No. 674,356. Patented May 14, 1901.

H. P. FEISTER.

PRINTING PRESS.

(Application filed Aug. 31, 1899.)

(No Model.) 8 Sheets—Sheet 1.

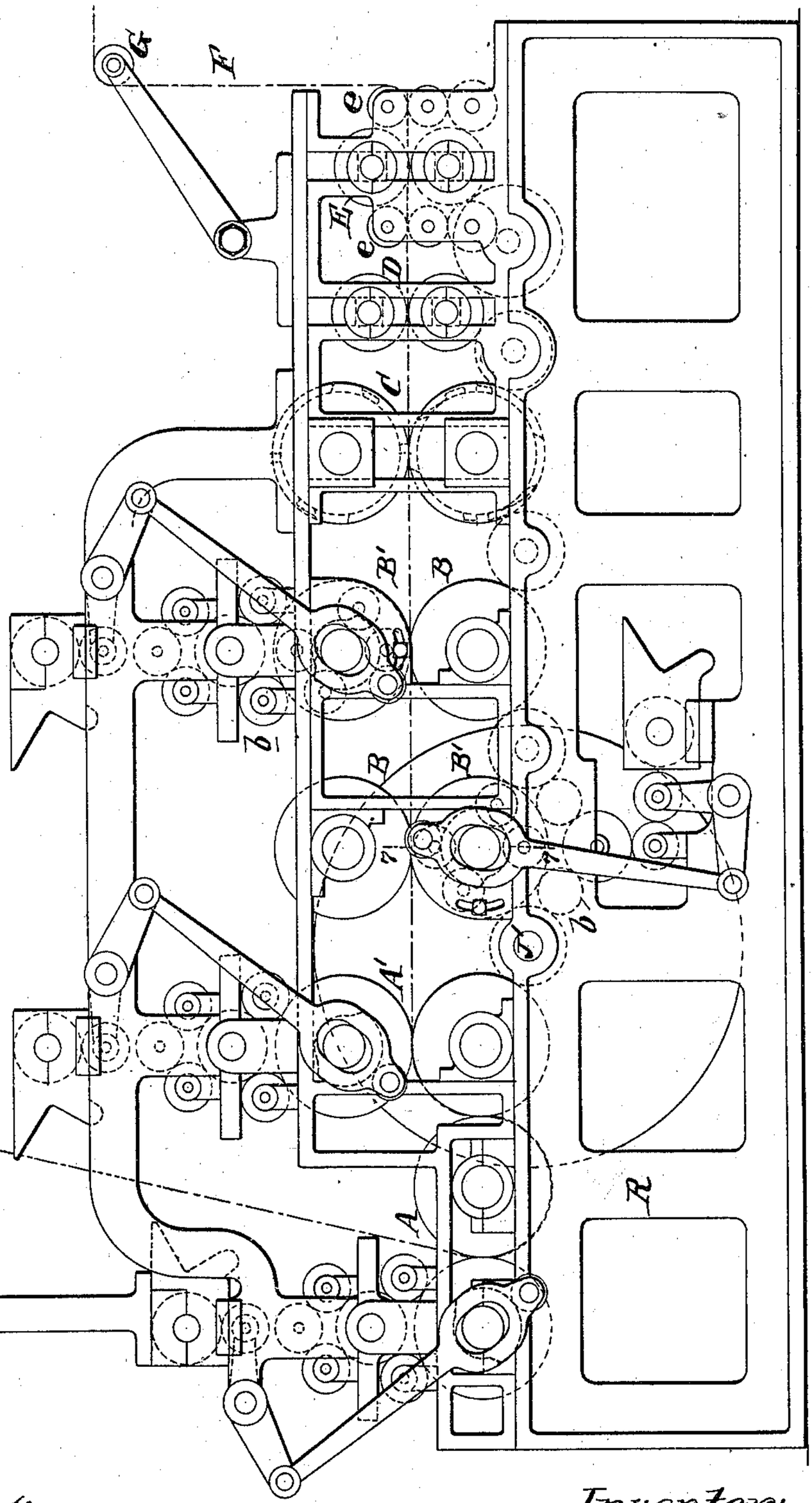

FIG. 1.

Witnesses:
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L. Dewart.

Inventor:
Henry P. Feister
By his Atty
Thos. G. Smith

No. 674,356.

Patented May 14, 1901.

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PRINTING PRESS.

(Application filed Aug. 31, 1899.)

(No Model.)

8 Sheets—Sheet 2.

FIG. 20.

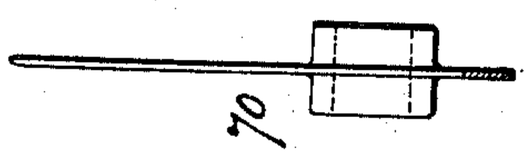


FIG. 19.

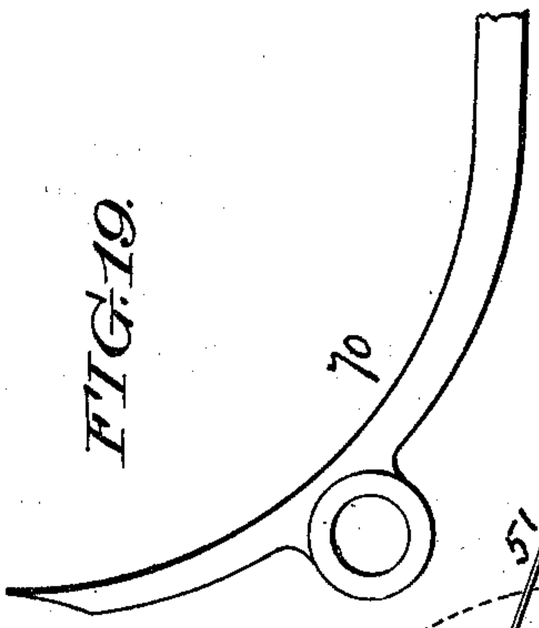


FIG. 21.

