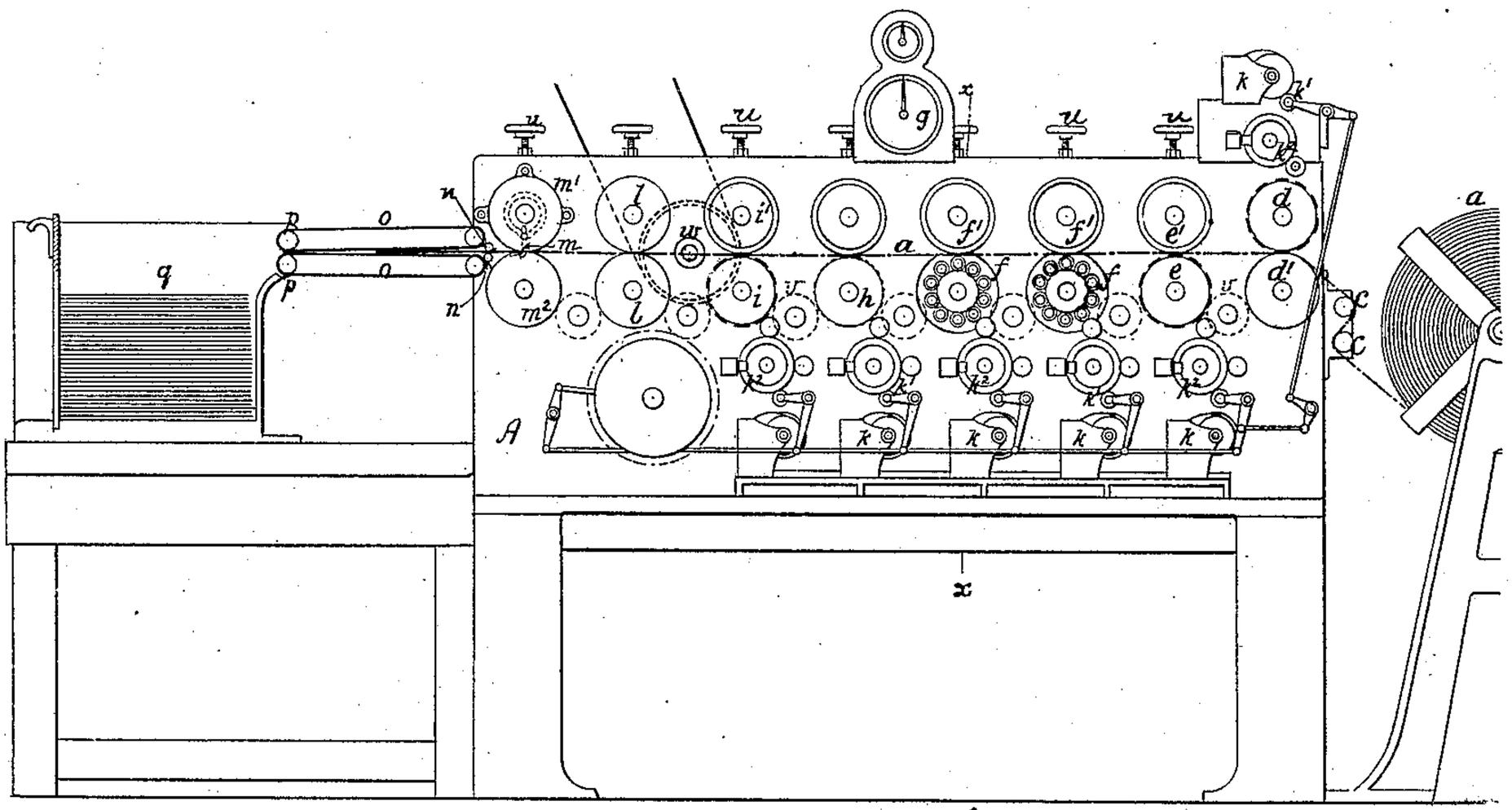


FIG. 5c

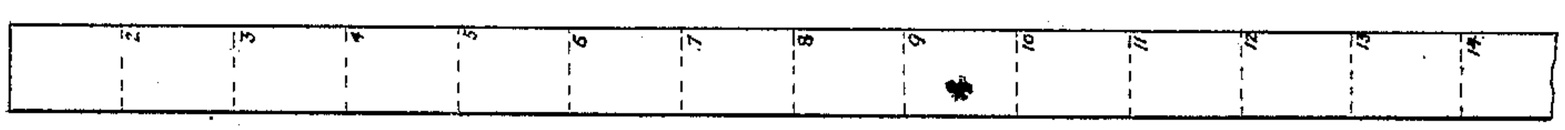


FIG. 2.

