

(No Model.)

8 Sheets—Sheet 1.

H. P. FEISTER.
PRINTING AND BINDING MACHINE.

No. 452,933.

Patented May 26, 1891.

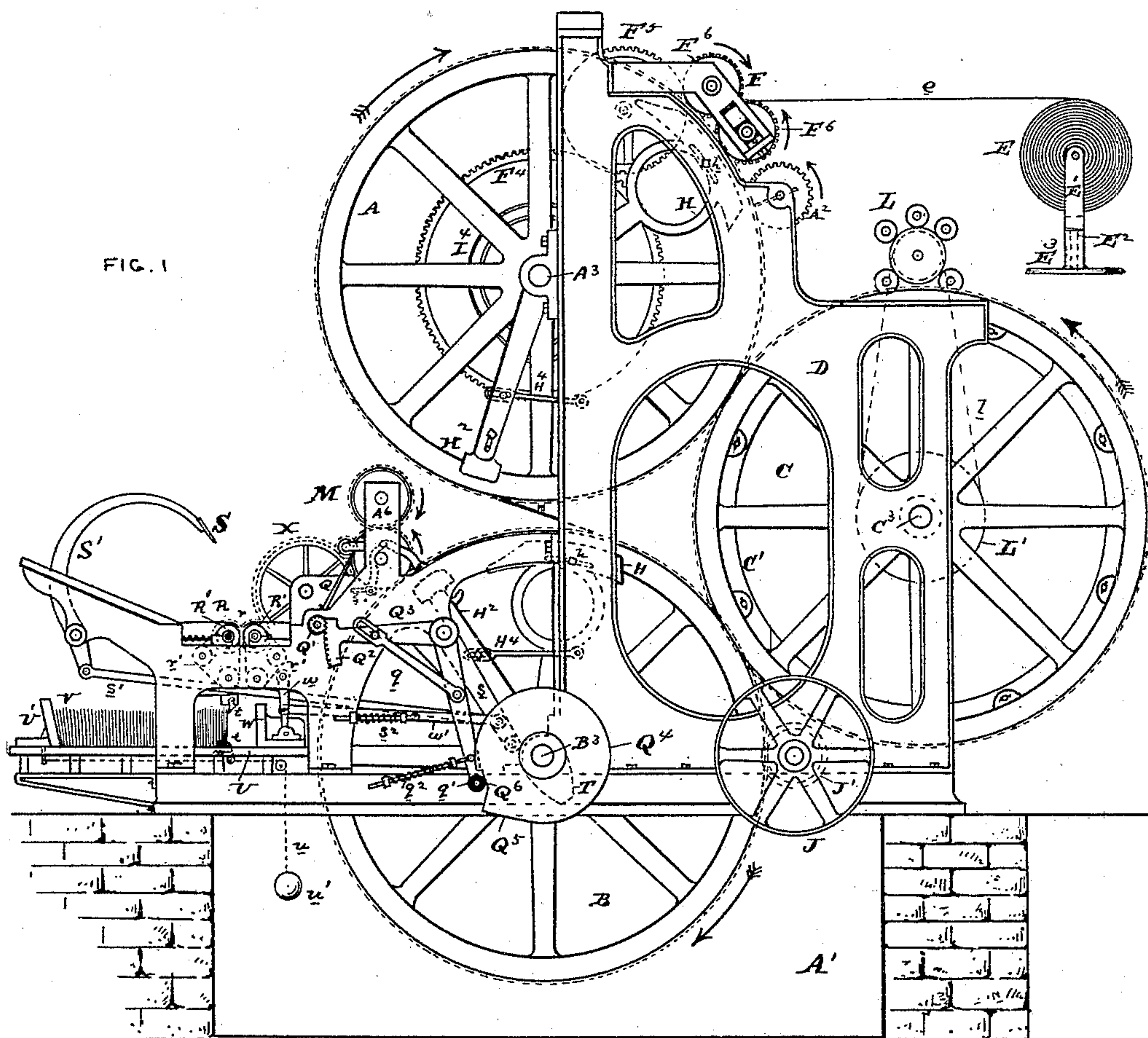
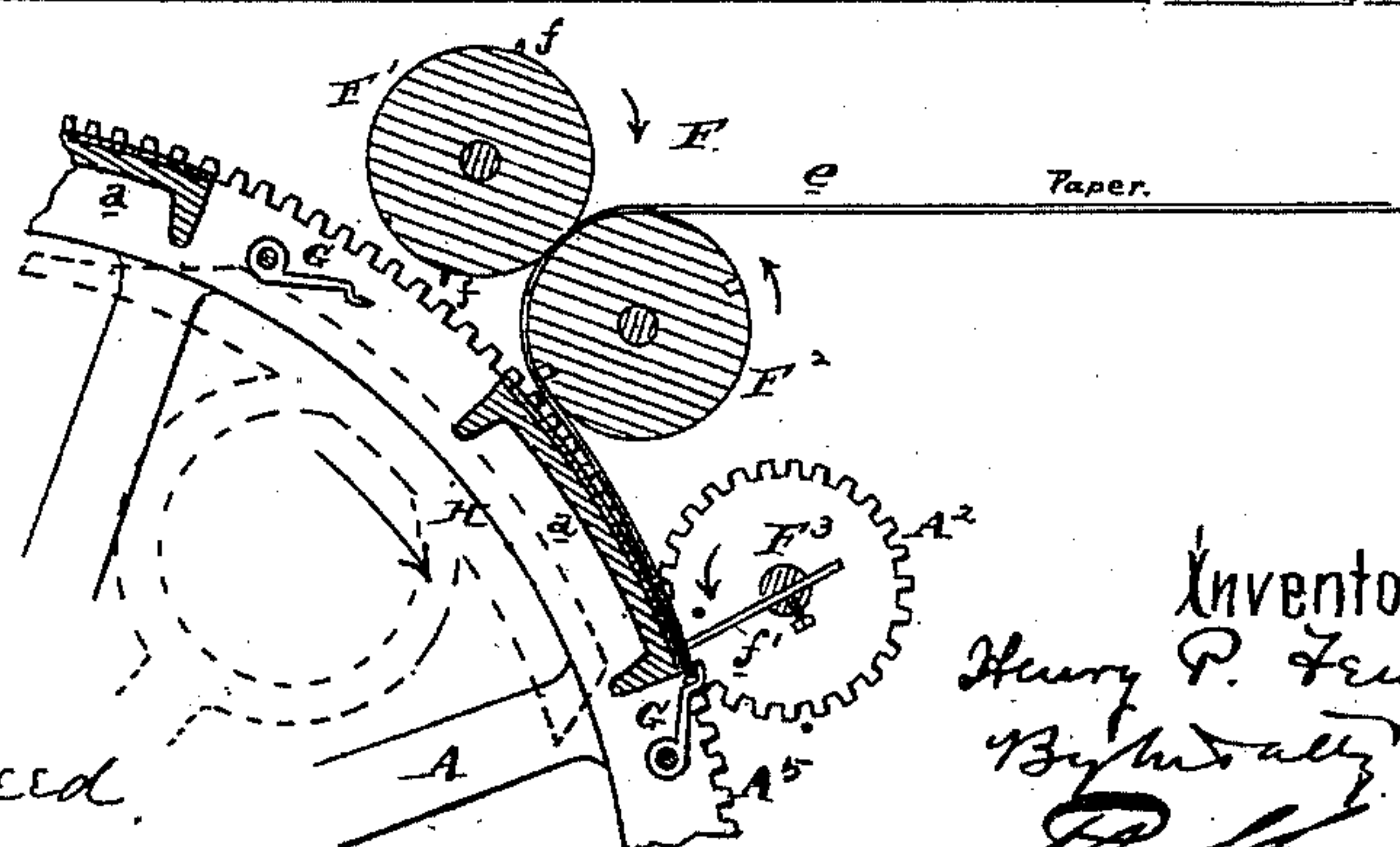


FIG. 2



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By *[Signature]*

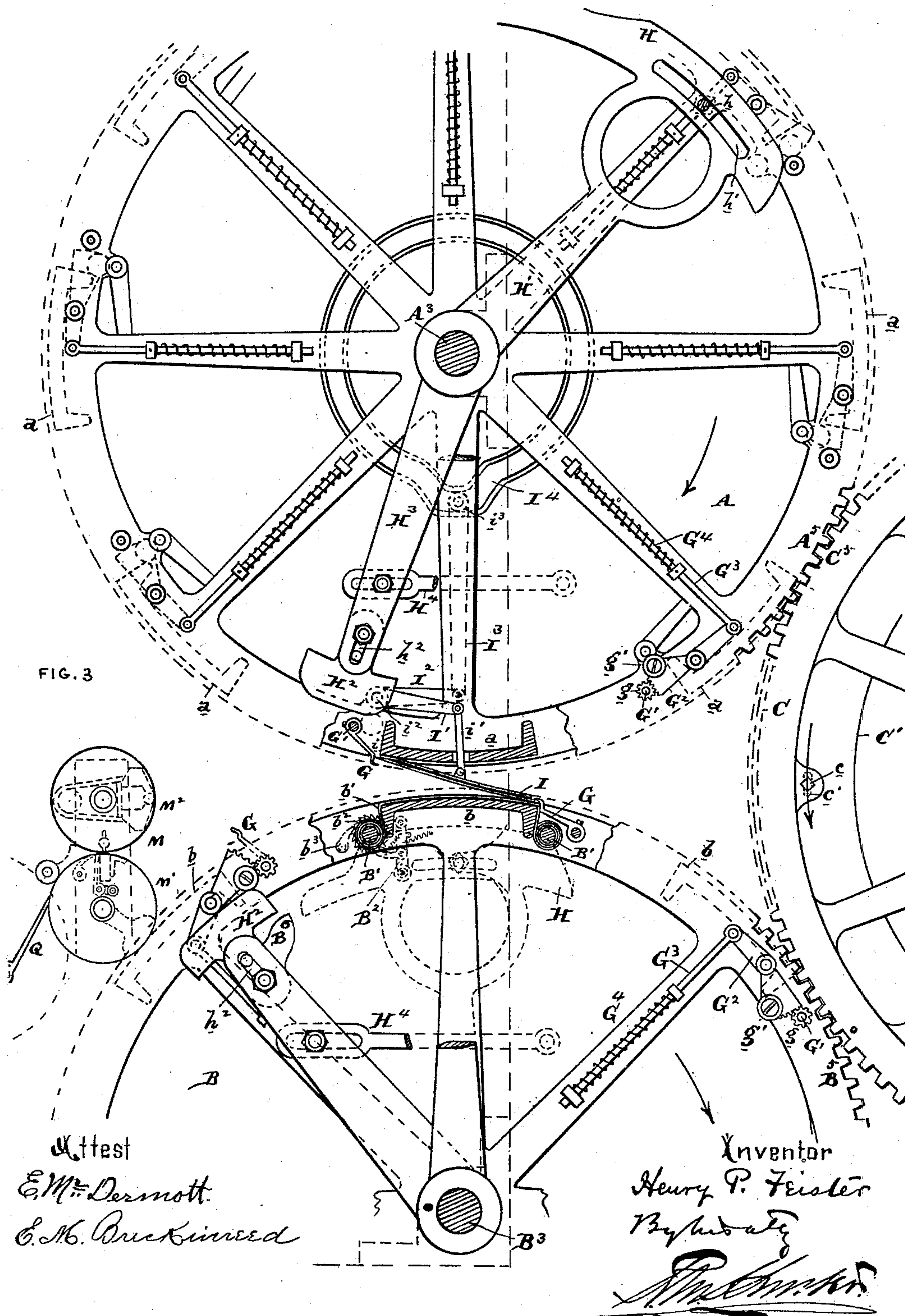
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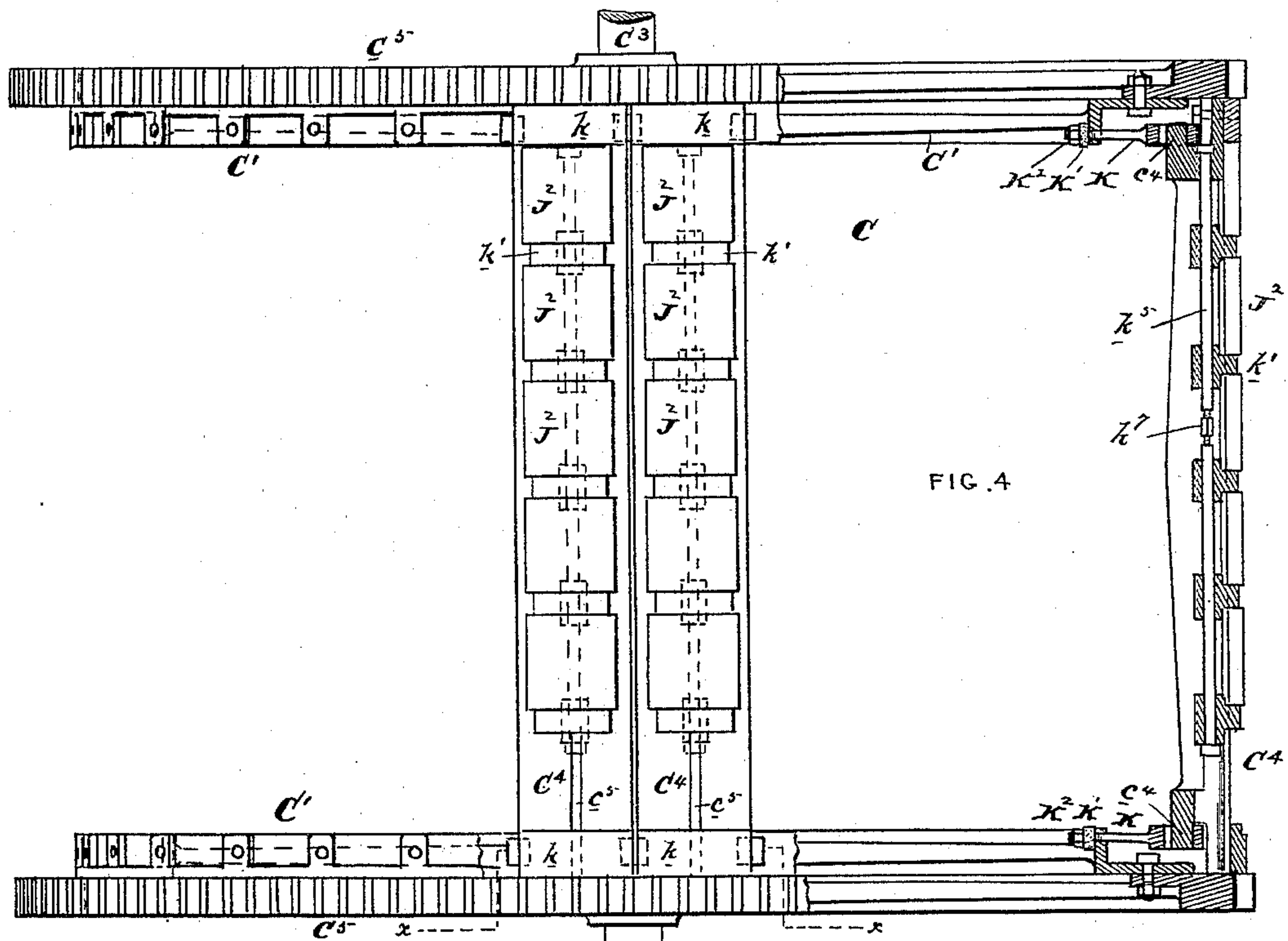