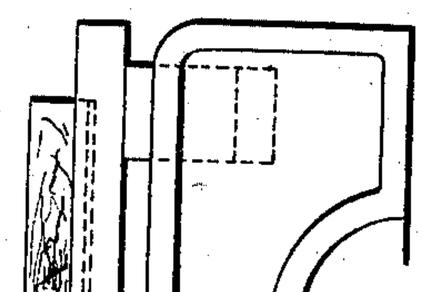
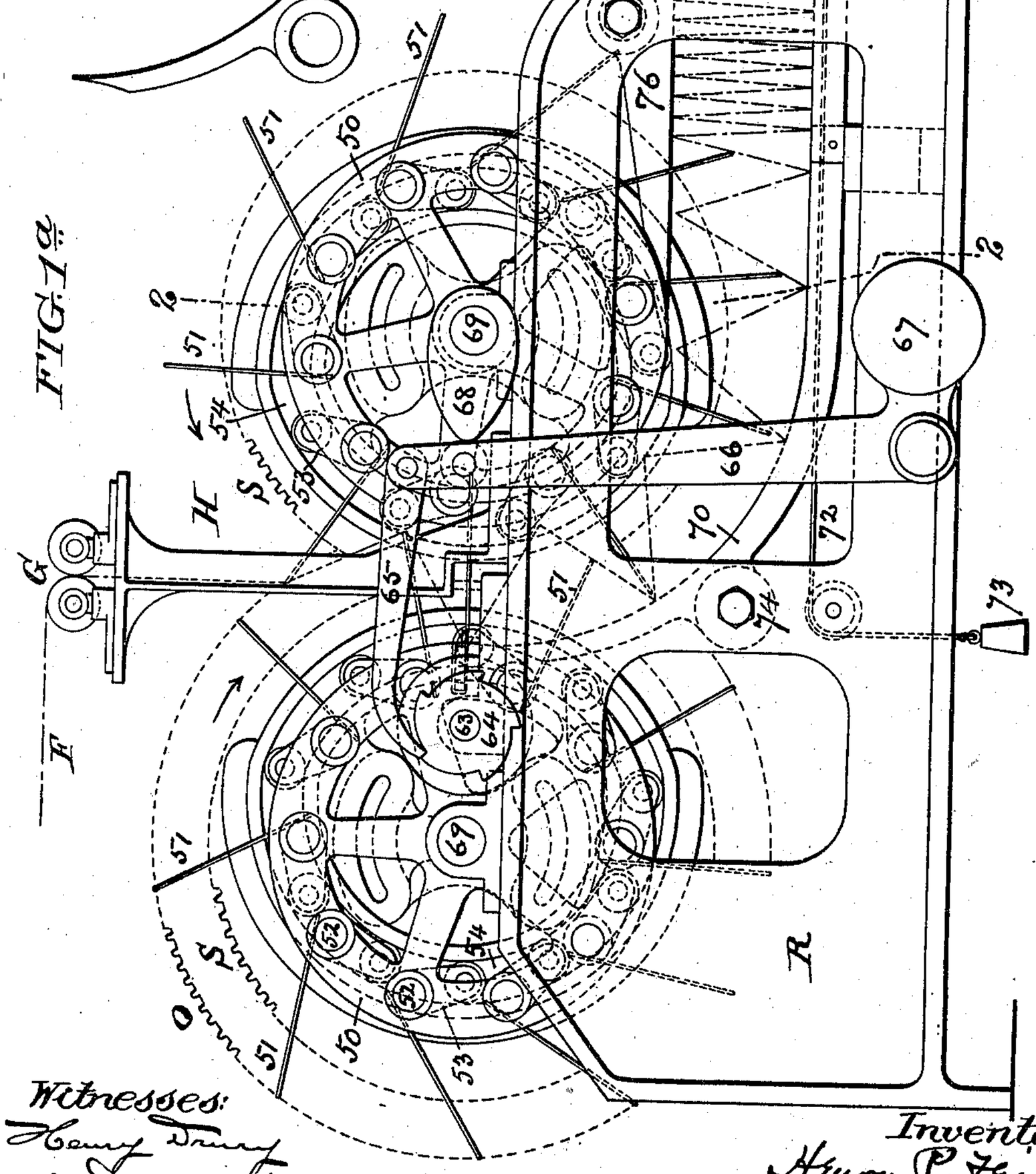


FIG. 19½.



Witnesses:
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No. 674,356. Patented May 14, 1901.

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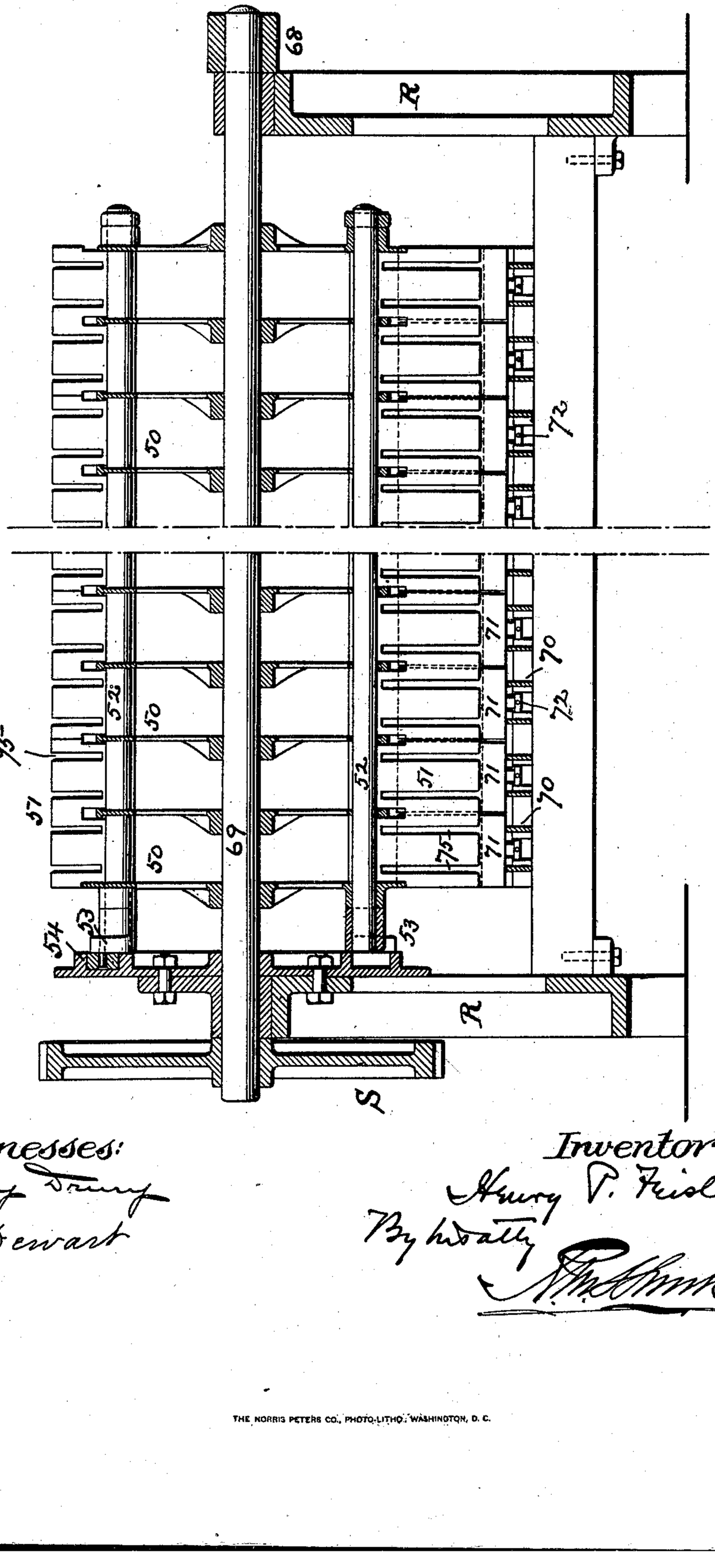
PRINTING PRESS.

(Application filed Aug. 31, 1899.)

(No Model.) 8 Sheets—Sheet 3.

FIG. 2.



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Patented May 14, 1901.

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(Application filed Aug. 31, 1899.)

(No Model.)

8 Sheets—Sheet 4.

FIG. 3.