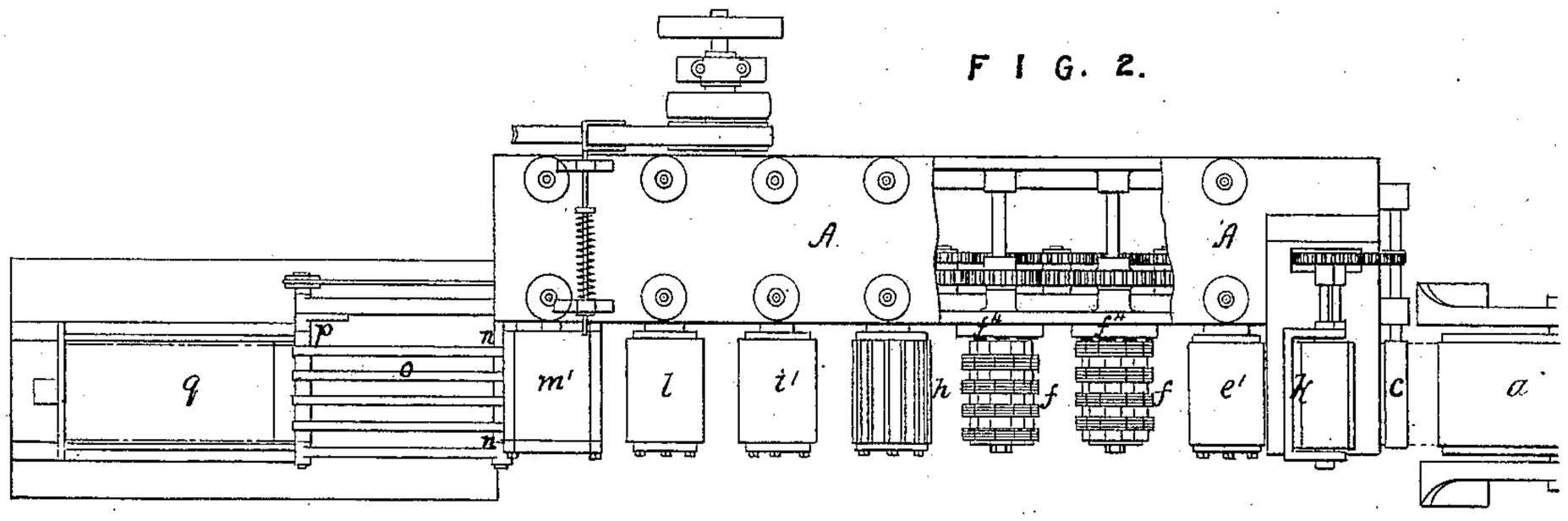


FIG. 3.

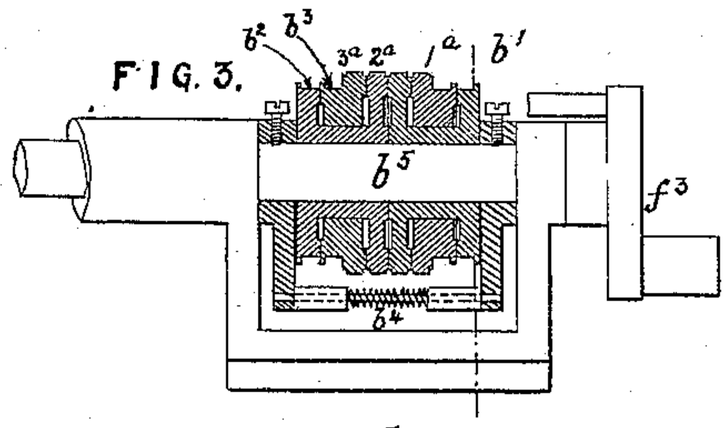


FIG. 3ª.

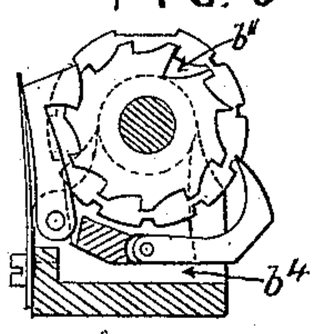
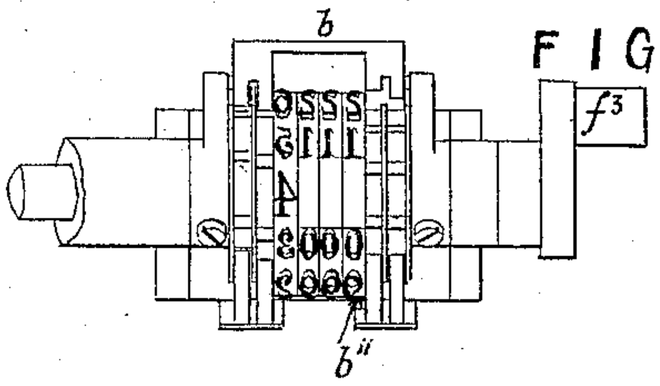


FIG. 3b.



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(No Model.) 3 Sheets—Sheet 2.

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NUMBERING MECHANISM.

No. 381,105. Patented Apr. 17, 1888.