FIG. 4

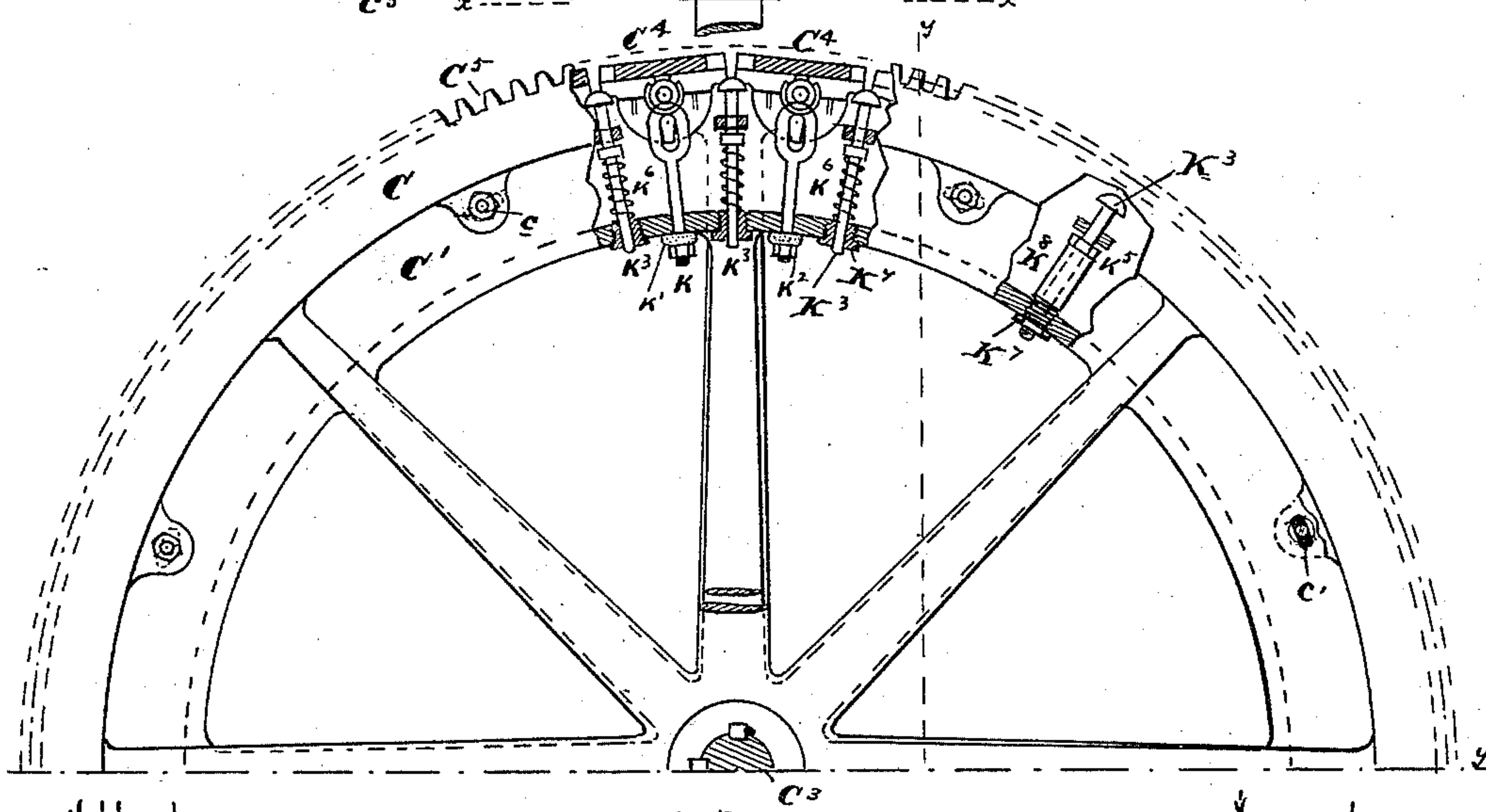


FIG. 5

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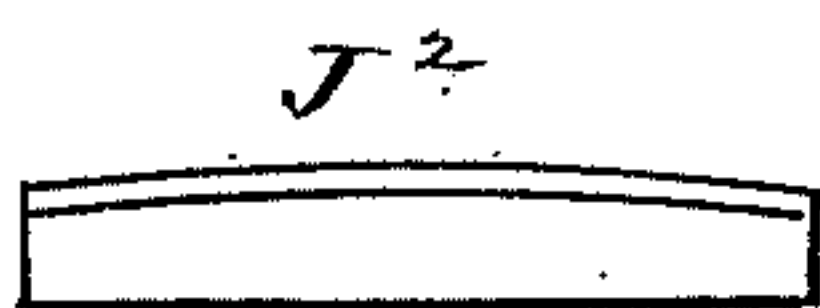


FIG. 6

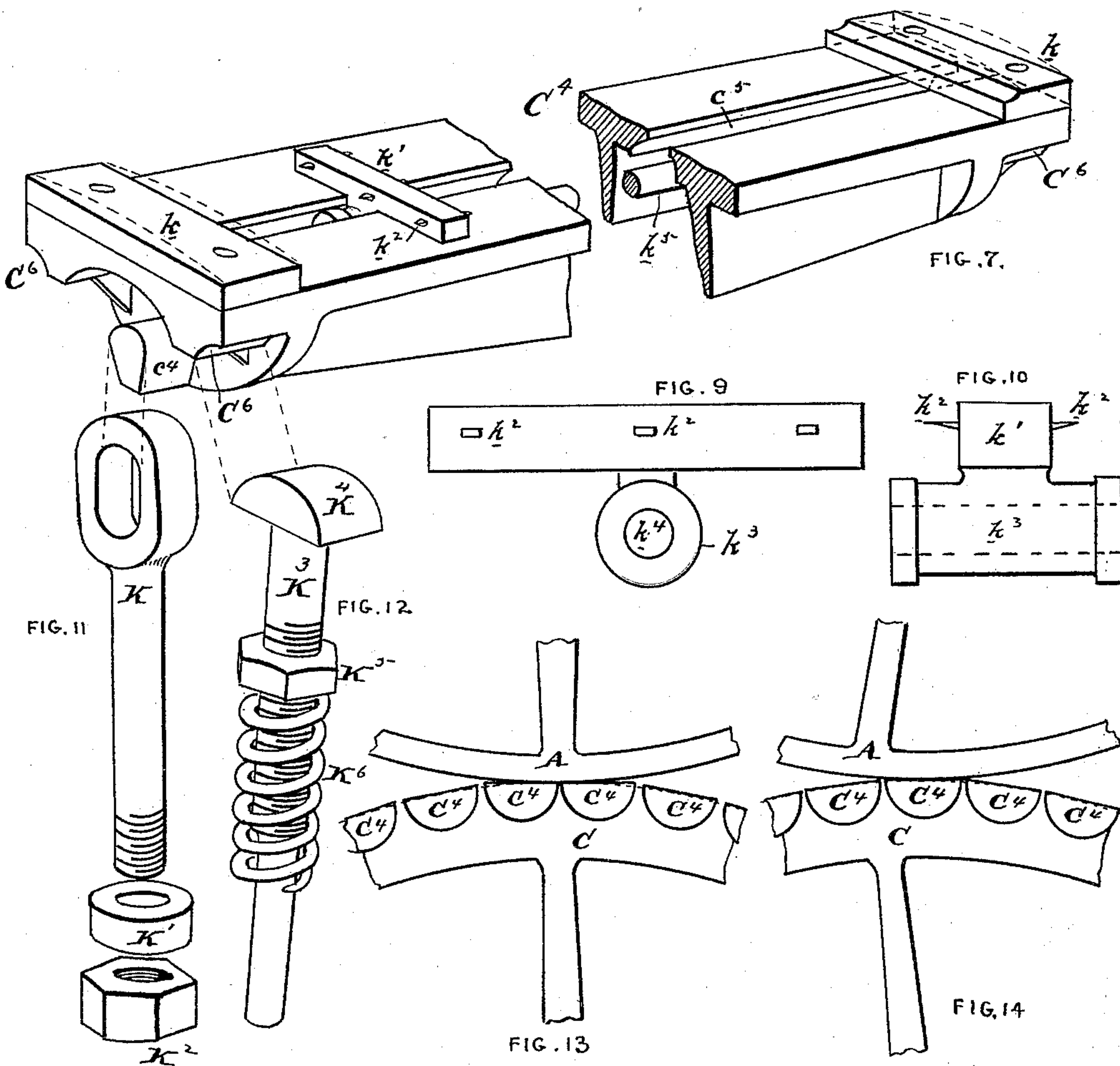
(No Model.)

8 Sheets—Sheet 4.

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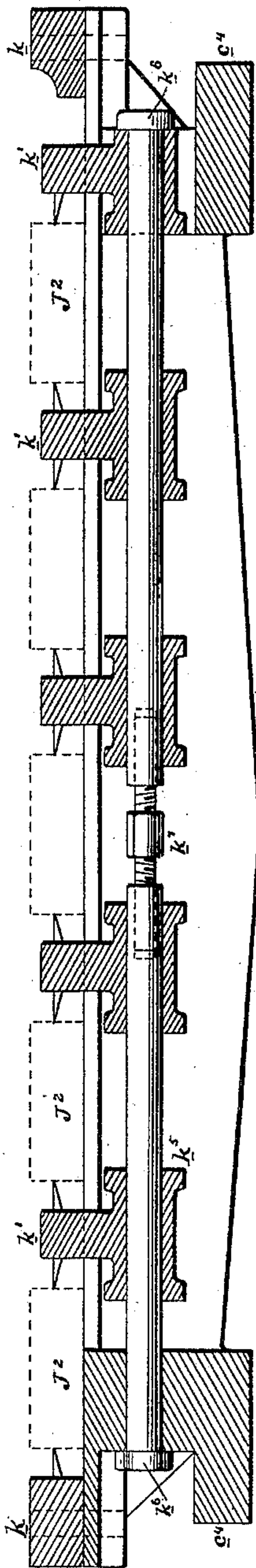
8 Sheets—Sheet 5.

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FIG. 8.