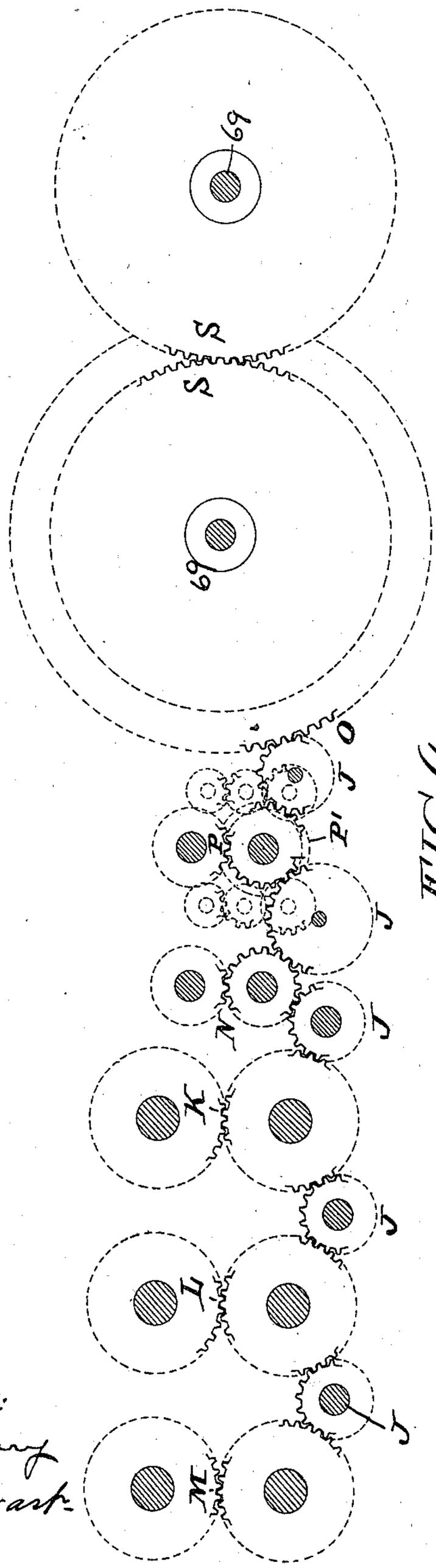
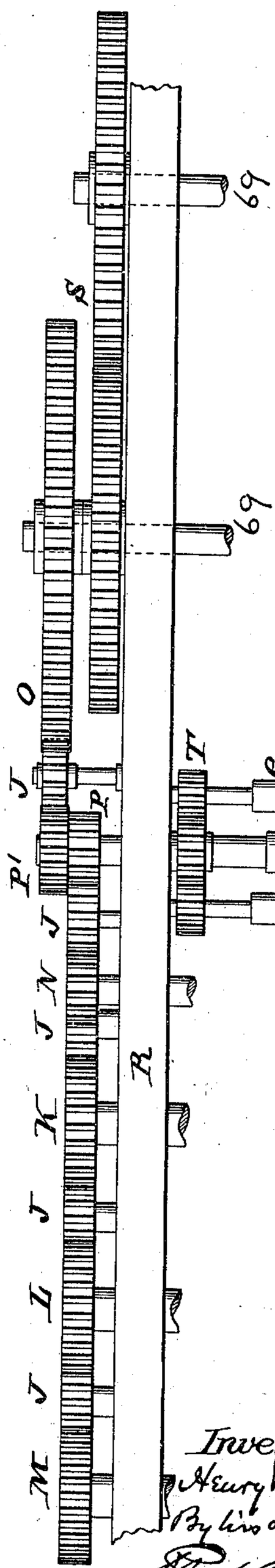


FIG. 4.



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No. 674,356. Patented May 14, 1901.

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(Application filed Aug. 31, 1899.)

(No Model.) 8 Sheets—Sheet 5.

FIG. 5.

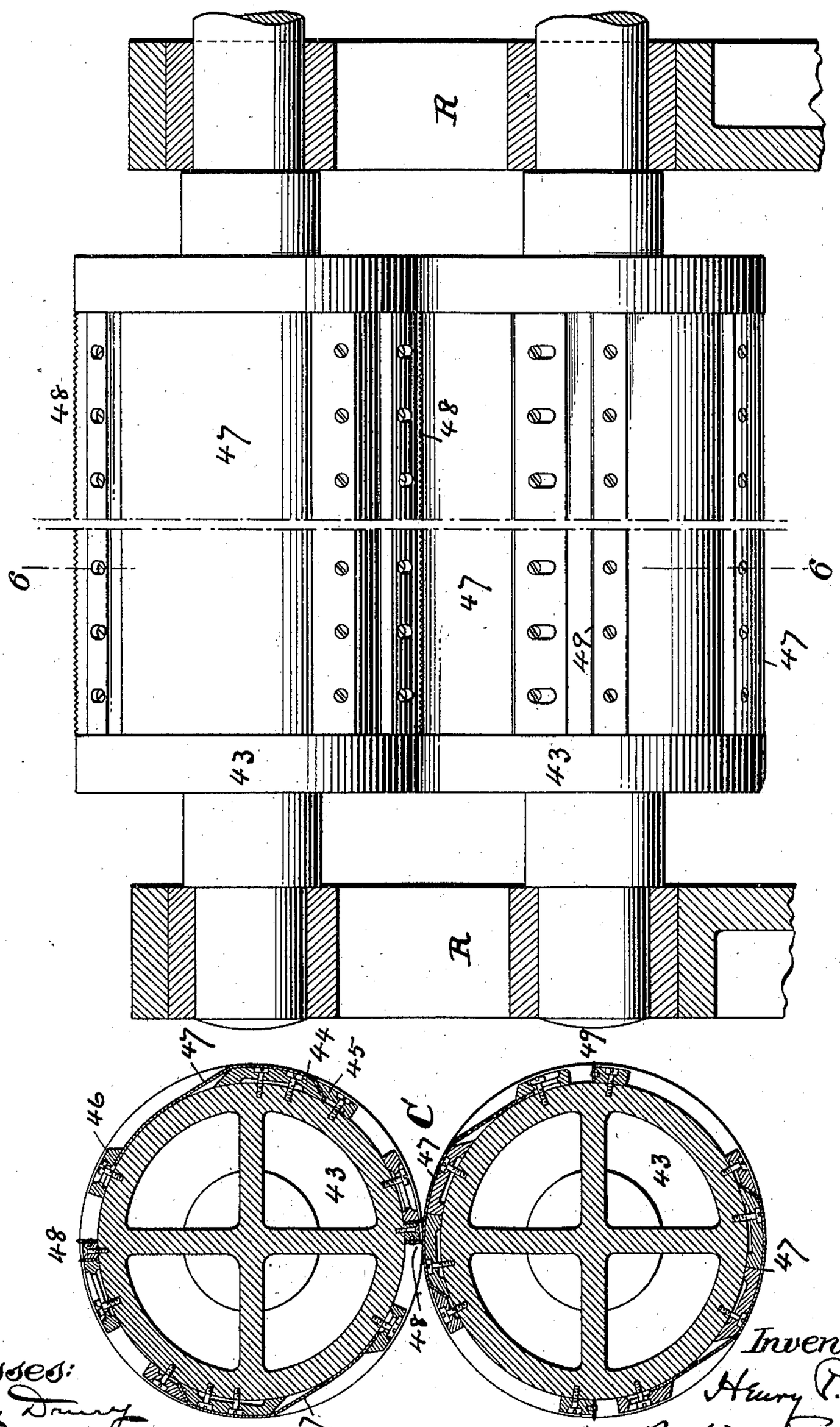

FIG. 6.

Witnesses:
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(Application filed Aug. 31, 1899.)

(No Model.) 8 Sheets—Sheet 6.