FIG. 4

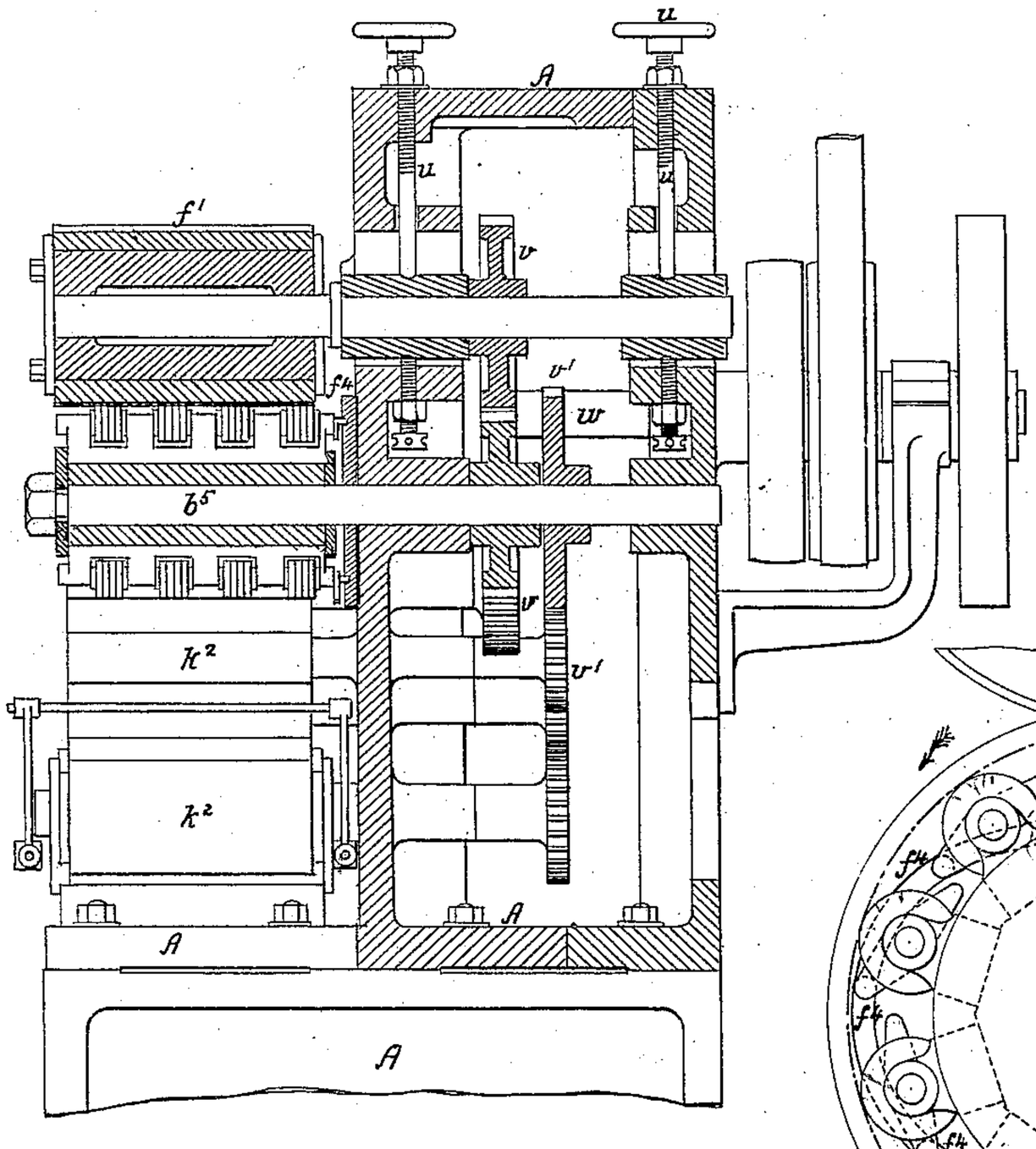


FIG. 3d

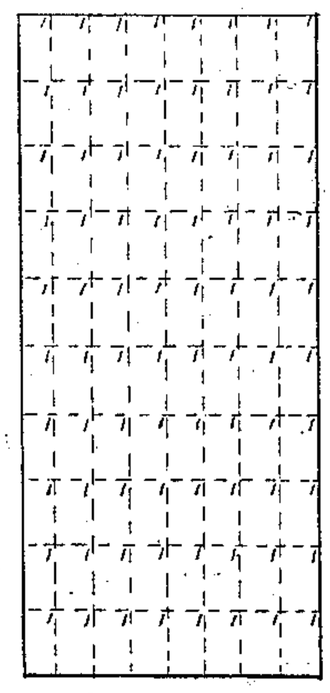


FIG. 5.

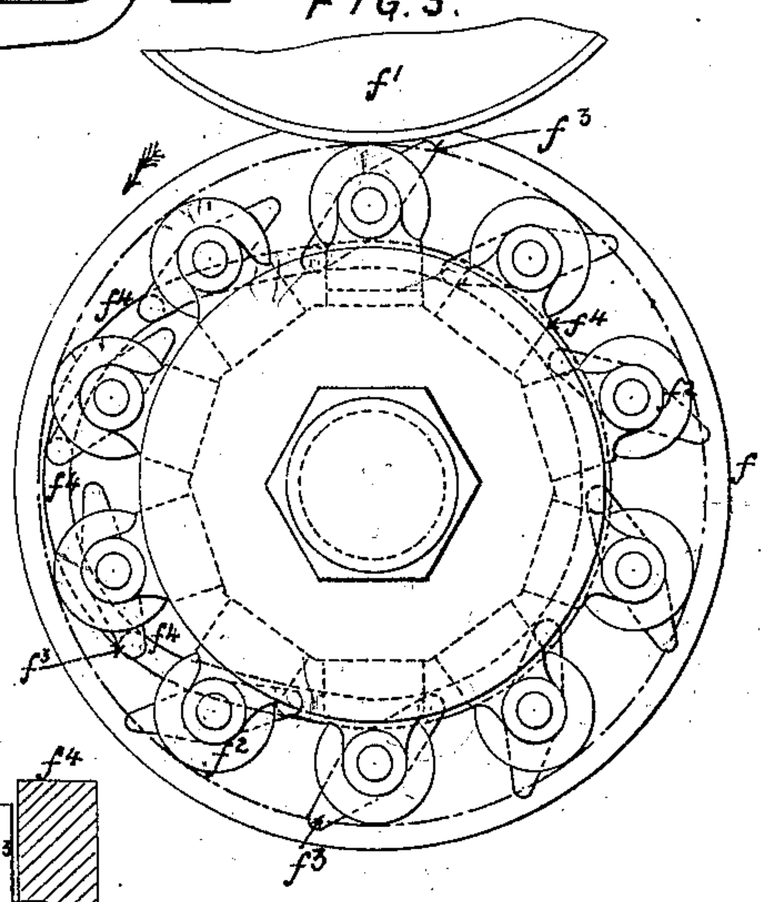


FIG. 7.