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Henry P. Feister Inventor:
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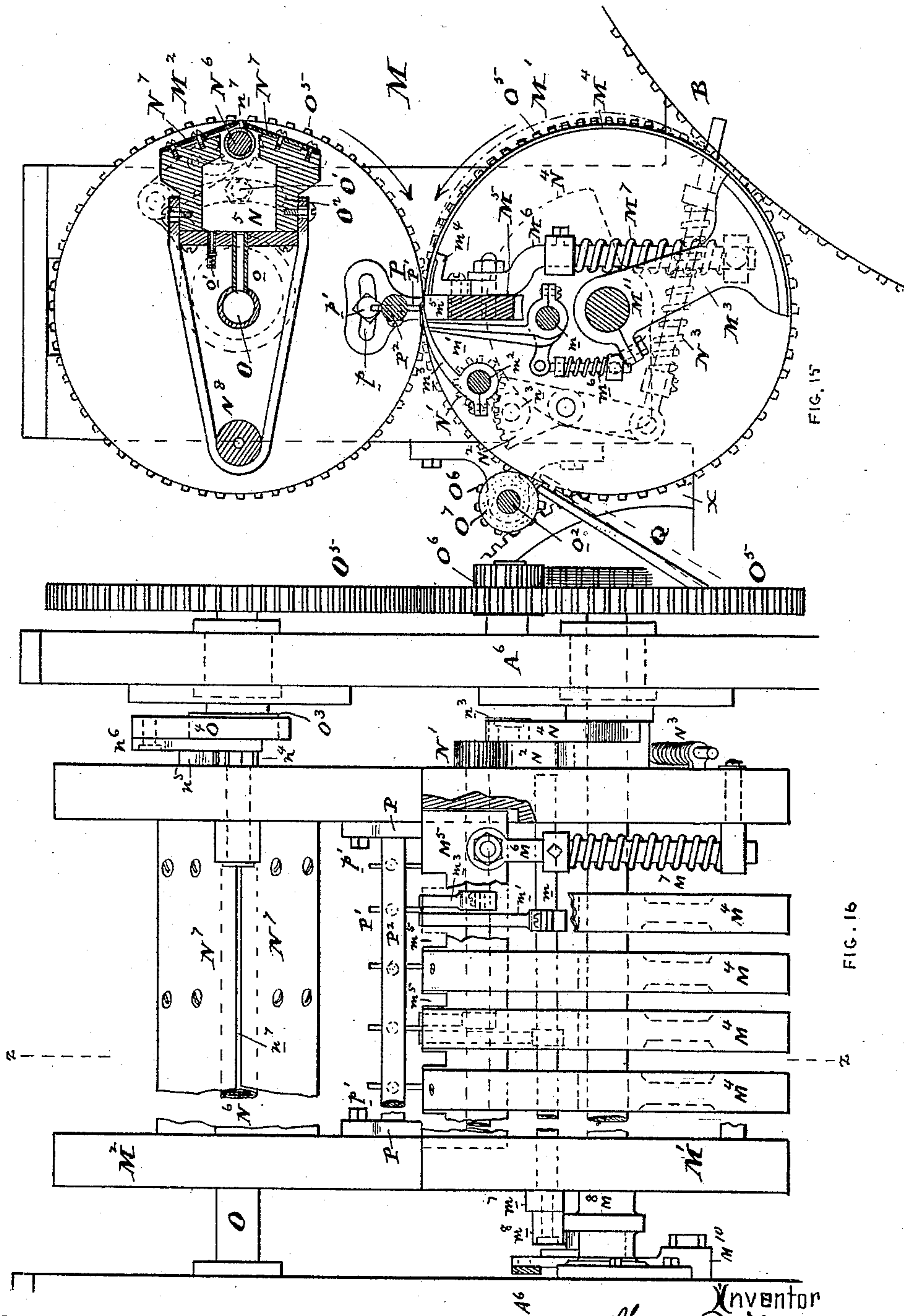
(No Model.)

8 Sheets—Sheet 6.

H. P. FEISTER.
PRINTING AND BINDING MACHINE.

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Attest
E. M. Dermott.
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(No Model.)

8 Sheets—Sheet 7.

H. P. FEISTER.
PRINTING AND BINDING MACHINE.

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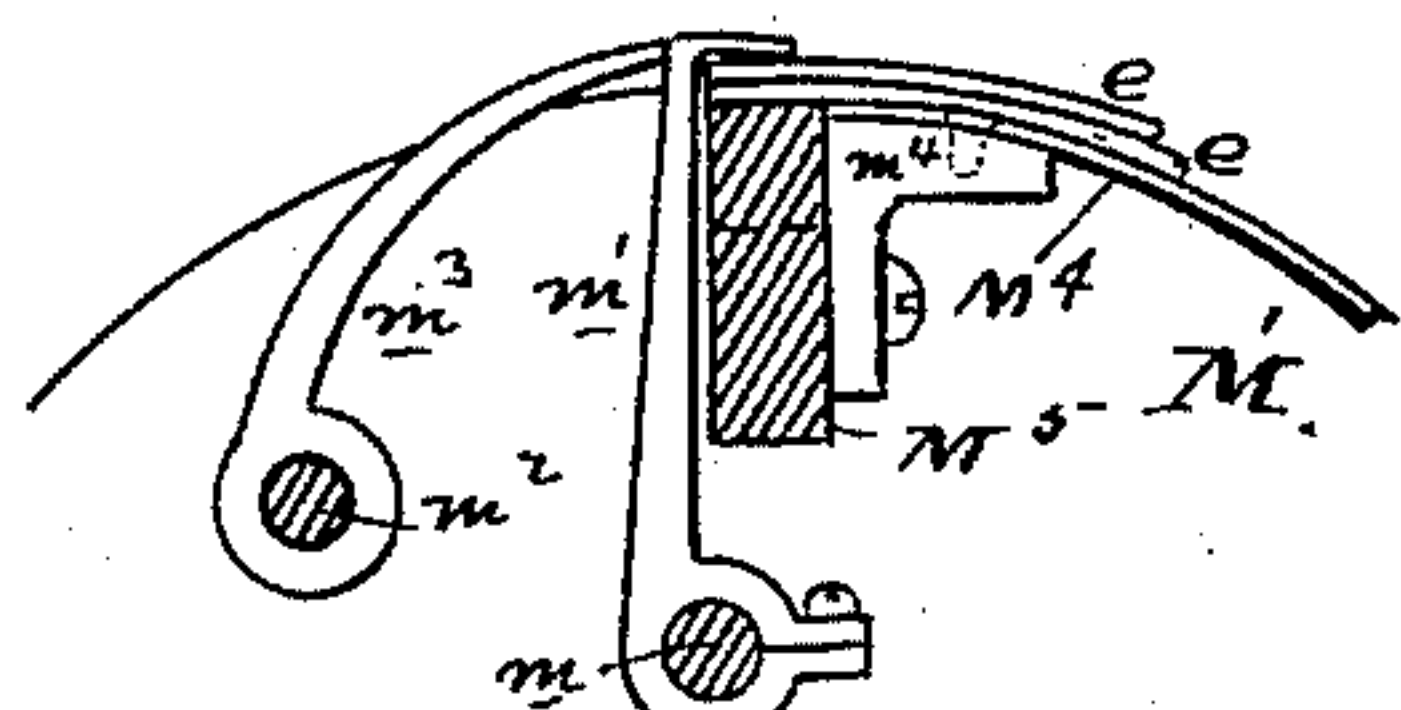


FIG. 20

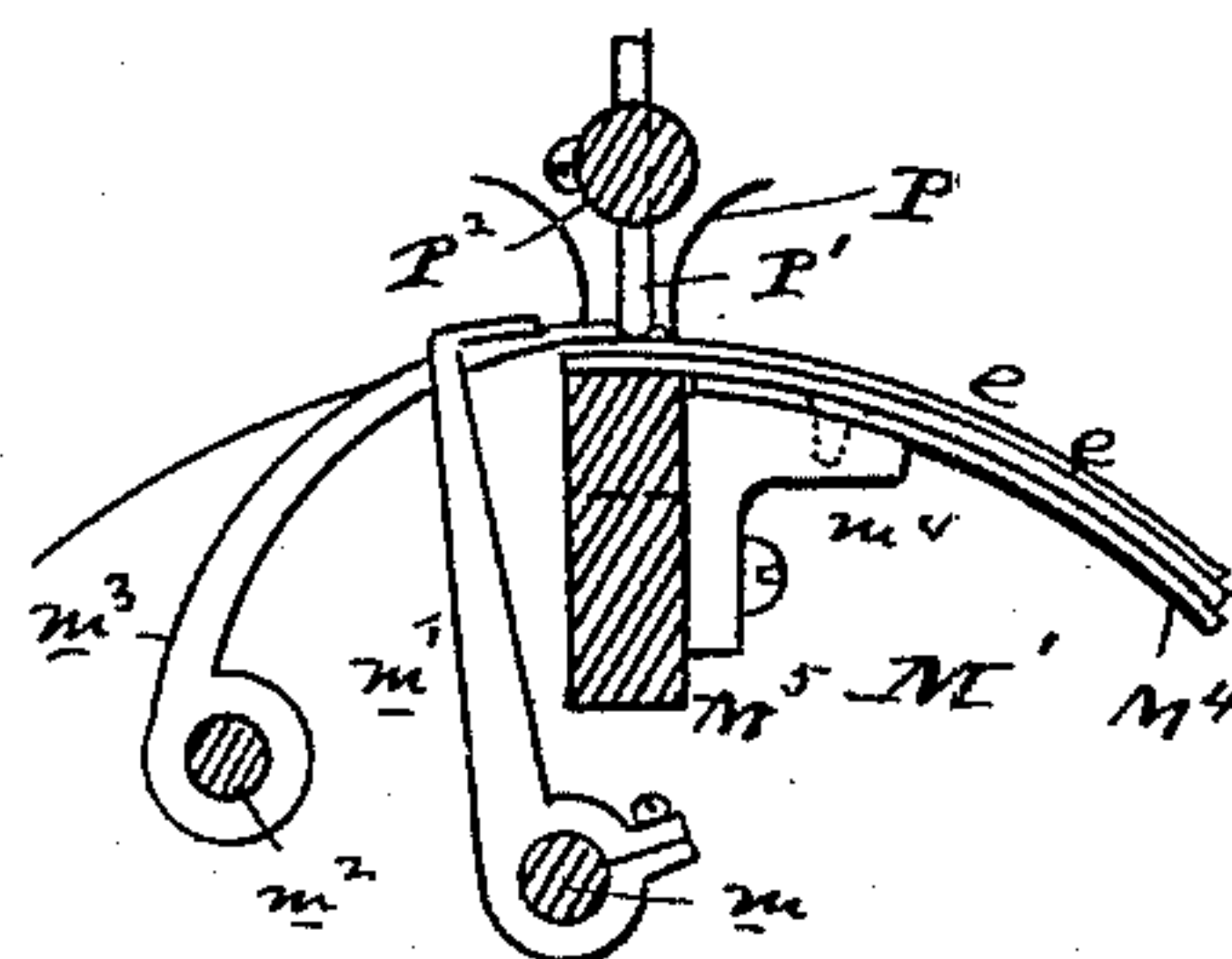
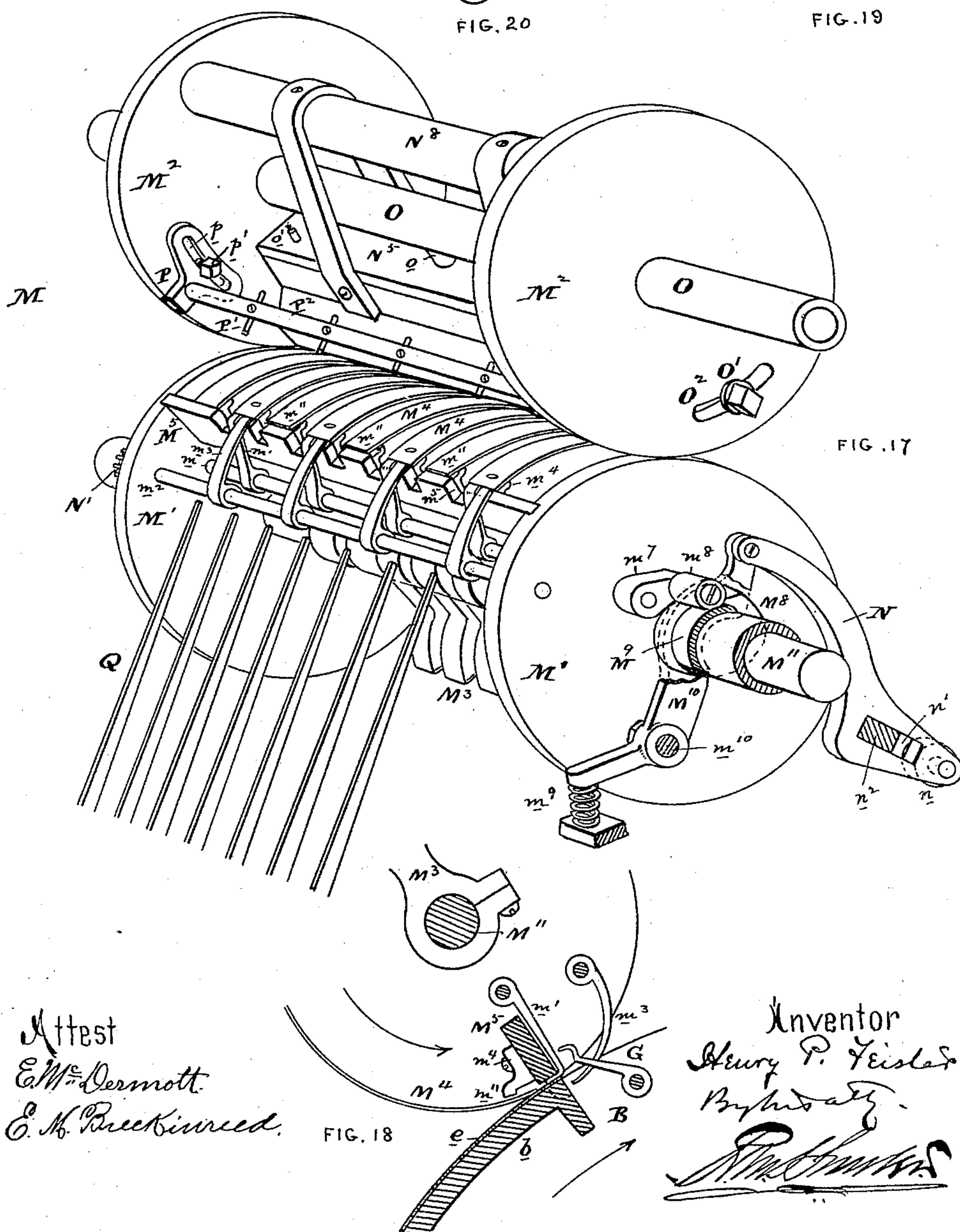