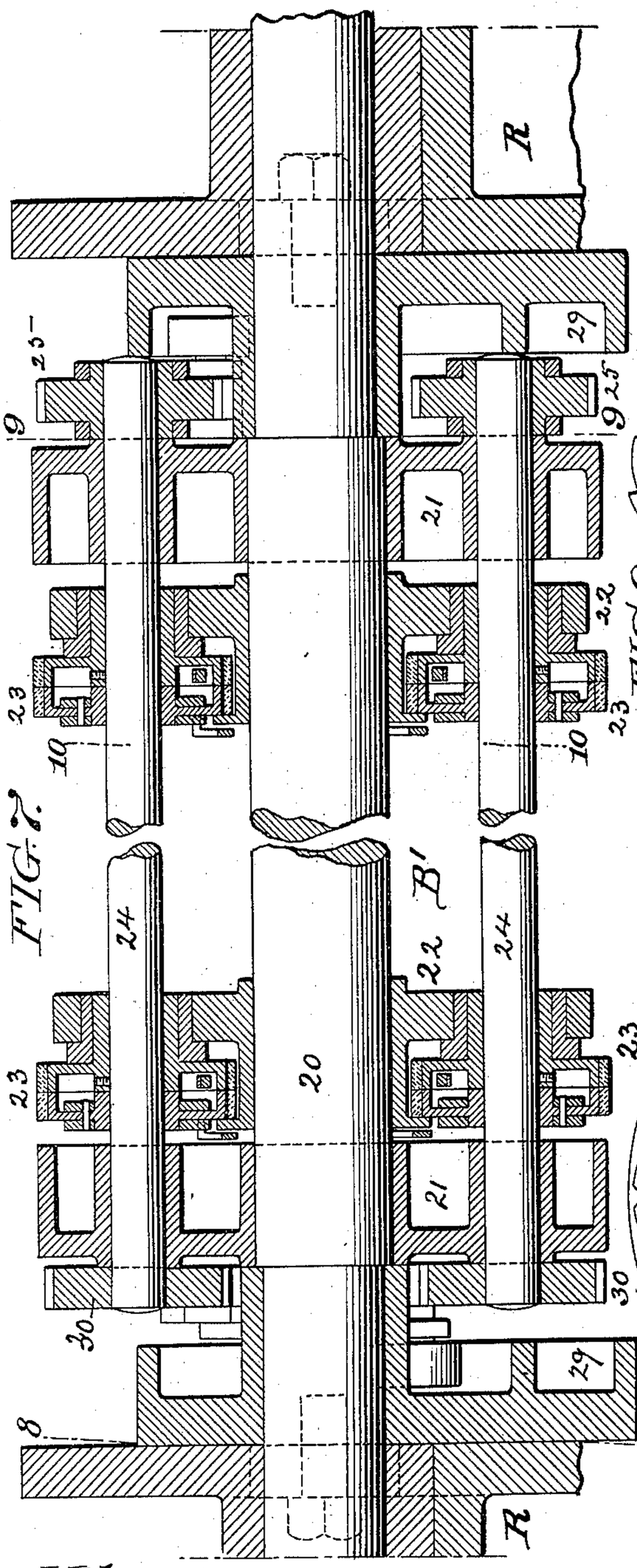

FIG. 7.

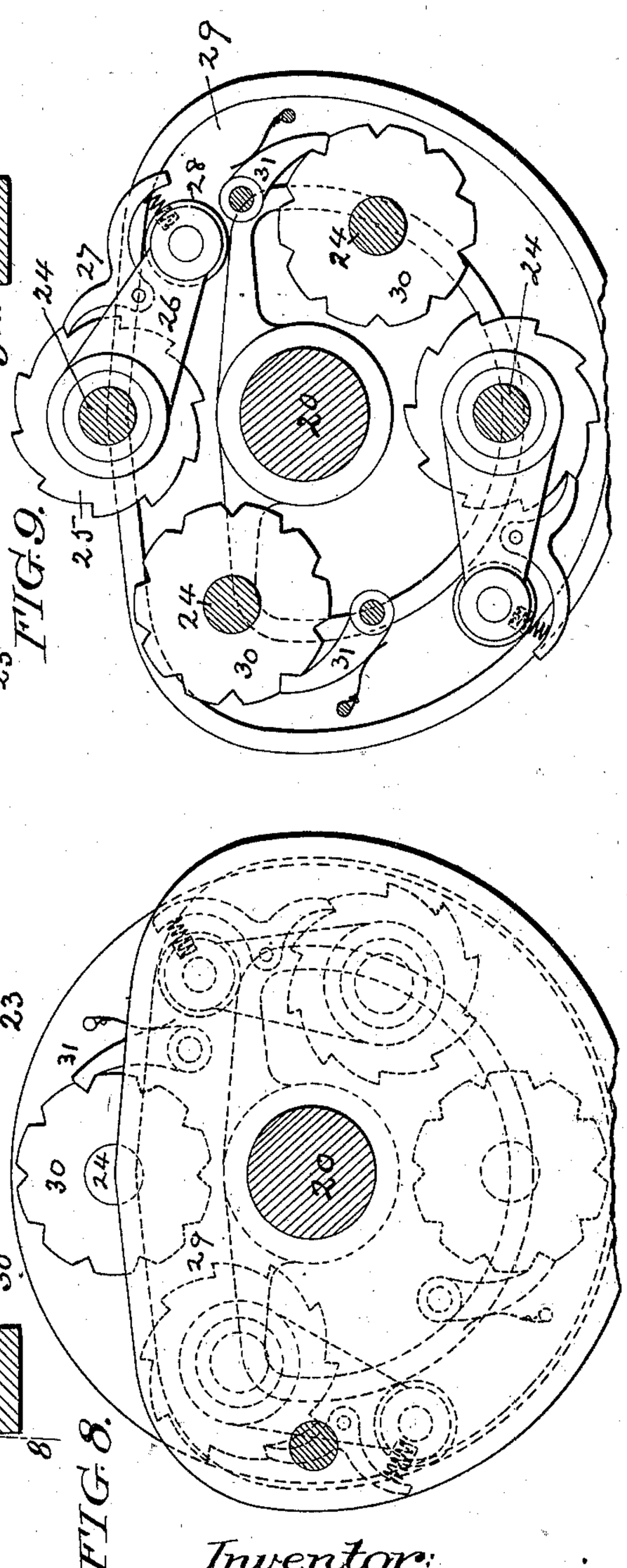

FIG. 9.

FIG. 8.

Witnesses:
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Inventor:
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[illegible]

No. 674,356.

Patented May 14, 1901.

H. P. FEISTER.

PRINTING PRESS.

(Application filed Aug. 31, 1899.)

(No Model.)

8 Sheets—Sheet 7.

FIG. 10.

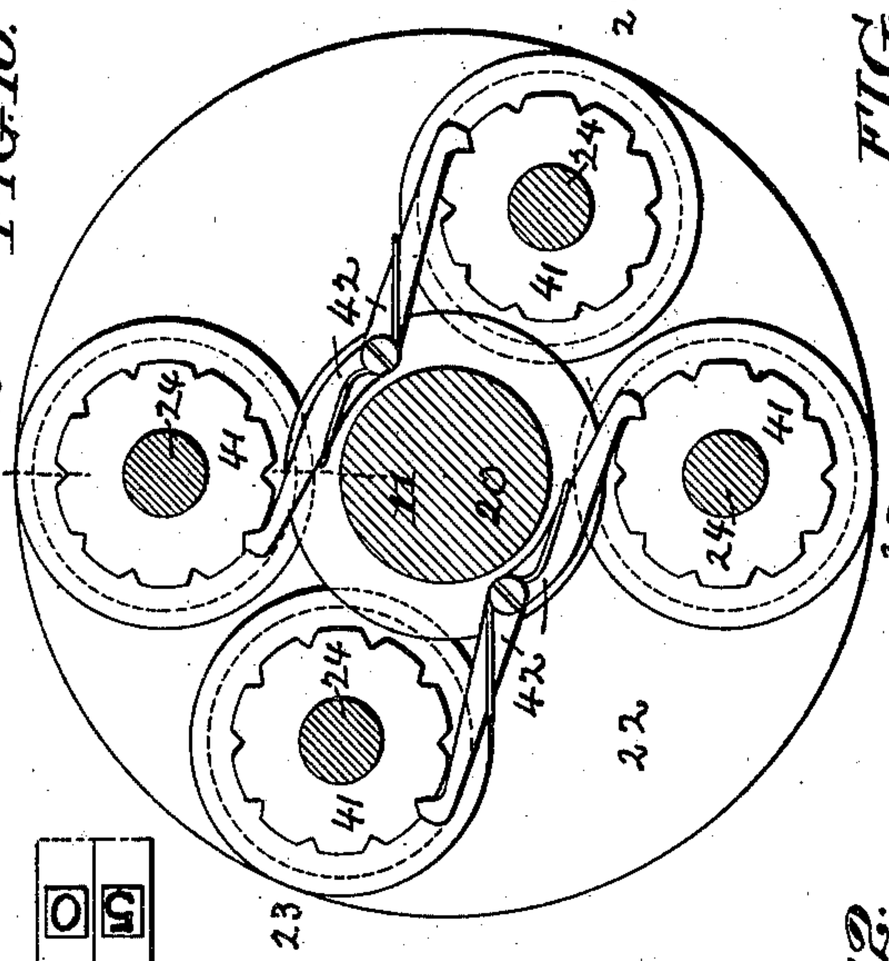

FIG. 11.