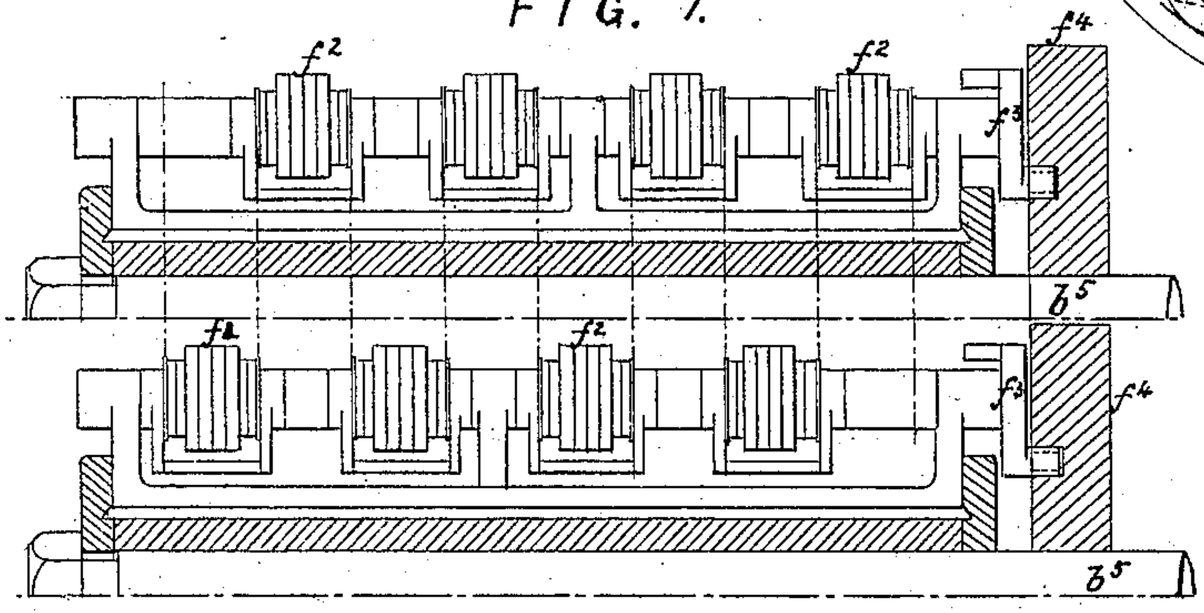


FIG. 3c

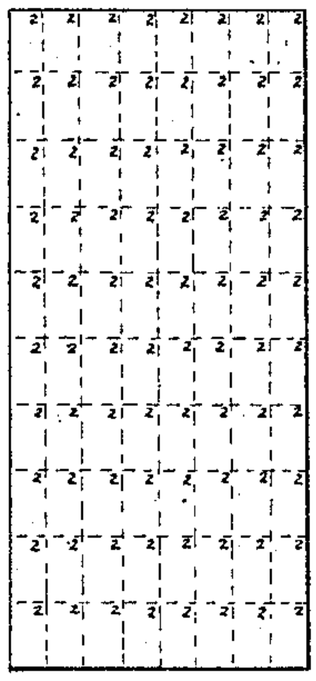
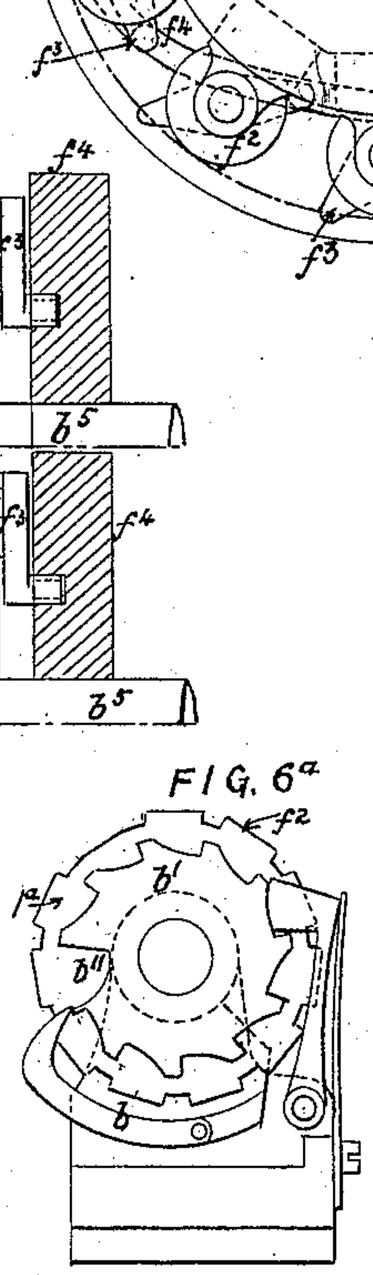


FIG. 6.

FIG. 6a



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NUMBERING MECHANISM.

No. 381,105. Patented Apr. 17, 1888.

Fig. 3e.