FIG. 19



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Wm. H. Smith

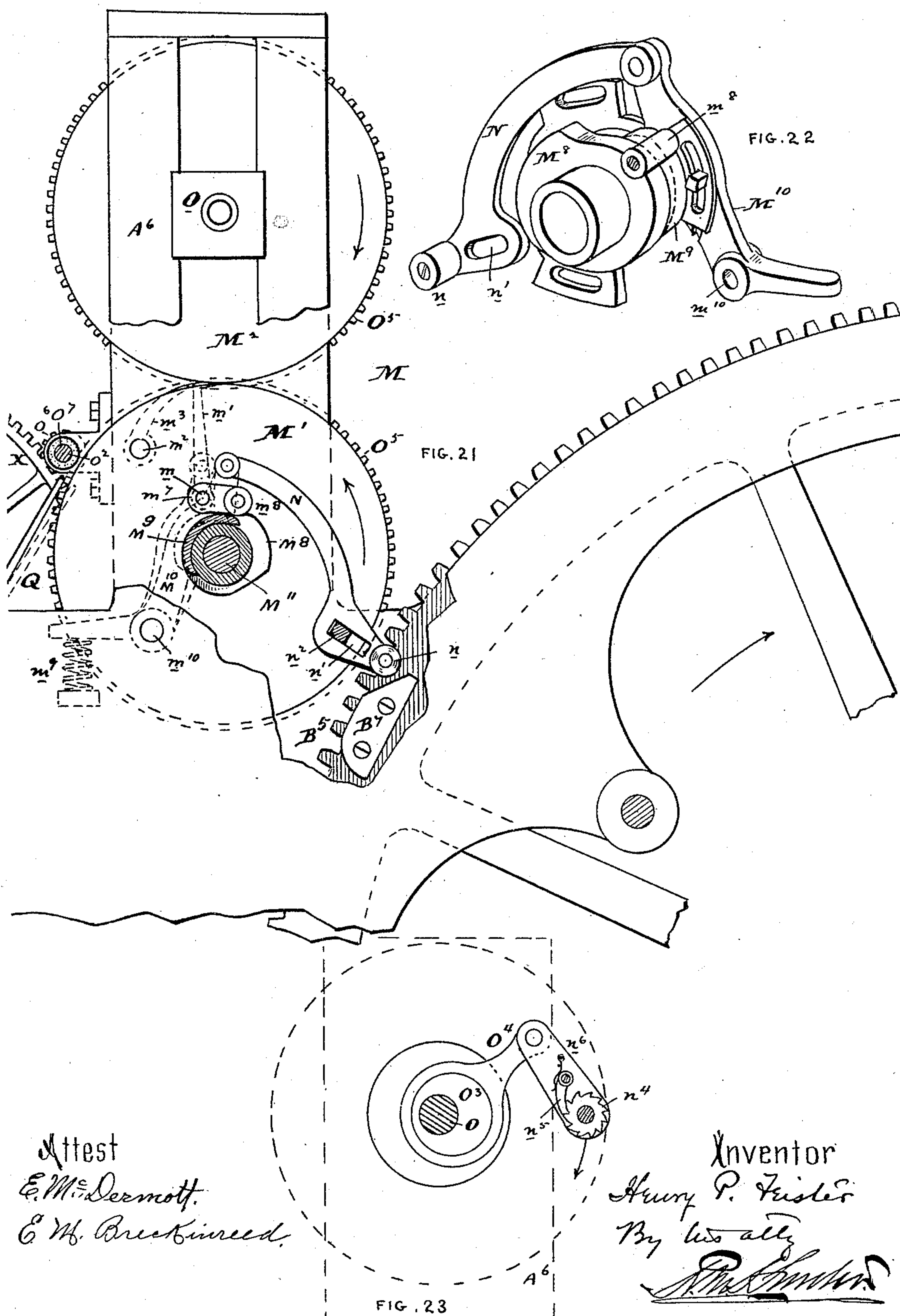
(No Model.)

8 Sheets—Sheet 8.

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PRINTING AND BINDING MACHINE.

No. 452,933.

Patented May 26, 1891.



Attest
E. M. Dermott.
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Inventor
Henry P. Feister
By *Wm. Allen*

UNITED STATES PATENT OFFICE.

HENRY P. FEISTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE
FEISTER PRINTING COMPANY, OF PENNSYLVANIA.

PRINTING AND BINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 452,933, dated May 26, 1891.

Application filed September 30, 1886. Serial No. 214,926. (No model.) Patented in England September 20, 1886, No. 11,953;
in France April 11, 1887, No. 170,600, and in Belgium April 15, 1887, No. 76,893.

To all whom it may concern:

Be it known that I, HENRY P. FEISTER, of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Printing and Binding Machines, of which the following is a specification.

My invention has reference to machines for printing and binding pamphlets or books direct from a roll of paper; and it consists in certain improvements, all of which are fully set forth in the following specification, and shown in the accompanying drawings, which form part thereof.

This invention was patented to me in Great Britain on September 20, 1886, No. 11,953; in Belgium on April 15, 1887, No. 76,893, and in France on April 11, 1887, No. 170,600.

The object of my invention is to make in an automatic manner a large number of books from a roll of paper, and to accomplish this object the paper is required to go under the following operations: As the paper web passes into the machine the book-sheets are cut off prior to printing, and are then printed, first on one side and then upon the other, in the manner hereinafter set forth, and after being printed upon both sides the said book-sheets are assembled sheet after sheet on top of each other and in perfect register and folio. These sheets in the act of being assembled are pasted together down their central margin, and the book so formed is secured to its cover, and the entire assembled sheets and cover are folded through their center margin and then subsequently trimmed where a particularly nice finish is required.

In carrying out my invention I provide two segmental impression-cylinders and one segmental type-form cylinder, the two former working in contact with and cog-gearred to the latter and rotating in the same direction at point of contact, so that one prints from alternate type-forms and the other prints from the type-forms omitted by the first. With these I provide suitable feed guide and cutting cylinders, which perforate the sheet transversely across and feed it to one of the impression-cylinders at a rate of speed equal to one-half that of the impression-surfaces upon said cylinder; but its feed is so timed that the

edge of the sheet will come in line with the forward advancing edge of the impression-surfaces, where it is gripped by suitable automatic nippers fitted to and working with the forward edge and carried around between the said impression-surfaces and the type-form-cylinder segments. If the sheet were wholly cut from the continuously-traveling web, there would be difficulty in its proper delivery to the nippers, as said nippers could not catch the paper till they had passed and descended beyond the cutting-cylinders a distance equal to the length of the sheet, owing to the different velocities of travel of said cylinder and sheet. It would be impracticable to rely upon the nippers holding the sheet so as to break or detach it from the web. To accomplish this result, I provide a sheet-detacher consisting of a series of pins arranged at right angles to a revolving shaft and adapted during their revolution to work in contact with the advancing or leading edge of the impression-surfaces of the impression-cylinder, and thereby at stated intervals nip the sheet and break it from the web, and at the same instant therewith the nippers close upon the leading edge of the sheet, and it is carried forward in perfect register with marginal allowance to meet the forms on the segmental form-cylinder. After the sheet is carried between the type-form or printing cylinder and the first impression-cylinder it is carried around and transferred by a suitable transfer device, such as set out in Letters Patent No. 323,925, and dated August 11, 1885, to the second impression-cylinder, which is revolving in the same direction as that of the first impression-cylinder, and the nippers upon said second impression-cylinder close upon the tail end of the sheet, while the nippers upon the first-mentioned cylinder open to free the forward end of the sheet. It will now be seen that what was before the leading edge of sheet now becomes the tail—i. e., reversed in its motion, so that the printed face of the sheet is now turned down upon the second impression-cylinder—and as it is carried between the impression-surface and the type-form cylinder the opposite or reverse side will be printed. The

sheet now being printed upon both sides, it is carried around the lower hemisphere of said second impression-cylinder and up and delivered to an assembling device located at the rear of the machine. The transfer device consists, essentially, of a hinged frame or tympan, the rear end of which swings out at the proper time through the agency of cam devices, so as to throw the tail end of the sheet within reach of the nippers upon the second impression-cylinder. The type-form cylinder has a continuous series of type-forms about its circumference, which may be either curved or flat and receive ink from stationary inking-rolls of any of the well-known constructions. When curved type-forms are used, then the type-form beds or segments to which they are secured are arranged rigidly upon the cylinder, their curvature being the same as the pitch curve of the said cylinder; but when flat plates are used, then these beds are pivoted in such a manner that they may rock slightly, so that each portion of the type-surface may at the instant of printing be brought in line with the pitch circle, and thereby have all the effect of a curved plate. This is accomplished by providing the said type-beds with bearer-plates on their ends, which shall run in contact with like curved surfaces on the impression-cylinders, the face of said bearer-plates being as tangents to the pitch circle. The type-form beds or segments are adjustably pivoted in this latter instance and held in position by suitable springs, which may be either of metal or rubber and are provided with devices whereby their outward or radial adjustment may be regulated so as to insure the requisite degree of printing-pressure. As constructed these type-form beds may be made rigid or adjustable to suit curved or flat type-forms. The type-form beds or segments are made rectangular in shape and are provided upon each end with journal lugs or studs, by which they are held through the agency of suitable links to a pair of wheels or spiders, which wheels are adjustably secured upon and between the gear-wheel and blank wheel forming the two outer walls of the type-form cylinder. The type-form gear meshes with the corresponding gears upon the impression-cylinders, and while it is found in practice that a single set of these gear-wheels and a set of blank wheels are sufficient, yet it is evident that the blank wheel may also be a gear-wheel. Both of these wheels are secured firmly upon a shaft, and the pair of spiders or type-form-carrying wheels are supported upon the same shaft and adjustably clamped by means of bolts or slots to the said gear and blank wheels, preferably near the periphery, whereby said spiders with their type-forms may be adjusted back and forth in the pitch circle. From this it will be seen that the internal wheels or spiders and the segmental type-form beds are adjustable either with or against the direction of the travel of the type-

form-cylinder gear and independently of the position of the teeth in same. This adjustment is very important, as it is by this means that books of different sizes are enabled to be printed on the same machine. These type-form beds are provided with a slot extending almost from end to end, through which the form-clamps pass and are made adjustable laterally upon the bed. These clamps are provided with pins or points upon their sides adapted to catch or hold the type-forms down upon the beds. These clamps project through to the under side of the bed, and are provided with enlarged portions through which the clamping-bolt passes. One end of this clamping-bolt is made in two parts, one part of which is screwed into one end of the bed, and is connected to the other part by a right and left hand screw-threaded coupling, so constructed that upon being turned the clamping-bolts will be drawn together. The free end of the last-mentioned bolt is provided with a head which draws upon the end clamp, and this through the mediation of the type-form presses upon the next clamp, and so on, clamping all of the type-forms firmly in position upon the bed. As many or few of these adjustable clamps may be used as are desired, as they are capable of being placed upon and removed from the bed at will. The construction of the type-form cylinder is novel in every particular, admitting of lateral adjustment of the clamps to hold type-forms of different widths or also of different lengths to suit books of different sizes. The maximum speed may be obtained as each cylinder revolves constantly in the same direction at point of gear-mesh. The advantage of the above-mentioned adjustable features will be readily appreciated when it is understood that the only limit to the size of the book or books capable of being printed upon this machine is the maximum width and length or linear dimensions of the type-form beds or impression-surfaces, as each impression-surface may print laterally one or more book-sheets at one time, as desired, and as governed by the previous adjustment. The sheets, after being printed upon both sides, may be delivered upon a fly-frame and used as circulars or bound in any manner desired; but I prefer to assemble them upon an assembling device, and then after the required number of sheets have been assembled deliver them to a folding mechanism. The assembling device consists of a skeleton frame revolving in unison with another or pasting fountain-frame, the former of which is provided with a series of adjustable spring-band sections to support the assembled sheets, and, further, with two sets of nippers, one of which sets is for the purpose of holding the leading edge of each sheet as they assemble on each other, while the other of which sets is for the purpose of taking and holding the leading edge of the sheet from the impression-segments of the second impression-cyl-