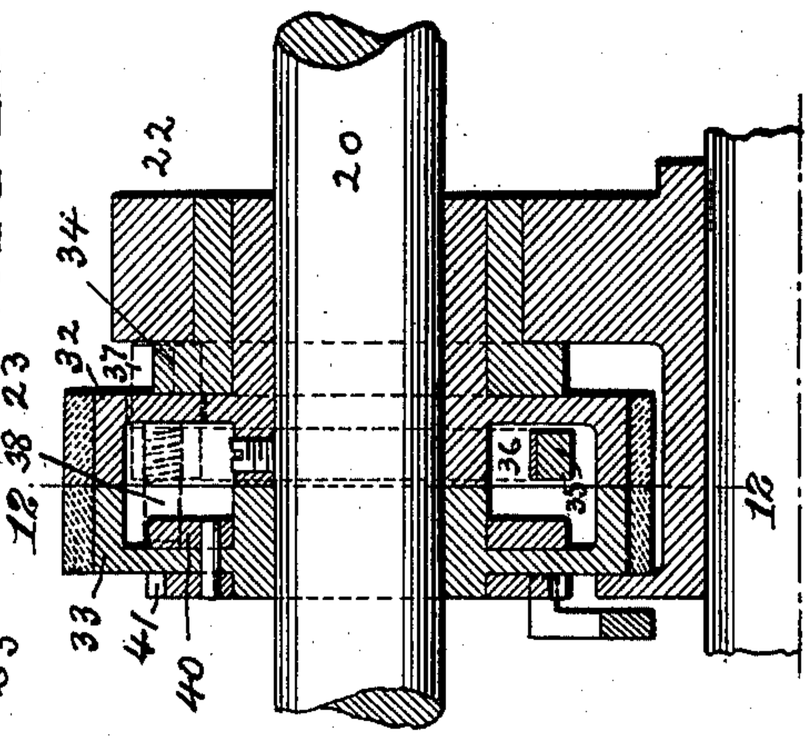

FIG. 12.

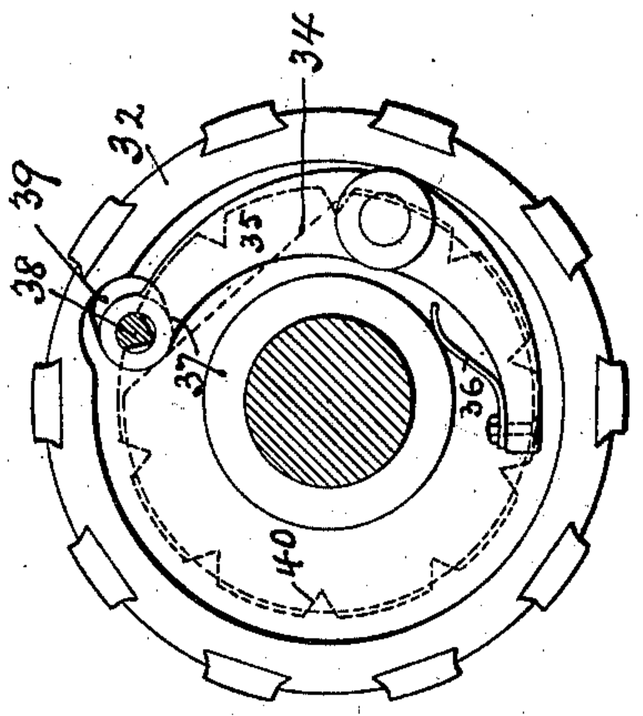

FIG. 13.

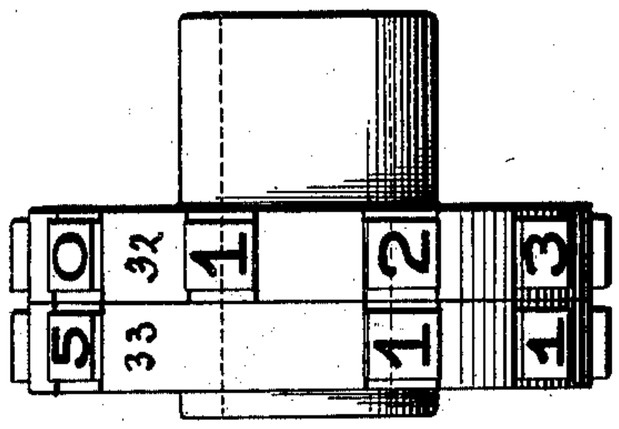

FIG. 14.

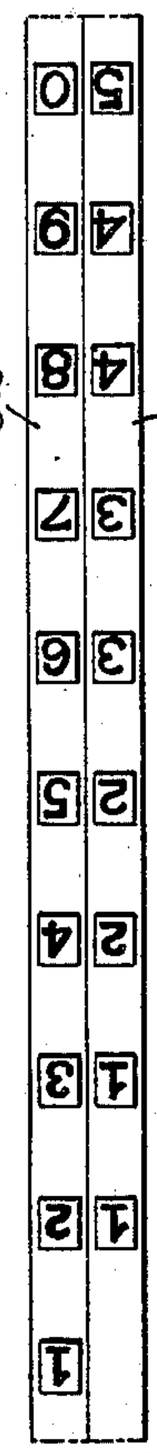

FIG. 15.

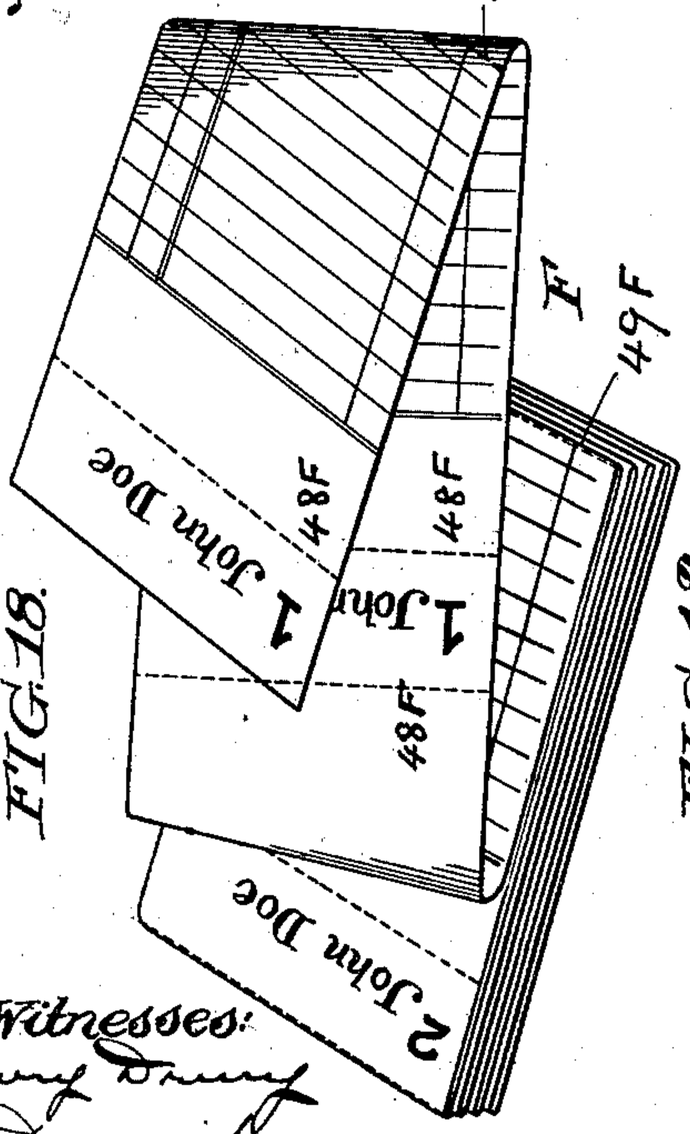

FIG. 16.

Witnesses:
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No. 674,356. Patented May 14, 1901.

H. P. FEISTER.

PRINTING PRESS.

(Application filed Aug. 31, 1899.)

(No Model.) 8 Sheets—Sheet 8.