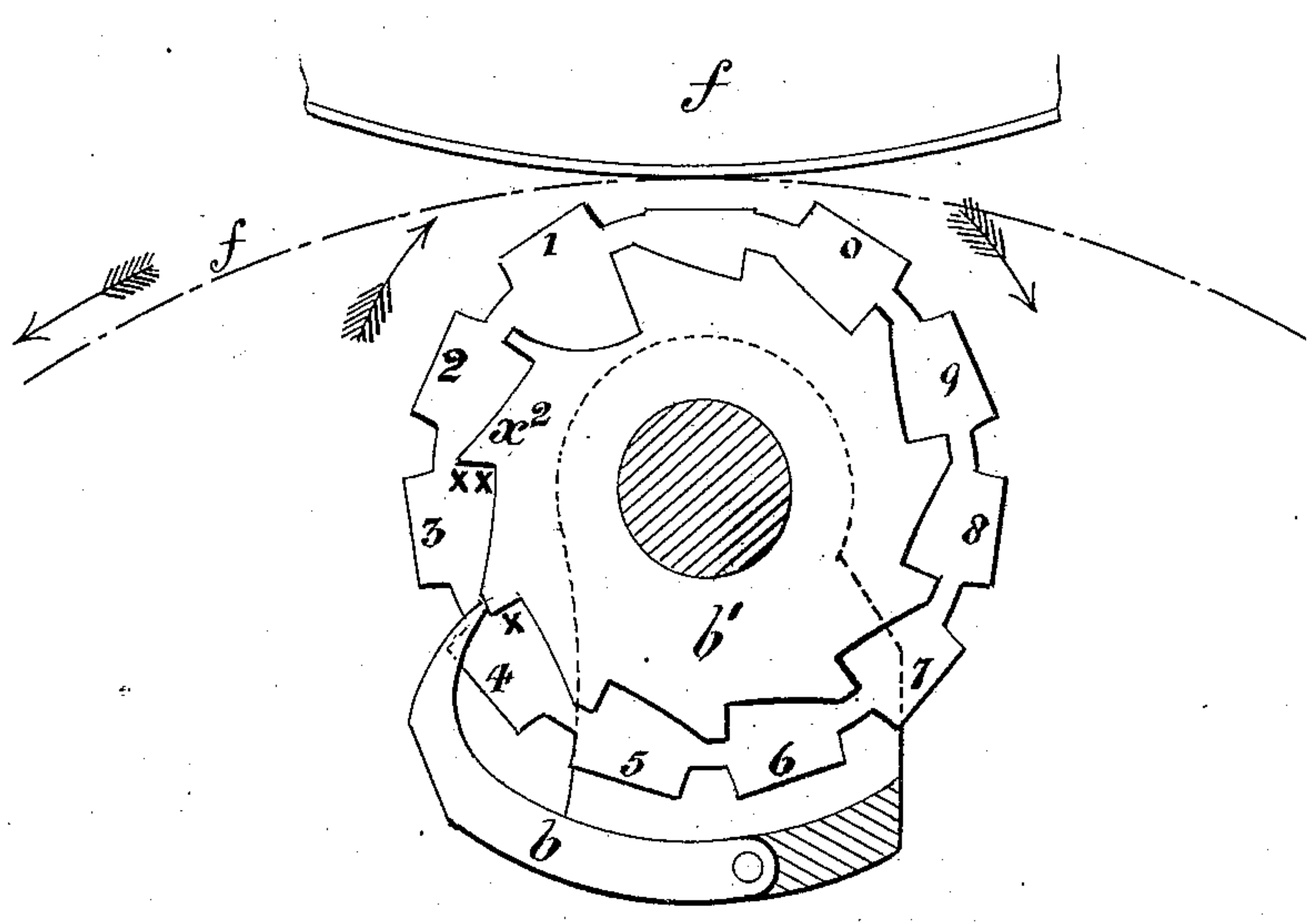
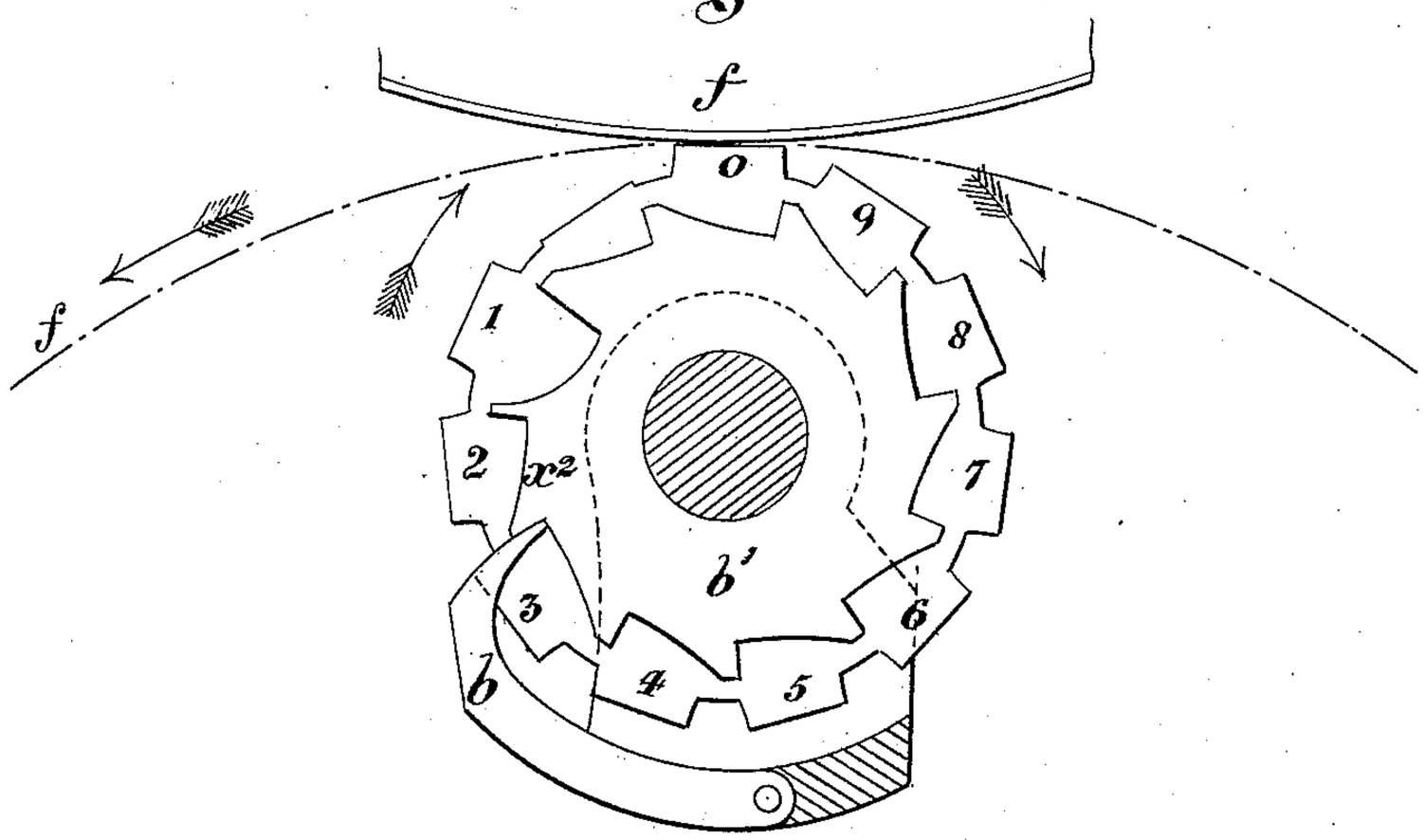


Fig. 3f.



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NUMBERING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 381,105, dated April 17, 1888.

Application filed March 3, 1886. Serial No. 193,857. (No model.) Patented in England February 18, 1884, No. 3,484, and June 6, 1884, No. 8,678; in Germany April 27, 1886, No. 38,867; in France May 10, 1886, No. 176,024, and in Belgium October 27, 1886, No. 57,501.

To all whom it may concern:

Be it known that I, JOHN MELTON BLACK, a citizen of the United Kingdom, England, residing at Tabernacle Street, Finsbury, in the city of London, England, have invented new and useful Improvements in Mechanism for Numbering, Printing, Cutting, and Collecting Tickets, Checks, Labels, or the Like, of which the following is a description, the same having been patented in Great Britain by Letters Patent No. 3,484, dated February 18, 1884, and No. 8,678, dated June 6, 1884; in France by Letters Patent No. 176,024, dated May 10, 1886; in Belgium by Letters Patent No. 57,510[B], dated October 27, 1886; in Germany No. 20,257, dated April 27, 1886, and entered in patent-roll under No. 38,867, and in no other countries.