inder as delivered until the first-mentioned set of nippers is withdrawn from under and placed on top of the sheet. The assembled sheets are successively clamped upon a radially-movable bar supported upon springs, which, with the forward edge of the sheets collected, is depressed by a cam on each side connected with a pin-bar (the purpose of the pin-bar is to distribute the buckles and wrinkles in each sheet as they assemble on said skeleton) as well as to hold the leading edge of the sheet close to the radial bar on the assembling-frame, so as to insure the retaining-nippers getting on top of said sheet as the bar rises, thereby allowing at one point in the revolution of the assembling-skeleton a proper working of the holding-nippers. These nippers are worked by suitable cam devices, so as to operate with each revolution of the skeleton frame to assemble and hold the leading edge of one or more sheets, and they are so arranged that after a given number of sheets are assembled a suitable cam operates to throw them entirely out of action, whereby the sheets are received upon the fly-frame, which has been tipped sufficiently to pass under the said sheets as their leading edges advance toward it. As the leading edge of each sheet is taken off the impression-segments of the second impression-cylinder the sheets naturally lie on top of the retaining or holding nippers, and said retaining-nippers by suitable cam mechanism are actuated to withdraw from under the sheet just prior to the depression of the radially-moving bar and to again close in the curvature of the pitch circle of the gears (by which the assembling-skeleton is driven) while the said moving bar is depressed. As the moving bar again rises it clamps the sheet or sheets against the retaining-nippers. The object of this radially-moving bar is to allow the withdrawing of the retaining-nippers from under the sheets and their passage above the same, and this is attained by causing the sheet to move down with the said bar after the retaining-nippers have been drawn back, so that upon the advance of said nippers the retaining part comes over the leading edge of the sheet, and when the said bar again rises it clamps the sheet against the said retaining-nippers. The leading ends of, say, four of the spring-bands of the assembling device are left loose in a measure compared with the others, so that they will press the leading edge of the sheets against the like edge of the impression-cylinder segments in order to prevent the sheets slipping during action of delivery of sheet to the assembling device, as for an instant of time the sheet at this period is not in the custody of any nippers. The upper of said assembling devices is provided with an air-tight paste-fountain arranged to automatically feed the paste with each revolution to place upon the last sheet as assembled as aforesaid a transverse line of paste, whereby the successive

sheets are pasted together. Said paste-fountain is adjustable with the radii of pitch circle of the gears by which the paste-fountain and assembling-skeleton revolve in unison, this being necessary in order to paste books of different sizes, they always being pasted down the center or folding margin. After the assembled and pasted sheets are delivered to the fly-frame they are laid upon the table upon which the back or cover has been previously placed or inserted, and the upper or exposed line of paste attaches the covers to the assembled and pasted sheets. The paste-fountain carried by one of the skeleton frames above mentioned may be counterbalanced to make it run smoothly, and the paste may be fed to the fountain while the machine is running. The paste-fountain consists of an air-tight receptacle having an orifice opening upon the pitch circle and furnished with two preferably adjustable plates, between which the paste-roller is intermittently rotated by suitable cam or eccentric devices, one of which plates lets out the paste and the other scrapes it off, whereby a limited amount of paste is brought to the face and applied to the book-center margin or folding-line with the reception of each new sheet, avoiding all excess which would tend to cause trouble in the proper binding of the books. This paste-fountain, as aforesaid, is adjustable on the pitch circle and about the center of the semicircle of the skeleton frame to which it is attached, whereby it may be caused to apply paste on the folding-line of books of different sizes. This is necessary where it is desired to print books of different sizes on the same machine. After the pasted sheets have been delivered by the fly-frame a folding-knife descends, folding the sheets and cover into a book form, and which folded sheets may be run between trimming-knives or be subsequently cut. If the machine is made of sufficient width, two or more pamphlets or books may be made and formed end to end and may be subsequently cut apart. The bound signature, after passing through the folder, is received by a packer, which presses each successive book backward in the rear of suitable spring-pawls, which retain it in the desired position and clear of the book next entering. The second impression-cylinders, receiving the printed sheets printed side down, are apt to have their tympan more or less inked by the reception of successive printed sheets and the consequent pressure to which they are subjected. To prevent blurring of sheets from this cause, I provide a movable tympan or make-ready web and a suitable device for moving it automatically with each impression, whereby each successive sheet is received upon a different portion thereof. The roll of paper is supported upon a carriage or frame, which is pivoted to a bed upon a vertical center, the object being to allow the paper to feed uniformly to the feed and perforating cylinders, and

thereby overcoming defects due to the difference that is sometimes found between the lengths in a given distance of the two lateral edges of a roll of paper.

5 In the drawings, Figure 1 is a side elevation of a printing and binding machine embodying my improvements. Fig. 2 is a sectional elevation of a portion of same, showing how the paper web is cut into sheets and delivered
10 to the first impression-cylinder. Fig. 3 is an enlarged side elevation, with a portion in section, showing the general construction of the two large impression-cylinders and their relation with reference to each other, the type-
15 form cylinder, and assembling device. Fig. 4 is a plan view of the type-form cylinder with part in section on line *y y* of Fig. 5, with most of the type-form beds removed. Fig. 5
20 is a side elevation of one-half of said type-form cylinder with a part in section on line *x x* of Fig. 4. Fig. 6 is a side elevation of a type-form when made with a curved face corresponding to the pitch circle of the type-form
cylinder. Fig. 7 is a perspective view of one
25 of the form-beds removed, with a portion of the center broken away. Fig. 8 is a longitudinal sectional elevation of same. Fig. 9 is an end elevation of one of the form-clamps. Fig. 10 is a side elevation of same. Fig. 11 is a
30 perspective view of one of the retaining-bolts by which the form-beds are secured to the type-form cylinder. Fig. 12 is a perspective view of one of the spring-bolts, upon which the beds are allowed to move and by which they
35 are held in the proper outward adjustment. Figs. 13 and 14 are diagrams illustrating the principle involved in the operation of the type-form beds, showing how flat forms may be arranged on a cylinder and printed from in conjunction with curved impression surfaces.
40 Fig. 15 is a sectional end elevation on line *z z* of the assembling device for assembling the sheets composing the book prior to being folded. Fig. 16 is a front elevation of same,
45 looking toward the rear of the machine. Fig. 17 is a perspective view of the assembling device as removed from its supporting framework. Fig. 18 is a sectional cross elevation (similar to Fig. 15) of portion of same, showing
50 the position of the nippers, radially-moving changer-bar, and skeleton-frame springs when the assembling device is in the act of taking a sheet from the impression-cylinder. Fig. 19 is a similar view of a portion of the
55 assembling device, showing how the radially-moving bar, with its sheets, is depressed to allow the retaining-nippers to pass above the last sheet assembled. Fig. 20 is a similar view showing the sheets clamped between the
60 retaining-nippers and the radially-moving changer-bar. Fig. 21 is an end elevation of the assembling device with a portion of its supporting frame-work broken away and showing the connecting cam device by which
65 the assembled sheets are caused to be delivered to the fly-frame and folding device at stated intervals. Fig. 22 is a perspective

view of said cam mechanism, and Fig. 23 is an elevation of the eccentric and ratchet device used for intermittently rotating the paste- 70 feeding roller.

D is the main frame-work of the machine and supports the two impression-cylinders A and B, both rotating in the same direction, but not in contact with each other, and the
75 type-form cylinder C, with which both of the impression-cylinders work, the organism being such that the impression-cylinder A prints from certain type-forms of the cylinder C, and those omitted by the said impression-cylinder
80 A are printed from by the cylinder B, substantially in the manner set out in Letters Patent No. 256,662, and granted to me April 18, 1882; also Letters Patent No. 323,925, dated
85 August 11, 1885; but in this application I have substituted a chain or series of type-beds in the form of a cylinder. The impression-cylinder A is provided with a series of
impression-surfaces *a*, separated by an equal
90 distance, and the leading end of each of said impression-surfaces is provided with suitable paper-clamping nippers G.

The roll of paper E is loosely supported upon a frame E', which is allowed to oscillate in a
95 horizontal plane by means of a vertical pivot E², formed in the base-plate E³, which in practice rests upon the floor. By this means inequalities in the lengths of the edges of the paper web will not cause a dragging effect
100 upon the feed and cutting rolls F. The feed and cutting rolls consist of a roller F', having perforating points or cutters *f*, and the roller F², having notches or grooves into which said
105 perforating points or cutters project. These rollers are geared together by spur-gears F⁶, (see Sheet 1,) whereby they are caused to run in unison and perforate the web of paper to form two sheets with each revolution. These
110 rollers do not entirely sever the sheet, but simply put it in such a condition that it is easily broken or detached from the web. The surface speeds of these perforating cylinders or rollers are one-half that of the impression-
115 cylinder A, so that the leading edge of each successive sheet delivered to the impression-cylinder shall coincide with the leading edge of each of the impression-surfaces *a*. These
perforating-rolls are driven by gears F⁴ F⁵, the former of which is secured to the impression-
120 cylinder A or its shaft A³.

F³ is the rotating shaft, to which are secured a series of detaching pins *f'*, and said shaft is rotated by a gear A², which meshes with the
125 teeth A⁵ of the impression-cylinder A. (See Fig. 2.) The object of this detacher is to catch at stated intervals the forward edge of the sheet by pressing it against the impression-
130 cylinder, and for an instant of time cause it to travel at double the velocity that it would otherwise have. The effect of this is to break the sheet away from the web along the lines
of perforations, and the instant this is done the nippers G fly down and clamp the leading edge of the sheet to the impression-surface *a*.

These nippers are secured to a cross rock-shaft G' , journaled on the impression-cylinder between the impression-surfaces, and has secured to its outer end the pinion g , which is rotated by a segmental lever G^2 , having roller g' , which runs against the nipping and releasing cams for the purpose of oscillating the segment to open or close the nippers. The nippers are normally kept closed by means of a rod G^3 and spring G^4 , connecting with the segment G^2 , the said springs opposing the action of the cams.

H is the nipping-cam, which is secured to an arm H' , journaled on the shaft of the impression-cylinder, and said cam is adjustable in the arc of a circle by means of a slot h' and bolts h , passing through the main frame of the machine. This cam H is so located that it opens the nippers fully to pass under the sheet-perforating rolls and allow them to close quickly immediately upon the sheet being detached, as hereinbefore described. The sheet so delivered to the impression-cylinder A is carried past the type-form cylinder and receives an impression upon one side, and is then carried on until it comes directly opposite to the other impression-cylinder B , when it is transferred by a suitable transfer device, set out in Letters Patent No. 323,925, above referred to. This transfer device consists, essentially, of a tympan I , secured at its leading edge i to the leading edge of the impression-surface a of the impression-cylinder A . This tympan is connected by a link i' near its middle and is swung out at the proper instant by said link, which is hinged to a lever I' , secured to a rock-shaft i^2 , which rock-shaft is rocked by means of a lever I^2 and reciprocating bar I^3 , having a roller i^3 , working in a stationary cam I^4 . This cam has but one operating part, and that is so located as to make the various tympan or transfer-frames operate at one particular place in the revolution of the impression-cylinder. Each of the impression-surfaces a is provided with a similar tympan and mechanism to operate it, though for simplicity and clearness only one such complete device is shown in Fig. 3. The instant the tympan moves the tail end of the sheet over to the cylinder B the nippers G are caused to release the leading edge of the sheet of paper by means of a releasing-cam H^2 , secured to a radial arm H^3 , journaled upon the axle A^3 , and made adjustable in the arc of a circle by means of the slotted link-and-bolt device H^4 , connecting with the main frame of the machine. In addition to this adjustment, the cam H^2 is adjustable by means of a slot or bolt connection h^2 to and from the center of the impression-cylinder to control the degree of opening of the nippers. The instant the sheet is thrown to the cylinder B and is released by the nippers on the cylinder A it is caught by the nippers G on the cylinder B , the tail end now becomes the leading end of the sheet, and the printed surface lies adjacent or next to the impression-

surface. The sheet is now carried between the type-form cylinder C and impression-cylinder B , and its reverse side is printed upon by one of the type-forms omitted by the cylinder A , and after being thus printed upon both sides the sheet is carried around and delivered to the assembling device M . The impression-cylinder B is in all material respects the same in construction as the cylinder A , with the exception that it has no transfer-tympan. It is combined with similar cams H to operate the nippers to close upon the forward or leading edge of the sheet and the releasing-cam H^2 to release the sheet when in the act of being delivered to the assembling device.

To prevent blurring of the sheet when in the custody of the second impression-cylinders B , I provide the impression-surface thereof with movable make-ready webs b' , which may be intermittently wound from one roller B' to another, traveling to a slight extent with each impression, so that every time a fresh sheet is received upon the impression-surface b the inked portion thereof is received upon a different portion of the make-ready. This make-ready web may be moved automatically in a large number of ways, that shown in Fig. 8 consisting of a ratchet-wheel b^2 , attached to one of the rollers B' , combined with a stop pawl b^3 and a pivot-pawl and lever-actuating device B^2 , which is reciprocated with each revolution of the cylinder B by being brought into contact with the stationary cam B^6 .

The type-form cylinder C consists of the two main wheels, one or both of which may be provided with gearing C^5 to engage with the teeth on the impression-cylinders, and thereby be caused to revolve in unison therewith, and to the inner faces of the said main wheels are adjustably secured spiders or form-supporting wheels C' , which are adjustable upon the shaft C^3 , to which the main wheels are secured. The form-wheels C' are adjustably bolted, by means of the bolts c and slots c' , to the main wheels near their periphery for the purpose of accurately adjusting the relative position of the type-forms with respect to the impression-surfaces without disengaging the main wheel or wheels of the form-cylinder from the gears of the impression-cylinders, and, furthermore, this adjustment admits of a very small variation in position of the type-beds, whereas if adjustment were made by shifting the gears relatively to each other it would necessitate at least a movement equal to the distance between the centers of two adjacent teeth. This adjustment is extremely important, as it is the means whereby books of different sizes may be printed upon the same machine, and enables the adjustment to be made with respect to the leading edge of the sheet, and thereby insure the impression to be properly located.