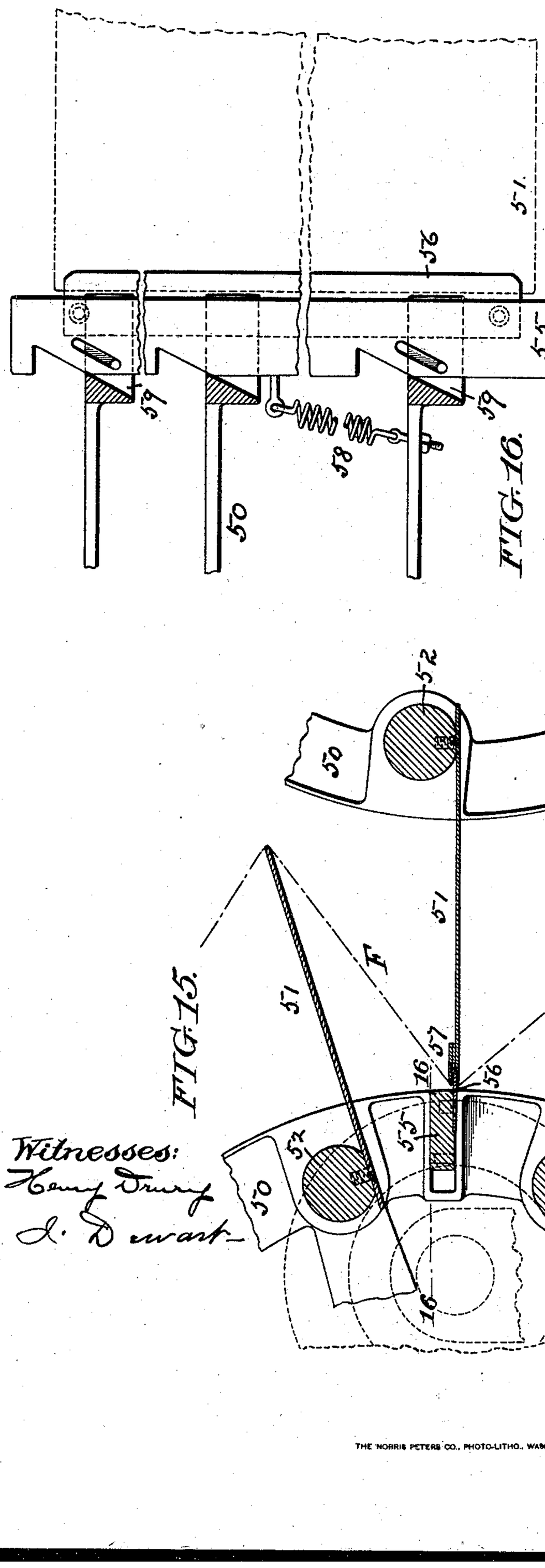

FIG. 16.

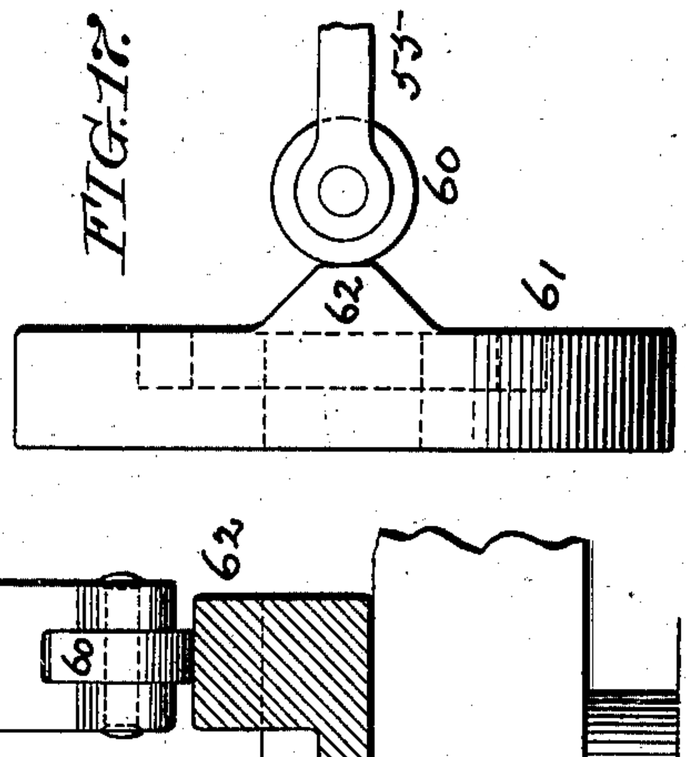

FIG. 12.

FIG. 15.

Witnesses:
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L. Dewart

Inventor:
Henry P. Feister
By his Atty
J. M. Bundy

UNITED STATES PATENT OFFICE.

HENRY P. FEISTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CARTER-CRUME CO., LIMITED, OF TORONTO, CANADA, AND NIAGARA FALLS, NEW YORK.

PRINTING-PRESS.

SPECIFICATION forming part of Letters Patent No. 674,356, dated May 14, 1901.

Application filed August 31, 1899. Serial No. 729,063. (No model.)

To all whom it may concern:

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

My invention has reference to printing-presses; and it consists of certain improvements set out in the following specification and shown in the accompanying drawings, which form a part thereof.

The object of my invention is to print sales-slips with the necessary printed matter and also to number the same and finally to fold the strip of paper constituting the slip in a zigzag manner to form a book.

My invention comprehends mechanism for printing, numbering, perforating or creasing, subdividing, and folding a web of paper to constitute the completed sales-slip. I am enabled by the improved mechanism to employ a roll of paper and split the same longitudinally into a series of slips, each of which is simultaneously subdivided transversely after being printed and numbered to form the series of these slips at one time.

More particularly considered, my invention comprehends the employment of two pairs of impression and printing cylinders adapted to print upon the opposite faces of the web as it passes continuously between the rollers of each pair and then to print upon the said web the paper-page numbers at stated intervals in the length, which will constitute the numbering of the different sheets after the web is folded, the said numbering devices being adapted to print upon both faces of the web. Combined with mechanism of this kind I provide suitable slitting mechanism for subdividing the web of paper into a series of narrow strips and suitable mechanism for folding the said narrow strips backward and forward in a zigzag manner and separating them into predetermined lengths, so that each subdivision constitutes a book of a given number of sheets.

My improvements will be better understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of that portion of my machine which performs the printing and slitting of the paper-web. Fig. 1ª is a side elevation of the remaining portion of the machine for receiving the paper after it is slitted and subdividing the strips transversely and also folding them in a zigzag manner. Fig. 2 is a transverse section on line 2 2, Fig. 1ª. Fig. 3 is a side elevation illustrating the gearing for the several parts of the machine constituting the numbering, slitting, folding, and subdividing mechanism. Fig. 4 is a plan view of same. Fig. 5 is a front elevation of the creasing or perforating rollers. Fig. 6 is a cross-section of same on line 6 6. Fig. 7 is a longitudinal sectional elevation of one of the numbering-cylinders. Fig. 8 is a transverse section of Fig. 7 on line 8 8. Fig. 9 is a transverse section of Fig. 7 on line 9 9. Fig. 10 is a transverse section of Fig. 7 on line 10 10. Fig. 11 is a longitudinal sectional elevation of a portion of the numbering-cylinder on line 11 11 of Fig. 10. Fig. 12 is a transverse section of Fig. 11 on line 12 12 through the numbering-wheels. Fig. 13 is a side elevation of the numbering-wheels separated from their supports. Fig. 14 is a diagram representing the peripheries of the numbering-wheels, showing the method of arranging the numbering-type on the wheels. Fig. 15 is a transverse section through the adjacent parts of the folding-cylinders. Fig. 16 is a sectional plan view of a portion of one of the folding-cylinders, taken on line 16 16 of Fig. 15. Fig. 17 is an elevation of the cam for operating the cutter of the folding mechanism, and Fig. 18 is a pespective view of the completed sales-slip.

R is the main frame of the machine and may be of any suitable construction.