The object of this invention is the construction of a machine which will print on a continuous web of paper tickets, checks, labels, or the like in consecutive order in series, and perforate the same so that such printed web as it issues from the machine, whether perforated or not, according to the purposes for which the tickets are subsequently intended, may be cut up into lengths and collected or piled in consecutive order, whether as individual tickets or in sheets superposed in consecutive order one on the other for subsequent division by a guillotine-knife, saws, or other cutters into consecutively-numbered bundles; or, in lieu of so cutting the web up into definite lengths, it may as it leaves the machine be formed into a roll of consecutively-numbered tickets divided one from the other by perforations.

In order that the invention may be well understood and explained in detail, I have hereunto annexed two sheets of drawings, upon which letters of reference are marked on corresponding parts on all the figures alike.

Figure 1 represents in front elevation the complete machine, combining the printing of subject-matter and consecutive numbers on a running web of paper, perforating and cutting the same up into lengths, and placing such lengths in consecutive order one on the other. Fig. 2 represents a plan view of the same, showing how the machine can be constructed for printing in series eight tickets in width, continuously and consecutively numbered, on a single web of paper, each series being represented by a distinctive alphabetical letter. Figs. 3, 3[a], and 3[b] represent, respectively and full size, a longitudinal section, end elevation, and plan of the instrument employed for printing numbers in quantities of the same denomination in consecutive order on a running strip of paper. (See samples, Figs. 3[c] and 3[d].) Fig. 3[e] represents an enlarged detail view, in side elevation, of one of the numbering-heads and the ratchet and pawl or bar operating therewith. Fig. 3[f] represents a similar view of the same parts in a different position. Fig. 4 represents in end elevation a transverse section of the parts shown in Fig. 1, taken through line *x x*. Fig. 5 represents in front elevation a detached view of the rotary cylinder, around which the consecutive-numbering instruments are placed, and also the fixed cam, by which the numbering-disks of the instrument are changed in consecutive order and in succession as the cylinder supporting the instrument revolves. The arrangement and disposition of the numbering-instruments and fixed cam here shown are the same whether the instruments are employed for printing a single line or a number of lines of numbers on a running web of paper. Figs. 6 and 6[a] represent, respectively and full size, a longitudinal and end elevation of the instrument or numbering-head employed for printing one line only of consecutive numbers on a running web of paper. (See sample, Fig. 5[c].)

I would here remark that the machine shown at Fig. 1 is designed more particularly for printing railway "return" tickets, checks, or the like, nicked or perforated, and which have to receive on their surface, in addition to subject-matter, duplicate consecutive numbers, printed by numbering-instruments similar to those shown at Figs. 3 and 3[a]. The only alteration required in the construction of a machine for printing "single" tickets, similar to those in use on tramcars, is to remove the ordinary arrangement of perforating-cylinders *l l* and place the numbering-instruments

in alternate positions on the cylinders, in manner as shown at Figs. 2 and 7; but if the web is intended when printed upon to form a roll of consecutively-numbered tickets then the machine is arranged to print one line of tickets only with numbering-instruments similar to those shown at Figs. 6 and 6ª. In this case perforating-cylinders are employed and the rotary knife removed.

In the above figures, A is the framing of the machine. At one end of this frame the blank web of paper, card-board, or other like material, *a*, is supported, out of which the consecutively-numbered tickets are subsequently formed. The web of paper *a*, entering the machine under the tension-rollers *c*, passes first between the printing-roller *d* and its impression-roller *d'*. The roller *d* is provided around its periphery with subject-matter designed for printing advertisements or the like on the back of the web of paper. From these rollers the web passes next between the printing and impression rollers *e e'*, which print on the opposite surface of the web subject-matter designed for the front of the tickets. After the running web in its onward course has been thus printed on back and front, it next comes under the action of the type-numbers of the consecutive-numbering cylinders *f f'*. The numbering-cylinders *f f'* are duplicated, as shown at Fig. 1. They print on the running web duplicate numbers, as in the case of railway return-tickets. The details and action of these cylinders and their numbering-disks will be clearly understood on reference to Figs. 3, 3ª, and 3ᵇ. The arrangement and disposition of the numbering-disks shown at Figs. 6 and 6ª are specially designed for printing while rotating numbers in consecutive order at equal distances apart representing tickets on the running web of paper representing a single line of tickets, as shown at Fig. 5ᶜ.

In order to prevent these numbering-heads when rotating printing the ciphers before the number 1 when the change is made for the tens, two ciphers when the change is made for the hundreds, and so on, leaving the impressions thus 01, 001, 0001, I provide the type-numbering disks of each numbering-head with eleven faces. The arrangement and actuation of these numbering-heads revolving with their supporting-cylinder will be understood on reference to Figs. 3, 3ª, 3ᵇ, 6, and 6ª.

Paging or consecutive hand-numbering machines of which the numbering-heads shown at Figs. 3, 3ª, and 3ᵇ, and 6 and 6ª are a type, are constructed with their ratchets placed between each type-numbered disk, so as to allow their actuating-pawl to be inserted in and work between them, and if such an arrangement as this were used in a rotary printing-machine such spaces would soon become filled in and choked with fluff and prevent the free rotation of such disks. To obviate such serious disadvantages when printing numbers consecutively in a rotary printing-machine on a running web, I arrange the type-numbering disks and actuating ratchets and pawls as shown at Figs. 3 and 6, in which it will be seen that the numbering-disks are placed close together, and are so constructed that their actuating ratchet-wheels are placed outside. By this arrangement no fluff or extraneous matter can get between the disks and their actuating mechanism. In order to eliminate the cipher when these disks are printing their numbers, I make the numbering-disk of the numbering-heads shown at Figs. 3, 3ª, and 3ᵇ, and also those shown at Figs. 6 and 6ª, with eleven faces, and actuate such disk through the medium of ratchets and pawls, which have motion transmitted to them by the levers f^3 and fixed cam f^4 through the axle b^5, on which the disks revolve. The pawls actuating the ratchets are made of one piece of metal, *b*, (*vide* Fig. 3ᵇ,) and are forced into contact with their respective ratchet-wheels by the springs b^4. The eleven faces of these numbering-heads are provided in the circle of their unit-figures representing ten heads with a unit-number on ten of their faces, the first having ten ciphers, the second ten ones, and so on through the series of ten numbering-heads, the eleventh face of each disk being left blank.