C^4 are the type-form beds and are connected to the wheels C' by means of links or eyebolts

K, connecting at one end with lugs c^1 on the ends of the type-form beds and at the other end connected by nuts K^2 and a spring K' with a flange of the wheels C' . The spring K^2 may be made of metal or simply a rubber washer. These links or bolts perform a function of holding the form-beds C^4 in the proper radially adjustment, so as to keep the printing-surface of the type-form in a line with the pitch circle of the impression and type-form cylinders, and thereby insure accurate and good printing. To prevent the form-beds from being forced toward the center of the form-cylinder, I provide bolts K^3 , having semi-cylindrical heads K^4 , which fit into corresponding recesses C^6 upon the ends of the form-bed and upon each side of the lugs c^4 , each bolt receiving a pressure from two adjacent form-beds. These bolts are guided through bearings K^7 and are supported upon springs K^6 , the tension of which may be adjusted by nuts K^5 . From this construction (see Sheets 3 and 4) it is evident that the form-beds will be free to rock so as to bring every portion of the printing-surface of a flat form at the instant of printing into the pitch-line or curved plane through the face of the impression-surface. To remove the pressure necessary to rock these beds from the type-forms, I provide upon each end of the bed a hardened steel bearing-plate, which rocks against the surface of the impression-cylinders and causes these beds to rock in a manner to print without undue pressure upon the type-form. If curved type-forms, such as indicated in Fig. 6, be used, then it is not necessary to rock the bed C^4 , and in that case curved bearer-plates would be substituted for the flat or tangent plates, as indicated in dotted lines in Fig. 7. In this case the springs K^6 around the bolts K^3 might be removed and metallic tube-sections K^8 substituted therefor, (see right-hand portion of Fig. 5,) which change would make the parts K^3 rigid, and by proper adjustment of the nuts K^5 the adjustment of the beds could be made to a nicety. It is evident that these details of construction might be modified in various ways and yet attain the same results. I therefore do not limit myself to the specific devices shown. As the bolts K and K^3 are carried by the inner wheel C' , it will be perceived that these beds are also necessarily carried by said wheels and are adjustable with them. This method of construction enables the machine to be changed to make the beds rigid or adjustable to suit curved or flat type-forms, as the case may be. These beds are provided with a longitudinal slot through which the form-clamps k' are adjustably connected to a tension-bolt k^5 , located in the under part of the bed, upon which they are threaded. These clamps k' are provided with teeth k^2 , preferably beveled with the incline face turned down, so that when they are pressed against the wooden side of the type-form the tendency will be to draw the said type-form

close to the bed. These clamps have a head k^3 on their lower parts, through a hole k^4 of which the tension-bolt k^5 passes. These clamps are inserted from one end of the bed before the bearer is secured in place, and the end clamp, or the one last placed on, is drawn up against the end type-form J^2 , and by arranging the clamps and the type-form, alternately, as indicated in Figs. 4 and 8, they may be clamped firmly in position, the clamping action being transmitted from one to the other, and the end form being pressed against the retaining-teeth on the bearer k . To create the tension I make a bolt k^5 in two parts, each of which has a head k^6 , one of which heads pulls against the end of the form-bed and the other of which head pulls against the last clamp k' , and these two parts of the bolt are drawn together by a right and left hand coupling-piece k^7 , as shown in Fig. 8. From this it is seen that by turning the coupling all of the type-forms may be clamped securely to the form-bed, and by varying the number of clamps any desired number or sizes of type-forms may be used.

In a machine of this class where there are a number of forms arranged end to end transversely across the cylinder it is evident that each type-form on each bed may be used to print a corresponding page in as many books as there are type-forms on each bed; or, if desired, the sheets printed from two or more such type-forms may be used as signatures and ultimately bound together into the same book. Thus, for instance, a machine holding five type-forms upon each bed and having sixteen beds would be capable of printing five books of sixteen pages with each revolution, or one book of eighty pages; or if we have two beds to each impression-surface these figures will be doubled, and it will thus be seen that the capacity of the machine will be enormous.

L is the inking-rollers for the form-cylinder, and are driven by a belt l , passing around a pulley L' , secured to the shaft C^3 of the form-cylinder.

J is the main drive-wheel or band-pulley, from which power is transferred to the machine by pinions J' , meshing with the teeth B^5 of the impression-cylinder B . The arrows on the different figures indicate the direction of travel of the various parts.

The sheets printed in the manner above described may be delivered by a suitable fly-frame or delivery apparatus and be used as circulars in the loose form, or they may be collected and bound in book form, by a suitable apparatus now to be described.

The binding apparatus consists of two parts—the assembling device by which the sheets are assembled upon each other one after the other and are pasted together down the center of their middle margins, and the folding device for folding the sheets so collected and pasted. These devices are clearly shown in Fig. 1 and Figs. 15 to 28, inclusive.

The assembling device M consists, essentially, of two skeleton frames revolving in contact with each other, one of said frames M' being the assembling-cylinder, while the other M² carries the paste-fountain and applies the paste to the sheets as they are successively assembled on the assembling-frame. The assembling-frame is supported upon an axle 18 or shaft M'', to which is adjustably clamped a series of arms M³. To these arms are secured a corresponding series of flexible spring-bands M⁴, which are curved around, forming a semicircle and giving the appearance to the frame of a semi-cylinder. Diametrically opposite to the arms M³ is a radially-moving changer-bar M⁵, adapted to move to or from the shaft M'', and is pressed away from the said shaft by rods M⁶, near each end, and springs M⁷. The ends of some of the bands M⁴ are secured to brackets m⁴, in turn bolted to the radially-moving bar M⁵, so as to be depressed with the said bar, while others of said bands have their ends m'' free, as indicated in Figs. 17 and 18, the purpose of which will be hereinafter set out. The skeleton frame so formed revolves upon its axis M'' and moves in unison, by means of gearing O⁵, with the frame M², carrying the paste-fountain and revolving upon an axis O. The frame M² is provided with the cams P, arranged to be adjusted about the axis O by means of slots p and screws p'. These cams are set so as to strike the radially-moving bar N⁵ once in every revolution and cause it to be depressed when the retaining-nippers are in the act of being shifted. Connecting these cams P is a cross-pin bar P², carrying a series of pins P', longitudinally adjustable in the direction of their length and arranged radially with respect to the axis O. The object of these pins is to cause the leading edge of the paper sheets to be held down upon the radially-moving bar in such a manner that any buckles formed thereon shall be pressed down or distributed, thereby reducing all wrinkles and buckles to a small size and insuring the retaining-nippers being freely passed above the leading edge of the sheet. The frame M' is provided with two sets of nippers, one set m', called the "retaining-nippers," and the other set m³, or "receiving-nippers." These two sets of nippers are respectively secured upon rock-shafts m and m² and are equal in number, being arranged side by side, as shown in Figs. 16 and 17, the pins P' of the pin-bar working between them. The nippers m³ are designed to catch every sheet from the impression-cylinder B just as the nippers G of the impression-cylinder are released by the delivery-cam H², whereas the nippers m' are simply designed to hold the assembled sheets collected by the action of nippers m³, while the said nippers m³ are raised in the act of catching the leading end of a fresh sheet. The action of these nippers at this part of their movement is clearly shown in Fig. 18. After a fresh sheet is assembled

upon those already resting upon the spring-bands M⁴ the said nippers m³ hold it till the next sheet is to be received, merely opening and closing once in a revolution, (except when delivering the assembled sheets to the folder,) and then when it is close to the impression-cylinder B. When the leading edges of the assembled sheets approach a vertical line through the axis of the cylinder M', the retaining-nippers m' are drawn from under the last-assembled sheet, and as the movement continues the cam P on the frame M² depresses the radially-moving bar with its assembled sheets, as indicated in Fig. 19. At this instant the retaining-nippers m' are allowed to move back over the top of the leading edges of the assembled sheets, as indicated in Fig. 20, and as the cam P is lifted from the radially-moving bar the springs M⁷ cause the said bar to move away from the axis M'' and clamp the sheets between itself and the retaining-nippers. The retaining-nipper shaft is caused to rock by means of a spring m⁶, so as to normally close the nippers into operating position, and when said nippers are to be turned from under the last-collected sheet this operation is performed through the agency of crank m⁷, having the roller m⁸, which works in contact with the stationary cam M⁸. (See Figs. 17, 21, and 22.) After the proper number of sheets have been assembled and it is desired to discharge them to the fly-frame Q, by which they are delivered to the folding portion of the machine, the retaining-nippers m' are thrown back a greater distance by means of a delivery-cam M⁹, connected to a lever M¹⁰, pivoted at m¹⁰ to the main frame of the machine and combined with a spring m⁹ to throw the cam M⁹ out of action. The free end of the lever M¹⁰ is connected to a link N, guided on the main frame by a slot n' and lug n², and this link is provided on its end with a roller n, with which one or more cams B⁷ on the impression-cylinder B (see Sheet 7) work. When the cam B⁷ shifts the link N, it raises the delivery-cam M⁹ into the position indicated in dotted lines, Fig. 21, so that as the roller m⁸ for operating the nippers travels around its overhang runs upon the delivery-cam and causes the nippers to open to allow the delivery of the assembled sheets. The nippers m³ are operated by a pinion and segmental gear similar to those upon the impression-cylinders for operating the nippers thereof.

Referring to Sheet 5, it will be seen that the nipper-shaft m² is provided on its end with a pinion N', with which the segmental gear N² meshes. This segmental gear is operated to open the nippers by means of a spring N³ and to close the nippers by means of a roller n³, carried by the segmental gear and adapted to follow the face of the stationary cam N⁴. This segmental gear and its spring N³ are secured to the frame M', and are thereby caused to travel about the stationary

cam. It will be observed that the nippers m' are thrown out of action by a cam, whereas the nippers m^3 are thrown into action by a cam.

Q is the fly-frame, which may be of any ordinary construction. Referring to Fig. 1, it will be observed that this fly-frame has imparted to it an oscillating movement about its axis by means of a pinion Q' , operated by a segmental gear Q^2 upon a bell-crank lever Q^3 . This bell-crank is formed with adjustable arms connected by an adjusting-link q for the purpose of regulating the position of the fly-frame. This bell-crank has a roller q' , which works upon the cam Q^4 , which has the extended part Q^5 and the depressed part Q^6 , the said bell-crank being pressed toward said cam by means of a suitable spring q^2 . This cam Q^4 is secured to the shaft B^3 of the impression-cylinder B , and makes one revolution to each revolution of the impression-cylinder. The object of the depressed portion Q^6 of the cam is to allow the fly-frame to drop into the position indicated in dotted lines, Fig. 15, so that as the assembling-frame M' revolves around the points of the fly-frame pass through the notches m^5 in the radially-moving bar, and hence the leading edge of the assembled sheets is brought above the fly-frame and may be delivered thereto, as at this instant the nippers will have released their hold upon the assembled sheets, and said sheets in running down upon the fly-frame will pass under the rubber rollers O^7 upon a shaft o^2 . Upon the end of this shaft is a pinion O^6 , which meshes with the gears O^5 of the frame M' . The cam portion Q^5 of the cam Q^4 then operates the bell-crank lever to cause the fly-frame to deliver the sheets upon the receiving or folding table R .

We will now return to the pasting devices for securing the sheets together by means of a line of paste down their middle margin.

Referring to Sheets 5 and 6, N^5 is the air-tight paste-fountain adjustably secured to the frame M^2 , (which revolves in unison with frame M'), and is made circumferentially adjustable by means of slots O^3 and screws O' , whereby it may be adjusted with reference to the leading edge of the sheet, and thereby insure the deposit of paste in the proper position in the middle margin with book-sheets of different sizes. The paste-fountain is located upon one side of the hollow shaft O , and is counterbalanced by a weight N^8 to prevent the excessive action of centrifugal force. The paste-fountain may be charged while the machine is running by forcing the paste through the hollow axle O and the branch pipe o , which connects the hollow axle with the paste-fountain, and when the fountain is full such condition will be indicated by the oozing of paste from under the detecting and air-vent spring-valve o' .

N^6 is the paste-feeding roller, and revolves with an intermittent movement back of a narrow slit n^7 , extending the full length of the paste-fountain and formed by the edges of

the adjustable scraping-plates N^7 , which regulate the amount of paste admitted to the slit. The paste-roller N^6 is operated by the eccentric and ratchet mechanism shown in Sheets 5 and 7, from which it will be seen that the said roller is provided on its end with a ratchet-wheel n^4 , which is intermittently rotated by a pawl n^5 , operated by a lever n^6 , pivoted to the axis of the ratchet-wheel and reciprocated by means of the eccentric-strap O^4 and stationary eccentric O^3 , arranged about the axis O of the frame M^2 . From this it will be seen that as the paste-fountain is carried about the stationary eccentric the ratchet-wheel will be intermittently rotated and cause a corresponding motion to the paste feed and roller N^6 . There would be enough play in the adjusting-slot O' to allow a slight adjustment radially to or from the axis O of the paste-fountain. The sheets on the frame M' when receiving paste are supported by the spring-bands M^4 , and said spring-bands may be adjusted by moving arms M^3 , so as to spring their curvature, as indicated in dotted lines, Fig. 15, and thereby increase or diminish their adjustment toward the paste-fountain. The frame M' is formed with the spring-bands M^4 , separated from each other by space, so that when the sheets are being delivered to the fly-frame the arms of said fly-frame may enter between the said spring-bands, so as to be under the sheets supported thereon.

From the above construction it will be observed that as each successive sheet is assembled upon the assembling-frame M' the paste-fountain deposits a line of paste centrally through the middle margins of the sheets so collected, whereby the said sheets are secured to each other, and upon the said sheets being transferred to the folding-table they are caused to be laid upon a cover which has been placed face downward, and the last deposit of paste upon the printed sheets will come next to the cover and secure it to the book.