A is one set of impression and printing cylinders, and A′ the second set thereof, each set comprising a type-form cylinder and an impression-cylinder. The web of paper F passes downward between the first pair of printing-cylinders A, thence horizontally between the second pair of printing-cylinders A′. The arrangement of these cylinders is such that one pair prints the necessary printed matter upon one side of the web and the second set prints

upon the opposite side, as is customary in perfecting printing-presses. The printed web then passes between two sets of numbering-cylinders. One of these sets numbers the web of paper upon the lower side and the other set numbers it upon the upper side and in proper relative position to the printed matter. As shown in Fig. 1, B′ represents the numbering-cylinders, and B represents the impression-cylinders therefor. After the web has been thus printed and numbered upon both sides it passes between the creasing or perforating cylinders C, which produce weakened portions in the web, corresponding to the dotted lines 48^F and 49^F in Fig. 18, the said weakened or perforated portions permitting the paper to be readily folded upon definite lines and also readily torn apart when the slip is used in practice. After leaving these creasing or perforating cylinders the web is drawn through the feeding-cylinders D, which may consist of a series of disks, which operate upon the paper in lines intermediate of the rows of printed matter, so as not to blur the printing. The web then passes between the feeding cylinders or disks *e e*, which may be made in any suitable manner, and while being held between said feeding-cylinders the web is slit longitudinally by a series of slitting-cutters E, of any well-known construction. The web F is then in a printed condition, both printed and numbered, and slit longitudinally and also weakened at intervals transversely. It then passes over the guide-rolls G and thence downward to the folding mechanism. (Shown in Fig. 1^a.) The folding mechanism H thus illustrated operates upon the web-strips to fold them in a zig-zag manner and upon a given number of sheets—fifty, for example—to subdivide the web-strips to constitute books. The folded strips are received in the packers I, from which they may be taken as desired.

I will now refer more specifically to the parts constituting the numbering, creasing or perforating, and the folding devices. Each of the numbering-cylinders B′ consists, essentially, of a shaft 20, journaled in the main frame R and having near each end a head 21, upon which is carried the numbering mechanism proper, and on each cylinder B′ there are four sets of numbering mechanism 23, arranged about the periphery, as shown in Fig. 10, from which it will be observed that the said numbering mechanism are not equispaced about the circumference of the cylinder, because two numbers are to be printed upon one face of the web constituting one of the sheets in the finished book and to be separated from the next two numbers on the same face of the web by a space equal to the length of one of the sheets, (which is numbered upon the opposite side by the second set of numbering-wheels.)

By describing one of the numbering devices it will suffice as the description for all of them.

24 is a shaft journaled in the heads 21 and having at one end a notched wheel 30, in the notches of which a spring-pawl operates to prevent the shaft from accidentally being turned. The other end of the shaft 24 is provided with a ratchet-wheel 25, and an arm 26, carrying a spring-actuated pawl 27, operating in connection with the ratchet-wheel, as shown in Fig. 9. This arm 26 carries at its free end a roller 28, which works in the groove of a suitable cam 29, bolted to the main frame of the machine. As the cylinder rotates the cam causes the arm 26 to oscillate to intermittently rotate the ratchet-wheel and its shaft 24. Arranged along the shaft 20 is a series of disks 22, through which the shaft 24 passes. Secured tightly upon the shaft 24 is a numbering-wheel 32, and loosely supported upon the said shaft and adjacent to the numbering-wheel 32 is a second numbering-wheel 33. These two numbering-wheels constitute the numbering-units 23 and change their positions relatively to each other to bring the proper type into consecutive position to print all the numbers properly upon the web of paper. The outer periphery of these numbering-cylinders 32 and 33 are provided with the type, as clearly shown in Figs. 11, 12, and 13, and the arrangement of the type on these cylinders is substantially as indicated in Fig. 14, from which it will be seen that on one of the cylinders the type prints from "1" to "9," and then "0," while upon the other cylinder there is one blank space, then consecutive numbers arranged in pairs—thus: "1 1," "2 2," "3 3," "4 4," and "5"—the reason of which will be explained later on. Arranged within the numbering-cylinder 32 is a pivoted lever 35, having a spring 36, which forces the opposite end inward. This end carries a laterally-projecting part extending through the side wall of the wheel and terminating in the roller 37, which operates against the face of the cam 34, secured to the disk 22. As the shaft 20, with the wheel 32, rotates it is evident that the roller 37, operating in connection with the cam 34, will cause the arm 35 to be moved inward and outward at stated intervals. The free end of the arm 35 on its near side carries detent 38, which operates in connection with a notched disk 40, secured upon the inside of the numbering-wheel 33. When detent 38 enters a notch of the disk 40, as indicated in Fig. 12, the turning of the shaft 20 will move both of the numbering-wheels 32 and 33. This will only take place when the roller 37 is over the flattened portion of the cam 34. At all other portions of the revolution of the shaft 20 the detent will be held out of contact with the notched disk 40 and the numbering-wheel 33 will remain stationary relatively to the shaft 20 and the disk 22. The outer part of the wheel 33 is also provided with a notched disk 41, in the notches of which spring-actuated pawl 42 operates to prevent the said wheel 33 from accidentally turning when not positively driven by the action of the detent 38. It will now

be observed that as the shaft 20 rotates and with it the numbering mechanism, the action of the cam 29 will, through the pawl and ratchet mechanism, cause the shaft 24 and the wheel 32 to rotate intermittently a portion of a revolution with each full revolution of the numbering-cylinder B'. After ten revolutions have been made the numbering-wheel 32 will have made one revolution with its shaft 24, and in completing the latter portion of this revolution it will have caused the roller 37 to come upon the flattened portion of the cam 34, and thereby lock the two wheels 32 and 33 together. Upon the next intermittent rotation of the shaft 24 both wheels 32 and 33 will move into printing position, so as to print "10." With the next intermittent movement of the shaft 24 the two wheels 32 and 33 will still be locked together and will come into position to print "11." Th enext intermittent forward motion of the shaft 24 releases the wheel 33, but gives the wheel 32 an intermittent movement forward, so that the next number printed is "12," and so on. It will now be observed that the employment of the double sets of numbers "1" to "4" on the wheel 33 is employed because it is practically necessary to move the wheel 33 more than a single space in its numbering to secure its movement from the operation of the wheel 32. Furthermore, it will be observed that the space following the figure "5" is left blank, because the highest number is "50," and all after that begin with the numeral "1," and at that time there must be no type to print from the wheel 33.

Owing to the fact that there are four sets of numbering-wheels on each of the cylinders B' it is convenient to operate two of these sets from one end and two from the other. Consequently I arrange the operating cams, pawls, and ratchet-wheels for two of the sets at one end of the cylinder B' and the corresponding parts from the other two sets at the opposite end. This is clearly shown in Fig. 7.

In this application I do not claim the specific construction of the numbering mechanism, as that forms the subject-matter of a divisional application, Serial No. 21,060, filed June 21, 1900.

Referring now to the creasing or perforating mechanism shown in Figs. 5 and 6, this part of the apparatus consists of two cylinders 43, about the periphery of which are arranged at intervals the serrated blades 48 and 49. One of the cylinders is provided on one side with the two serrated blades 48, arranged at a small distance apart, and on the side diametrically opposite with a second and similar set of serrated blades 48. The surface of the cylinder intermediate of these serrated blades 48 48 is provided with a copper sheet 47, the ends of which are clamped at 45 and 46 and the intermediate portion raised over a block 44. The other of the cylinders 43 is constructed substantially similar to the one just described, with the exception that it is provided only with a single serrated blade 49 on diametrically opposite sides. These cylinders are geared together, and as they rotate the blades 48 and 49 alternately operate in conjunction with the copper sheets 47 of the opposite cylinder to produce an impression or perforation, as the case may be, upon the paper web passing between them. The effect of this is that the serrated blades 48 produce the weakened portions 48^F of the paper strip, as shown in Fig. 18, and the operation of the serrated blades 49 in connection with the copper strip 47 of the other cylinder produces the weakened portion 49^F of the paper strip, as shown in Fig. 18. It will be observed that the impression upon the paper by these blades 48 and 49 are made upon opposite sides, so that the paper may be readily folded in a zigzag manner, as described hereinafter.