The numbering-heads shown at Figs. 3, 3ª, and 3ᵇ are designed for printing numbers of the same denomination during each revolution of their supporting-cylinder in quantities corresponding to the number of heads employed in a circle. According to this arrangement the four disks are independently actuated by their ratchets. The numbering-heads shown at Figs. 6 and 6ª are designed for printing numbers on a running-web similar to the sample shown at Fig. 5ᶜ. The only difference between this numbering-head and that shown at Figs. 3, 3ª, and 3ᵇ is that the units and tens disk are connected together so as to form one disk, which is actuated by one ratchet. The action of the numbering-heads will now be understood by the following description, reference being had to Figs. 6 and 6ª, which as to general feature and the manner of actuating the ratchets is similar to that shown at Figs. 3, 3ª, and 3ᵇ.

The pawls *b*, acting on the ratchets giving the intermittent motion to the disks, together with the indentations in such ratchets, are so arranged that when the change is being effected for the tens the pawl *b* is caused to sink deeper into the recess *b''* of the ratchet *b'*. This nearing of the pawl toward the axle on which the numbering-disks rotate allows with the next advance of the bar *b* the pawl giving motion to the hundreds-disk 2ª to gear with its ratchet b^2, and so place in position the disk 2ª, printing the hundreds, which change is also effected in like manner by the pawl and ratchet b^3 on the disk 3ª when the thousands are printed.

In each case, when the movement has been completed, the pawl giving motion to the units and tens disk again assumes its elevated position, and does with its next advance give a double throw to the units and tens disk, and so causes the extent of movement thus given

to advance the eleventh (blank) space forward in the circle of figures printing the units and tens beyond the printing-surface and out of position for inking and delivering its impression, and in lieu thereof places in position the next figure for continuing the printing in consecutive order. The double throw of the ratchet at the time of throwing the cipher over and out of position and leaving in its place the unit (1) one is effected in the manner following: The disks of the numbering-heads when in position preparatory for delivering their numbers from zero are so placed that their eleventh blank spaces are in a line opposite the impression-cylinder *f*, the ciphers being on the advanced side of the said blanks and the unit one (1) on the opposite side next to follow. (*Vide* Fig. 3^e, which is an enlarged diagram of one of the numbering heads.) The numbering-disks of the numbering-heads on their supporting-cylinder are in this position when the machine starts, so that with the first half-revolution of such cylinder the annular groove in the fixed cam f^4 causes the pawl *b* to place the unit one (1) of the numbering-disk in position for being inked, in which position it is retained, as before described, until it has delivered its impression on the running web of paper.

The intermittent changes to the numbering-disks are thus effected with each revolution of the cylinder supporting the numbering-heads during the time the units are being printed; but when the changes are being made from the tens to the hundreds and from the hundreds to the thousands the blanks forming the eleventh space on each disk are advanced beyond the printing position in the manner following: The pawl-piece, through the means described, has imparted to it a motion not quite equal to the length of two teeth of the ratchet-wheel, except at the point *x x*, where the pawl reaches the cut-away tooth, as indicated in Fig. 3^e. The pawl-piece *b* hence has a movement given to it greater than the intermittent movement given to the ratchet *b'*, actuating the numbering disks. (*Vide* Fig. 3^e, in which it will be seen that the pawl at the commencement of its movement is at *x*, from which point it has an idle movement forward equal to almost one-half its throw when it comes into contact with the ratchet-tooth at the point *x x*, from whence up to the completion of its throw it gives to the ratchet *b'* and numbering-disk a movement equal in length to one of the eleven spaces on such disk.) It will thus be seen that during the ten (10) intermittent movements required to print the numbers from 1 to 10 the throw of the pawl-piece *b* is equal to two complete movements of the ratchet *b'*, moving the units-disk; but, by reason of the formation of the ratchet-teeth giving these ten throws there is a loss of movement with each throw, but immediately the eleventh movement is to be given the tooth x^2 of the ratchet *b'* then coming into action is made shorter, or of a length which will allow the pawl *b* to fall at once into gear, (*vide* Fig. 3^f,) which, with the advance of such pawl, transmits a movement to the ratchet equal to two of the eleven faces of the numbering-disk. This double throw advances the blank space out of position and places in lieu thereof the next figure for continuing the consecutive order of number-printing. When the machine is designed, as shown at Figs. 1 and 2, for printing consecutively-numbered sheets, (shown in the example at Figs. 3^b and 3^c,) the numbering-disks of the instruments f^2 are arranged singly as units-disks, as shown at Figs. 3, 3^a, and 3^b, each disk having its own independent action by ten numbering-instruments placed around the cylinder *f* to be two and one-fourth inches long, the circumference of the type-surface of such cylinder would be twenty-two and one-half inches. It is therefore evident that if tickets, checks, or labels longer than two and one-fourth inches are required to be printed by the same machine the numbering-instruments will be fewer. For example, when printing tickets or the like two and one-half inches long there would only be nine instruments employed to form the circumference of the type-surface, and if longer than this there would be a corresponding reduction of the numbering-heads employed. The combined surfaces of these disks f^2 form the periphery of the disk *f*, between which and the impression-roller *f'* the running web of paper *a*, receiving the type-numbers, passes in the direction shown by the arrows. At Fig. 5, f^4 is a fixed cam, which through the medium of the levers f^3, secured to the axles of the numbering-disks f^2, gives such disks while revolving around the axle of the cylinder *f* their consecutive order of change, as required, preparatory to being inked and transferring their impression to the running web of paper. When the machine is first started, the numbers on the various disks f^2 of the cylinders *f f* will deliver with the first revolution of such cylinder ten ones (1) eight times repeated by the arrangement of multi-numbering heads, as shown in example at Fig. 7, during the first revolution. The levers and friction-bowls f^3, while being carried round the groove of the fixed cam f^4, will immediately after having passed the top center in the direction of the arrow receive in succession a motion which effects the necessary consecutive change to the type-numbers through the medium of the pawls and ratchets before they arrive at the bottom center, where they receive their supply of ink, after which, by reason of the concentric portion of the groove of the cam f^4, they are steadily retained in position until they have again passed their top center and delivered their impressions on the running web of paper *a*. The action of the various parts being thus repeated with each revolution of the cylinders *f f*, the consecutive order of numbering is continuously advanced in quantities of ten—for example, the first revolution prints in lines ten ones, (1,) the second ten twos, (2,) the third ten threes, (3,) and so on, as shown in examples Figs. 3^c