R is the receiving-table of the folding device and is provided with a transverse slot r , beneath which are the pressure-rollers R' , around which endless bands r' travel.

S is the folding-knife secured to a rocking lever s' , and is adapted to fold the assembled and pasted sheets and back on their middle margins, and such folded sheets and back are fed between the rollers R' and their bands and are deposited upon the packing-table U . They are then forced back by a reciprocating slide W to the rear of two spring-pawls t , and between said pawls and a retaining-frame U' , which is constantly drawn toward the said pawls by a chain u and weight u' . As the books accumulate at V the frame U' moves back, but at the same time holds them in a packed condition. The folding-knife S and its arm are operated by a lever s and links s' , which are acted upon by a cam T , secured to the axle B^3 of the impression-cylinder B . The slide W is also operated from the same lever s by a link w' , and said lever s is caused to fol-

low the face of the cam by means of a spring device s^2 .

X is a spur-wheel connecting the assembling-cylinder gears O^5 and O^6 with the folding-rollers R' , whereby they receive motion. The assembling-cylinders receive their motion from the impression-cylinder B, and have the same surface speed therewith.

I would remark that I do not limit myself to the details of construction involved in this machine, as such details may be greatly modified without in any wise changing the principle of the invention, and it will be readily understood that almost any form of a folding and packing device might be used with a machine of this class.

The practical operation of this machine has developed the fact that the speed may be very great without the least injury to the cleanliness of the impression or the register of the sheets. The work printed upon this machine, in view of the improvements herein set out, is equal to that of the best printing-presses with flat reciprocating beds, and the assembling and binding are so perfect that trimming is not absolutely necessary.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a perfecting printing-press, the combination of a supporting horizontally-movable frame for the paper roll with a stationary frame, and a vertical axis between said frames and extending vertically substantially through the paper roll; whereby the paper roll may unwind upon a horizontal axis and also move horizontally about a vertical axis, substantially as and for the purpose specified.

2. In a printing-press, the combination of the constantly-moving feed-rollers for the paper web, with a frame for a roll of paper and movable horizontally without lateral motion, and a support for said frame to hold it at a distance from said feed-rolls, whereby the paper roll may be fed uniformly between the feeding-rolls, irrespective of the local differences in the length of the edges of the paper and without shifting the paper web laterally between the feed-rolls.

3. In a printing-press, the combination of a revolving impression-cylinder having a series of impression-surfaces, nippers at the leading ends of each of said impression-surfaces, means to operate said nippers to hold the leading edge of a sheet upon the said impression-surfaces, and feed-rolls having a less surface speed than the impression-surfaces and adapted to feed the web of paper to the impression-cylinder, whereby as the nippers close upon the leading edge of the paper the feed-rolls liberate the tail of the paper constituting a sheet, substantially as and for the purpose specified.

4. In a printing-press, the combination of a revolving impression-cylinder having a series of impression surfaces, nippers at the

leading ends of each of said impression-surfaces, means to operate said nippers to hold the leading edge of a sheet upon the said impression-surfaces, cutting or perforating rolls for dividing the web of paper into sheets, having a less surface speed than the impression-surfaces and adapted to feed the web of paper to the impression-cylinder, whereby as the nippers close upon the leading edge of the paper the cutting or perforating rolls liberate the tail of the paper constituting a sheet, substantially as and for the purpose specified.

5. In a printing-press, the combination of a revolving impression-cylinder having a series of impression-surfaces, nippers at the leading ends of each of said impression-surfaces, means to operate said nippers to hold the leading edge of a sheet upon the said impression-surfaces, cutting or perforating rolls for dividing the web of paper into sheets, having a less surface speed than the impression-surfaces and adapted to feed the web of paper to the impression-cylinder, whereby as the nippers close upon the leading edge of the paper the cutting or perforating rolls liberate the tail of the paper constituting a sheet, and an auxiliary detaching device, substantially as set forth, to break the sheet from the web just prior to or at the instant the nippers close upon the leading edge thereof, substantially as and for the purpose specified.

6. In a printing-press, the combination of a revolving impression-cylinder having a series of impression-surfaces, nippers at the leading ends of each of said impression-surfaces, means to operate said nippers to hold the leading edge of a sheet upon the said impression-surfaces, cutting or perforating rolls for dividing the web of paper into sheets, having a less surface speed than the impression-surfaces and adapted to feed the web of paper to the impression-cylinder, whereby as the nippers close upon the leading edge of the paper the cutting or perforating rolls liberate the tail of the paper constituting a sheet, and an auxiliary detaching device consisting of a revolving shaft having a series of radial pins which clamp the paper upon the impression-surface for an instant to break the sheet from the web just prior to or at the instant the nippers close upon the leading edge thereof, substantially as and for the purpose specified.

7. The combination, in a printing-press, of an impression-cylinder having its periphery divided into a series of impression-surfaces, nippers arranged at the leading ends of said impression-surfaces, supports for a roll of paper, feeding devices for feeding the paper web to the impression-cylinder with a less speed than the travel of the impression-cylinder, suitable perforating or cutting devices for partly cutting the sheet from the web, an auxiliary device, substantially as set forth, to detach the sheet from the web, and means to

close the nippers upon the leading edge of said detached sheet, substantially as and for the purpose specified.

8. The combination, in a printing-press, of the impression-cylinder A, having impression-surfaces *a*, nippers G at the leading ends of said surfaces, cam H for operating said nippers, feeding and perforating or cutting cylinder F, and sheet-detacher consisting of the rotating shaft F³, having the pins *f*, substantially as and for the purpose specified.

9. In a perfecting printing-press, the combination of the impression-cylinder A, having impression-surfaces *a*, tympan I, carried by said surfaces and hinged to their leading ends, rock-shaft *i*², arms I' and I, secured to said rock-shafts, links *i*', connecting the arms I' with the middle of the tympan through the impression-surfaces, rods I³, having rollers *i*³, and connected to arms I², stationary cams I⁴ for operating said mechanism, and tympan for transferring the sheet, impression-cylinder B, having impression-surfaces *b* and nippers G, type-form cylinder C, and gearing for causing said cylinders to rotate in unison, whereby the sheet is printed on one side, then reversed and printed upon the other side, substantially as and for the purpose specified.

10. In a printing-machine, two impression-cylinders provided with one or more impression-surfaces, in combination with a support for a series of type-forms, a series of type-forms carried by said support and adapted to be moved in contact with said impression-cylinders, one of said cylinders printing from one set of type-forms and the other printing from those omitted, speed-controlling gearing to insure the proper speed to the said parts, and means to adjust the type-forms in the direction of their travel to suit books of different sizes.

11. In a printing-machine, two impression-cylinders provided with one or more impression-surfaces, in combination with a support for a series of type-forms, a series of type-forms carried by said support and adapted to be moved in contact with said impression-cylinders, one of said cylinders printing from one set of type-forms and the other printing from those omitted, speed-controlling gearing to insure the proper speed to the said parts, and clamping devices to adjust the type-forms laterally upon their support to suit books of different sizes.

12. In a printing-machine, two impression-cylinders provided each with one or more impression-surfaces, in combination with a series of type-forms arranged to be passed in succession in contact with said cylinders, one of which cylinders prints from alternate type-forms, and the other of which prints from those omitted, nippers arranged upon said cylinders, cams to operate said nippers to catch the sheet, delivery-cams adjustable about and to or from the axis of the cylinders and adapted to operate the nippers to catch, release, and deliver the sheets, transfer-

frames, substantially as described, pivoted to one of said cylinders and adapted to swing the tail end of the sheet over to the other cylinder, operating parts acting upon said frame at or about their middle part, where it is caught by the nippers before the sheet has left the first impression-cylinder, a stationary cam to operate said transfer-frames at the proper instant, and adjusting devices, substantially as described, to regulate the time of operation of the said nipper-cams with reference to the transfer-frame, substantially as and for the purpose specified.

13. A perfecting printing-press having combined therein a type-revolving cylinder, type-forms thereon, two impression-cylinders arranged so as to respectively make contact with and avoid alternate forms on said type-cylinder, a pair of cutting and feeding cylinders, a suitable conveyer for receiving a sheet head first on the first impression-cylinder and delivering the same tail first to the second impression-cylinder, whereby the sheets are first cut from the web and then successively printed upon opposite sides, and means for adjusting the type-forms upon the type-cylinder to vary their relative contact with the impression-cylinders, substantially as and for the purpose specified.

14. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, and means for adjusting the type-forms upon the type-cylinder to vary their relative contact with the impression-cylinders, substantially as and for the purpose specified.

15. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, and means for adjusting a series of type-forms transversely upon the type-cylinder to vary their lateral impression-contact with the impression-cylinders, substantially as and for the purpose specified.

16. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, and a rotary assembling device to carry and assemble a given number of the sheets so printed, and a

means to deliver the assembled sheets, substantially as and for the purpose specified.

17. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, a rotary assembling device to carry and assemble a given number of the sheets so printed, means to deliver the assembled sheets, and a folding device to fold the assembled sheets, substantially as and for the purpose specified.

18. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, a rotary assembling device to carry and assemble a given number of the sheets so printed, gearing to rotate the assembling device with a speed commensurate with that of the impression-cylinder, a means to deliver the assembled sheets, and means to paste the sheets together while in the custody of the assembling device, substantially as and for the purpose specified.

19. In a printing-machine, two impression-cylinders provided each with one or more impression-surfaces, in combination with a series of type-forms arranged to be passed in succession in contact with said cylinders, one of which cylinders prints from alternate type-forms, and the other of which prints from those omitted, nippers arranged upon said cylinder, mechanism, substantially as described, to operate said nippers to catch and deliver the sheets, transfer-frames, substantially as described, pivoted to one of said cylinders and adapted to swing the tail end of the sheet over to the other cylinder, where it is caught by the nippers before the sheet has left the first impression-cylinder, mechanism, substantially as described, to operate said transfer-frames at the proper instant, and a rotary assembling device to carry and assemble a given number of the sheets so printed, substantially as and for the purpose specified.

20. In a printing-machine, two impression-cylinders provided each with one or more impression-surfaces, in combination with a series of type-forms arranged to be passed in succession in contact with said cylinders, one of which cylinders prints from alternate type-forms, and the other of which prints from those omitted, nippers arranged upon said cylinders, mechanism, substantially as described, to operate said nippers to catch and deliver the sheets, transfer-frames, substantially as described, pivoted to one of said cyl-

inders and adapted to swing the tail end of the sheet over to the other cylinder, where it is caught by the nippers before the sheet has left the first impression-cylinder, and mechanism, substantially as described, to operate said transfer-frames at the proper instant, a rotary assembling device to carry and assemble a given number of the sheets so printed, and a folding device to fold the assembled sheets, substantially as and for the purpose specified.

21. In a printing-machine, two impression-cylinders provided each with one or more impression-surfaces, in combination with a series of type-forms arranged to be passed in succession in contact with said cylinders, one of which cylinders prints from alternate type-forms, and the other of which prints from those omitted, nippers arranged upon said cylinders, mechanism, substantially as described, to operate said nippers to catch and deliver the sheets, transfer-frame, substantially as described, pivoted to one of said cylinders and adapted to swing the tail end of the sheet over to the other cylinder, where it is caught by the nippers before the sheet has left the first impression-cylinder, mechanism, substantially as described, to operate said transfer-frame at the proper instant, a rotary assembling device to carry and assemble a given number of the sheets so printed, gearing to rotate the assembling device with a speed commensurate with that of the impression-cylinder, and means to paste the sheets together while in the custody of the assembling device, substantially as and for the purpose specified.

22. In a printing-press, the type-form cylinder having an internal cylinder circumferentially adjustable within it, and a series of type-forms secured to said internal cylinder, substantially as and for the purpose specified.

23. In a type-form cylinder, a series of pivoted tangentially-arranged form-beds combined with spring-supports therefor, whereby said form-beds may rock to conform to the curve of the impression-cylinders, substantially as and for the purpose specified.

24. In a type-form cylinder, a series of pivoted tangentially-arranged form-beds combined with spring-supports therefor, and means, substantially as set forth, to adjust the tension of said springs, whereby said form-beds may rock to conform to the curve of the impression-cylinders, substantially as and for the purpose specified.

25. In a type-form cylinder, a series of pivoted tangentially-arranged form-beds having bearer-plates and combined with spring-supports for said beds, whereby said form-beds may rock to conform to the curve of the impression-cylinder, substantially as and for the purpose specified.

26. In a type-form cylinder, a series of pivoted tangentially-arranged form-beds combined with spring-supports therefor, whereby said form-beds may rock to conform to the

curve of the impression-cylinders, and means to adjust said beds to or from the center of the cylinder, substantially as and for the purpose specified.

27. In a printing-machine, the combination of two impression-cylinders each having a series of curved impression-surfaces adapted to print from alternate type-forms, with a type-form cylinder having its periphery composed of a series of pivoted flat type-form beds.

28. A type-form cylinder for a printing-machine, having its periphery composed of pivoted type-form beds, and elastic or spring connections through the pivot-points for holding said beds to the cylinder.

29. The combination of the wheels C', the form-beds C⁴, having lugs c⁴ and bearing-surfaces C⁶, with bolts K to fit over said lugs and clamp the bed to the wheels C', spring-bolts K³ to fit under the surfaces C⁶, and spring K⁶ to press said bolts K³ up against the form-beds, substantially as and for the purpose specified.