After the paper web has been printed and creased or perforated transversely in the manner above described it is then fed forward by a series of feeding-rolls D, already referred to, thence through a feeding-roll *e*, and is split longitudinally into a series of slips, each of which is of the narrow shape indicated in Fig. 18. The splitting of the web is being performed by a series of cutting-disks upon the rolls E. The second set of feeding-rolls *e* receive the split web and guide it to the guide-roll G, from which it extends rearwardly to the folding mechanism.

Referring now to the folding mechanism, it consists of two cylindrical frames 50, journaled upon the transverse shafts 69. The cylinders 50 consist, essentially, of a series of disks fastened upon the shaft 69, as illustrated in Fig. 2, and journaled in these disks near the periphery are a series of transverse rock-shafts 52, upon which are secured folding-blades 51. One of the ends of these shafts 52 is provided with crank-arms 53, having rollers which are guided in the stationary cams 54, bolted to the main frame of the machine. As the cylinders rotate the cams cause the rock-shafts to oscillate or rock in that manner to insure the blades 51 operating in the requisite manner to properly receive the paper web, so that the transverse creases or perforations therein shall lie upon the outer edges of the blades 51, as indicated in Figs. 1^a and 15. The cams 54 are so shaped that they cause the blades 51 to adjust themselves at the time they are operating upon the paper, as will be apparent from examination of Fig. 1^a. The two cylinders 50 are geared together by spur-gearing S, so that they revolve in opposite directions, and the blades 51 of one cylinder pass into the spaces between adjacent blades of the other cylinder, and vice versa, so that the said blades fold the paper into a zigzag shape and positively insure the creasing and folding of the paper at the proper places. As the paper is folded into a zigzag condition it is fed downward upon the guides

70 by the most rearward cylinder and blades and is received by a packer 71 at the rear of the machine. The guides 70 are formed of flat curved blades having hubs, through which a supporting-bolt 74 passes for holding them into position. I would furthermore add that the blades 51 are slotted, as at 75, Fig. 2, so that the guides may pass through the blades. An additional upper series of guide-plates 76 are employed to prevent the folded strips from riding upward or being carried upward by the ascending blades during their rotation. These guides 76 also pass through the slots 75 of the blades 51.

As the cylinders shown each contain ten blades, it is evident that a single revolution of these cylinders will fold ten pages; but as the books are supposed to contain fifty pages provision must be made to sever the longitudinal strips or webs after the said cylinders have made five revolutions or multiples of five. To accomplish this, I employ the following construction: One of the blades 51 of one of the cylinders is provided with a double outer cutting edge 57, constituting two parallel sharp edges over which the paper is stretched, as clearly shown in Fig. 15. The other cylinders are provided with a blade 56, which is moved outward and transversely to produce a drawing cut. The cutting edge of this blade passes between the two cutting edges 57 of the blade of the other cylinder. The cutting-blade 56 is secured to the transverse bar 55, which is guided upon oblique cam-guides 59, so that when it is shifted transversely it is also pushed outward, and vice versa. A spring 58 moves the bar 55 in one direction to retract the cutting-blade and a cam 61, having the projection 62, which operates upon a roller 60 on the bar 55 to move said bar transversely against the action of the spring, and so as to project the cutting-blades outwardly. The cam 61 is connected to a shaft 63, journaled in the main frame R of the machine and provided on the other end with a ratchet-wheel 64, having five teeth, as clearly shown in Fig. 1ª. A pawl 65 operates in connection with a ratchet-wheel 64 and is carried upon the upper end of a rocking arm 66, which is moved forward under the impulse of a cam 68 on the shaft 69 of the opposite cylinder 50. A counterweight 67 may retract the pawl and so as to make the arm 66 follow the cam 68. It will now be seen that upon the shaft 69, together with its cylinder making five revolutions, the cam 61 will be moved at the right time to cause the projection 62 thereof to thrust outwardly the blade 56 just as it comes in line with the double cutter-blades 57 on the opposite cylinder. This severs the several strips immediately at the juncture of two adjacent sheets—namely, between sheets which are numbered "1" and "50." As soon as the paper is severed the roller 60 moves off the cam projection 62 and the cutter 56 is retracted. In this manner the series of zigzag strips which are passing through the folding mechanism are subdivided at points corresponding to fifty pages of folds; and this is done during the act of folding, so that the blades 51 are acting upon the web on both sides of the place of severance, and thereby retains the custody of the paper web upon each side of the division. The paper is fed down over the guides 70 and under the guides 76. The blades 51 change their angle and gradually draw upward and away from the folded paper. The paper in the folded condition, as at I, presses upon the series of packers 71, which are guided in the main frame of the machine and drawn forward by cords 72, counterweighted at 73. In this manner there is always a resistance to the backward packing of the paper at I, and yet at the same time the packers 71 give way under the backward movement of the folded paper. From time to time the folded paper is removed from in front of the packers, as may be required.

It is evident that in a machine of this character all of the movable parts must be timed so as to coact or operate in unison. This is accomplished by providing the ends of the rotating shafts with suitable gearing, which is shown in Figs. 3 and 4. The gearing in these figures is that which relates to those parts of the machine which treat the paper web after the web has been printed upon both sides and ready for numbering. M represents the gearing between the first pair of numbering-cylinders B B′. L is the gearing between the second pair of numbering-cylinders B′ B. K is the gearing between the creasing or perforating rolls C. N is the gearing between the feeding-rolls D. P is the gearing between slitting-rolls. The several sets of gears M, L, K, and N are coupled by intermediate gears J. A further intermediate gear J and a pinion P transmits motion to the slitting-rolls from the feeding-rolls. A still further pair of intermediate rolls J and P′ and a large spur-gear O transmit power from the slitting-rolls to one of the shafts 69 of the folding-cylinders. The feeding-rolls *e* are driven from the slitting-rolls by gearing T. The several printing-cylinders A A′ are also geared together, so as to run at the same surface speeds, and these, as well as gears M of the numbering-cylinders, are driven by suitable gearing from the main driven shaft J′, Fig. 1.

I do not confine myself to any particular character of gearing, as the several parts of the machine may be made to run in unison by any suitable power-transmitting devices.

While I prefer the construction illustrated as being excellently adapted to the purpose of the invention, I do not limit myself to the minor details thereof, as they may be modified in various ways without departing from the principles of my invention.

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

1. In a printing-press the combination of means for printing and numbering a web of paper, with a pair of creasing-cylinders one of which is provided with a projecting or creasing blade arranged transversely to the travel of the web of paper and the other provided with a removable sheet of ductile material upon which the blade presses in creasing the paper, and means for folding the creased web of paper on the lines of the creases.

2. In a printing-machine the combination of means for printing upon both sides of a web of paper, with two folding-cylinders each having a series of radially-projecting blades adapted to operate in conjunction so that the blades of one cylinder are received in the spaces between the blades of the other cylinder and vice versa, cam devices for adjusting the blades during the rotation of the cylinders while folding the web of paper, cutting devices for severing the web of paper while passing between the two folding-cylinders, cam mechanism for throwing the cutters into operation, and means controlled by the rotation of the cylinders for causing a cam mechanism to be operative for a short period after a given number of revolutions of the folding-cylinders.

3. In a printing-machine the combination of means for printing a web of paper, with a pair of folding-cylinders each provided with a series of rock-shafts carrying radially-projecting blades one of the blades of one of the cylinders being provided with a cutting edge, a transverse cutter carried by the other cylinder, cam mechanism for forcing the last-mentioned cutter-blade outwardly into cutting position, and means for bringing the cam into operative position after a given number of revolutions of the folding-cylinders whereby the web of paper may be severed after a given number of folds have been produced upon the web.

In testimony of which invention I have hereunto set my hand.

HENRY P. FEISTER.

Witnesses:
R. M. HUNTER,
J. W. KENWORTHY.