and 3^q, until the highest numbers are complete which the disks of the numbering-instruments, f^2, are capable of printing, viz., 9999. The consecutive numbers during the progress of printing are automatically registered on the dials *g*, an inspection of which enables the man in charge to know exactly the advance of the consecutive order of the numbers printed by the machine, and will also give him timely warning by a bell or other call when the machine is completing its highest number. When this alarm is given and the machine has completed its highest number, it is stopped, the final impression indicated being represented by four ciphers 0000, which has a number 1 prefixed thereto by hands, making up the maximum number of tickets printed ten thousand (10,000,) which is termed the "first series."

When starting the machine for printing the second series of ten thousand, fixed type and numbers on the cylinder *h* are so arranged as to print on each ticket with the consecutive number the alphabetical letter A, and with the third series, B, and so on, altering the letters or letter and numbers for each series of ten thousand tickets printed.

In those machines in which two or more lines of tickets are printed side by side on one web each line printed may represent a different series. For example, in the arrangement shown at Figs. 2 and 7, where eight lines of tickets are printed at one time, the series type-letters of the disks on the cylinder *h* may be so arranged that each line will represent a different series, enabling thereby eight series of tickets to be printed at the same time on one line, or eighty on the right lines. The running web of paper having now received on its surfaces subject-matter, consecutive numbers, and series letters, it passes under the action of the rollers *i i'*, which are type and impression rollers, and can be used or not for printing on the divisions of tickets forming the continuous web devices, signs, or marks. The inking of the type on the type-rollers *d*, *e*, *f*, *h*, and *i*, whether black or in colors, is transferred thereto from the ink-troughs *k* by the vibrating "ductor-rollers" *k'* and the distributing and conveying rollers k^2. The web of paper now being fully printed on as it leaves the rollers *i i'* can be directed so as to pass under guide-rollers *l l* to the action of the rotary knife *m*, for being cut up into lengths in the manner as hereinafter described. The web of paper after leaving the guide or perforating rollers *l l* passes direct to the action of the rotary knife *m*. This knife is supported by and slides in a radial groove formed in the top roller of the pair of rollers m' and m^2, and is caused while the roller *m* is passing its bottom center through the medium of the fixed cams to fall and rise, the action of which, in conjunction with the fixed cutters of the under roller, m^2, with every revolution of such rollers severs or cuts the printed continuous web into definite lengths representing ten tickets long and eight wide. These lengths are printed with each revolution of the subject-matter and numbering-cylinders, and bear upon their surfaces like numbers of the same denomination, and are, as each length is severed from the web, taken hold of by and passed between the rollers *n n*, the circumferential speed of which is equal to the surface speed of the printing-rollers and rollers supporting the upper movable and under fixed knives. The sheets so passing between the rollers are received by the endless running tapes *o o*, which support and carry each one in succession until its full length has passed through the rollers *n n*, at which time it becomes nipped between the rollers *p p*, which are driven at a speed superior to the rollers *n n*, and delivered by them into the box *q*, one on the other, in such a manner that when a definite number has been so delivered their positions will be such that the numbers and subject-matter of each sheet representing tickets will be directly over each other—that is, the combined sheets will form in a vertical direction consecutively-numbered tickets. The pile of tickets so placed in register is then subjected to the action of a guillotine-knife, which cuts each pile up into eight longitudinal blocks of the width of one ticket and ten tickets long. The tickets forming these blocks are then secured together through each of their eight divisions by nails or pins, after which each block is subjected to the action of a guillotine-knife or circular saws, which cut the same up into separate bundles representing consecutively-numbered tickets.

When the machine is constructed for printing only one line of tickets in consecutive order, the numbering-instrument shown on the drawings, Figs. 6 and 6^a, will be employed, and the web of paper so printed on will be delivered from the machine as rolled tickets.

The adjustment of the knife-rollers m' m^2 relative to each other according to the thickness of paper or card-board passing between them, and also the adjustment of the impression-rollers of the various type-cylinders, is effected by the screws and wheels *u*.

The driving-shaft *w* gives motion through the train of wheels and carriers *v* to the type and impression rollers, and also to the rotating knife, and through the train of wheels *v'* to the inking-rollers. Taking the tickets printed by ten numbering-instruments placed round the cylinder *f* to be two and one-fourth inches long, the circumference of the type surface of such cylinder would be twenty-two and one-half inches. It is therefore evident that if tickets, checks, or labels longer than two and one-fourth inches are required to be printed by the same machine the numbering-instruments will be fewer. For example, when printing tickets or the like two and one-half inches long there would only be nine instruments employed to form the circumference of the type-surface, and if longer than this there would be a corresponding reduction of the numbering-heads employed.

Having thus described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary printing-machine, the fixed annular grooved cam f^4, in combination with printing-cylinders and the levers, pawls, and ratchets through which said cam changes the type-numbers, substantially as set forth.

2. A series of numbering-disks, each having ten dies and a blank space, and each provided with a ratchet-wheel having eleven teeth, one of which is somewhat cut away, in combination with a pawl provided with means, substantially as described, for giving the same a motion not quite equal to the length of two teeth, except at the point where the pawl reaches the cut-away tooth at the end of its motion.

In testimony whereof I have hereunto subscribed my name in the presence of two witnesses.

J. M. BLACK.

Witnesses:
THOMAS WRIGLEY,
J. T. LONG.