30. The combination of the wheels C', the form-beds C⁴, having lugs c⁴ and bearing-surfaces C⁶, with bolts K to fit over said lugs and clamp the bed to the wheels C', springs K' to hold said bolt K with an elastic tension, spring-bolts K³ to fit under the surfaces C⁶, and springs K⁶ to press said bolts K³ up against the form-beds, substantially as and for the purpose specified.

31. The combination of the wheels C', the form-beds C⁴, having bearer-plates k, lugs c⁴, and bearing-surfaces C⁶, with bolts K to fit over said lugs and clamp the beds to the wheels C', spring-bolts K³ to fit under the surfaces C⁶, and springs K⁶ to press said bolts K³ up against the form-beds, substantially as and for the purpose specified.

32. In a printing-press, in combination with a type-revolving cylinder provided with forms for printing both sides of a sheet, said forms being flat and pivoted to the cylinder and provided with bearer-plates which run in contact with the impression-cylinders to rock the forms while in the act of printing, a pair of impression-cylinders for printing opposite sides of a sheet arranged relatively to said type-cylinder, so that when either one of said cylinders is imparting an impression in contact with the type-cylinder the other is out of contact with the type-cylinder, substantially as and for the purpose specified.

33. In a printing-machine, a type-cylinder provided with a series of type-form beds having slots extending their entire length, in combination with loose clamps extending through said slots to clamp the type-forms, type-forms arranged between said clamps, and a tension-bolt to draw the end clamps toward each other, substantially as and for the purpose specified.

34. A form-bed for a type-cylinder of a printing-machine, combined with a series of clamps k', adapted to be arranged between the type-forms, and tension-bolt k⁵, made in

two parts and united by a right and left hand coupling k⁵, substantially as and for the purpose specified.

35. In a printing-machine, the combination of two impression-cylinders, each having a series of impression-surfaces and adapted to print from alternate type-forms, a type-form cylinder having a series of type-forms from which the impression-surfaces print, a movable tympan or make-ready for each impression-surface of one of said impression-cylinders, and means, substantially as described, to move it during the rotation of the cylinder, whereby the partly-printed sheet, after being printed by the type-form cylinder and one impression-cylinder, is received upon a clean surface printed side down, and printed by the second impression-cylinder and type-form cylinder.

36. In a printing-machine, the combination of two impression-cylinders, each having a series of impression-surfaces and adapted to print from alternate type-forms, a type-form cylinder having a series of type-forms from which the impression-surfaces print, a movable tympan or make-ready for each impression-surface of one of said impression-cylinders, and means, substantially as described, to move it during the rotation of the cylinder, consisting of rollers and ratchet mechanism to intermittently rotate them, whereby the partly-printed sheet after being printed by the type-form cylinder and one impression-cylinder is received upon a clean surface printed side down, and printed by the second impression-cylinder and type-form cylinder.

37. In a printing-machine, the combination of two impression-cylinders, each having a series of impression-surfaces and adapted to print from alternate type-forms, a type-form cylinder having a series of type-forms from which the impression-surfaces print, a sheet-transfer device to transfer the sheet from one impression-cylinder to the other, a sheet-delivery device, a movable tympan or make-ready for each impression-surface of one of said impression-cylinders, and means, substantially as described, to move it during the rotation of the cylinder, which means is located between the delivery and sheet-transfer positions, whereby the partly-printed sheet, after being printed by the type-form cylinder and one impression-cylinder, is received upon a clean surface printed side down, and printed by the second impression-cylinder and type-form cylinder.

38. The combination of impression and form cylinders adapted to print isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets,

and a fly-frame to receive said assembled sheets, substantially as and for the purpose specified.

39. The combination of impression and form cylinders adapted to print isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, and a cam device to cause said fly-frame to pass below the leading edges of the assembled sheets when it is desired to deliver them from the assembling device, substantially as and for the purpose specified.

40. The combination of impression and form cylinders adapted to print upon isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, and a paste-applying device to paste the sheets together in the order in which they are assembled, substantially as and for the purpose specified.

41. The combination of impression and form cylinders adapted to print upon isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, and a revolving paste-applying device revolving in unison with the assembling-frame to paste the sheets together in the order in which they are assembled, substantially as and for the purpose specified.

42. The combination of impression and form cylinders adapted to print upon isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, a paste-applying device to paste the sheets together in the order in which they are assembled, and means to regulate the position of application of paste, substantially as and for the purpose specified.

43. The combination of impression and form

cylinders adapted to print upon isolated sheets of paper, with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of each of the sheets in succession and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, a rotating paste-applying device to paste the sheets together in the order in which they are assembled, and means to regulate the position of application of paste, substantially as and for the purpose specified.

44. The combination of impression and form cylinders with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of the sheets and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to release the assembled sheets, a fly-frame to receive said assembled sheets, and a revolving airtight paste-fountain moving in unison with the assembling-frame and adapted to apply a line of paste upon each successive sheet as it is assembled.

45. An impression-cylinder, in combination with a revolving assembling device consisting of a skeleton frame formed of bands and provided with two sets of nippers, one of which sets is for taking the sheets from the impression-cylinder and also holding them in position upon the skeleton frame while the other set of nippers is passing from under the edge to the top of the sheet, the latter set of nippers being for the purpose of holding the assembled sheets while the other nippers are taking a fresh sheet, substantially as and for the purpose specified.

46. An impression-cylinder, in combination with a revolving assembling device consisting of a skeleton frame formed of bands and provided with two sets of nippers, one of which sets is for taking the sheets from the impression-cylinder and also holding them in position upon the skeleton frame while the other set of nippers is passing from under the edge to the top of the sheet, the latter set of nippers being for the purpose of holding the assembled sheets while the other nippers are taking a fresh sheet, and cam mechanism to operate said nippers to assemble and hold said sheets, substantially as and for the purpose specified.

47. An impression-cylinder, in combination with a revolving assembling device consisting of a skeleton frame formed of adjustable spring-bands and provided with two sets of nippers, one of which sets is for taking the sheets from the impression-cylinder and also holding them in position upon the skeleton frame while the other set of nippers is passing from under the edge to the top of the sheet, the latter set of nippers being for the

purpose of holding the assembled sheets while the other nippers are taking a fresh sheet, substantially as and for the purpose specified.

48. An impression-cylinder, in combination
5 with a revolving assembling device consisting of a skeleton frame formed of bands and provided with two sets of nippers, one of which sets is for taking the sheets from the impression-cylinder and also holding them in position
10 upon the skeleton frame while the other set of nippers is passing from under the edge to the top of the sheet, the latter set of nippers being for the purpose of holding the assembled sheets while the other nippers are
15 taking a fresh sheet, cam mechanism to operate said nippers to assemble and hold said sheets, and means to depress the leading edges of the sheets while the nippers are passing from below to above the sheet, substantially
20 as and for the purpose specified.

49. The combination of impression and printing cylinders with an assembling device consisting of a rotating frame provided with nippers to catch the leading edges of the
25 sheets and transfer them from the impression-cylinder onto the assembling device, means to operate said nippers to catch and hold each successive sheet, means to operate said nippers to deliver the assembled sheets, a
30 fly-frame to receive said assembled sheets, a revolving paste-applying device revolving in unison with the assembling-frame to paste the sheets together in the order in which they are assembled, and a paste-supplying pas-
35 sage-way to supply paste to the paste-fountain while it is revolving, substantially as and for the purpose specified.

50. A revolving paste-fountain provided with a paste-supplying passage-way opening
40 through the axis thereof to supply paste to the paste-fountain while it is revolving, and an air-vent to allow escape of air from said fountain.

51. A revolving paste-fountain provided
45 with a paste-supplying passage-way opening through the axis thereof to supply paste to the paste-fountain while it is revolving, and an indicator to indicate when said fountain is full of paste.

52. The combination of the impression-cylinder having one or more impression-surfaces and paper-holding nippers with the rotary assembling-frame having the same surface
50 speed with the impression-cylinder, said frame consisting of a central shaft having a series of arms clamped thereto, a series of metal bands secured thereto and curved to form a semi-cylinder, one or more of the ends of said bands being free to press upon the paper sheet on the impression-cylinder to hold
55 it while for an instant it is unsupported by any nippers, and receiving-nippers carried by said frame to take the sheet from the said impression-cylinder, substantially as and for
60 the purpose specified.

53. The combination of the impression-cyl-

inder having one or more impression-surfaces, and paper-holding nippers with the rotary assembling-frame, having the same surface
70 speed with the impression-cylinder, said frame consisting of a central shaft having a series of arms clamped thereto, a series of metal bands secured thereto and curved to form a semi-cylinder, one or more of the ends of said bands being free to press upon the paper
75 sheet on the impression-cylinder to hold it while for an instant it is unsupported by any nippers, receiving-nippers carried by said frame to take the sheet from the said impression-cylinder, and a bar upon which the lead-
80 ing edges of the assembled sheets are clamped by the nippers, substantially as and for the purpose specified.

54. The combination of the impression-cylinder having one or more impression-surfaces,
85 and paper-holding nippers with the rotary assembling-frame having the same surface speed with the impression-cylinder, said frame consisting of a central shaft having a series of arms clamped thereto, a series of
90 metal bands secured thereto and curved to form a semi-cylinder, one or more of the ends of said bands being free to press upon the paper sheet on the impression-cylinder to hold it while for an instant it is unsupported
95 by any nippers, receiving-nippers carried by said frame to take the sheet from the said impression-cylinder, retaining-nippers for holding the sheets when the receiving-nippers are taking a fresh sheet, a radially-moving
100 spring-actuated bar upon which the leading edges of the assembled sheets are clamped by the nippers, and means to depress the said bar at one place in its revolution to allow the retaining-nippers to pass above the sheet last
105 assembled, substantially as and for the purpose specified.

55. The combination of the impression-cylinder having one or more impression-sur-
110 faces and paper-holding nippers with the rotary assembling-frame having the same surface speed with the impression-cylinder, said frame consisting of a central shaft having a series of arms clamped thereto, a series of metal bands secured thereto and curved to
115 form a semi-cylinder, one or more of the ends of said bands being free to press upon the paper sheet on the impression-cylinder to hold it while for an instant it is unsupported by any nippers, and receiving-nippers car-
120 ried by said frame to take the sheet from the said impression-cylinder, retaining-nippers for holding the sheets when the receiving-nippers are taking a fresh sheet, a radially-moving spring-actuated bar upon which the
125 leading edges of the assembled sheets are clamped by the nippers, means to depress the said bar at one place in its revolution to allow the retaining-nippers to pass above the sheet last assembled, and a pin-bar to press upon
130 the leading edges of the sheets on a line with the nippers to distribute the buckles and in-

sure the retaining-nippers passing freely over the edge of the assembled sheets, substantially as and for the purpose specified.

56. An impression-cylinder, in combination with a revolving assembling device consisting of a skeleton frame formed of bands and provided with two sets of nippers, one of which sets is for taking the sheets from the impression-cylinder and also holding them in position upon the skeleton frame while the other set of nippers is passing from under the edge to the top of the sheet, the latter set of nippers being for the purpose of holding the assembled sheets while the other nippers are taking a fresh sheet, cam mechanism to operate said nippers to assemble and hold said sheets, means, substantially as set forth, to depress the leading edges of the sheets while the nippers are passing from below to above the sheets, and a series of pins or points to simultaneously press upon the leading edges of the sheets to distribute the buckles and allow of the nippers passing freely above the depressed leading edges of the sheets, substantially as and for the purpose specified.

57. The combination of the impression-cylinder with the assembling device consisting of the shaft M'' , skeleton frame M' , formed of the arms M^3 , secured to the shaft, curved spring-bands M^4 , secured to said arms, radially-moving bar M^5 , shaft m^2 , carrying the receiving-nippers m^3 , shaft m , carrying the retaining-nippers m' , suitable cam mechanism to operate said shafts, a revolving frame M^2 , carrying cams P to depress said bar M^5 , and an auxiliary cam M^9 to cause the retaining-nippers to open fully to free the assembled sheets, substantially as and for the purpose specified.

58. The combination of the impression-cylinder with the assembling device consisting of the shaft M'' , skeleton frame M' , formed of the arms M^3 , secured to the shaft, curved spring-bands M^4 , secured to said arms, radially-moving bar M^5 , shaft m^2 , carrying the receiving-nippers m^3 , shaft m , carrying the retaining-nippers m' , suitable cam mechanism to operate said shafts, a revolving frame M^2 , carrying cams P to depress said bar M^5 , a paste-fountain N^5 , carried by said frame M^2 , and an auxiliary cam M^9 to cause the retaining-nippers to open fully to free the assembled sheets, substantially as and for the purpose specified.

59. The combination of the impression-cylinder with the assembling device consisting of the shaft M'' , skeleton frame M' , formed of the arms M^3 , secured to the shaft, curved spring-bands M^4 , secured to said arms, radially-moving bar M^5 , shaft m^2 , carrying the receiving-nippers m^3 , shaft m , carrying the retaining-nippers m' , suitable cam mechanism to operate said shafts, a revolving frame M^2 , carrying cams P to depress said bar M^5 , a paste-fountain N^5 , carried by said frame M^2 , a paste-feeding roller N^6 and scraping-plates N^7 , and an auxiliary cam M^9 to cause the retaining-nippers to open fully to free the assembled sheets, substantially as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

HENRY P. FEISTER.

Witnesses:

E. M. BRECKINREED,
R. M. HUNTER.