(No Model.)

11 Sheets—Sheet 1.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

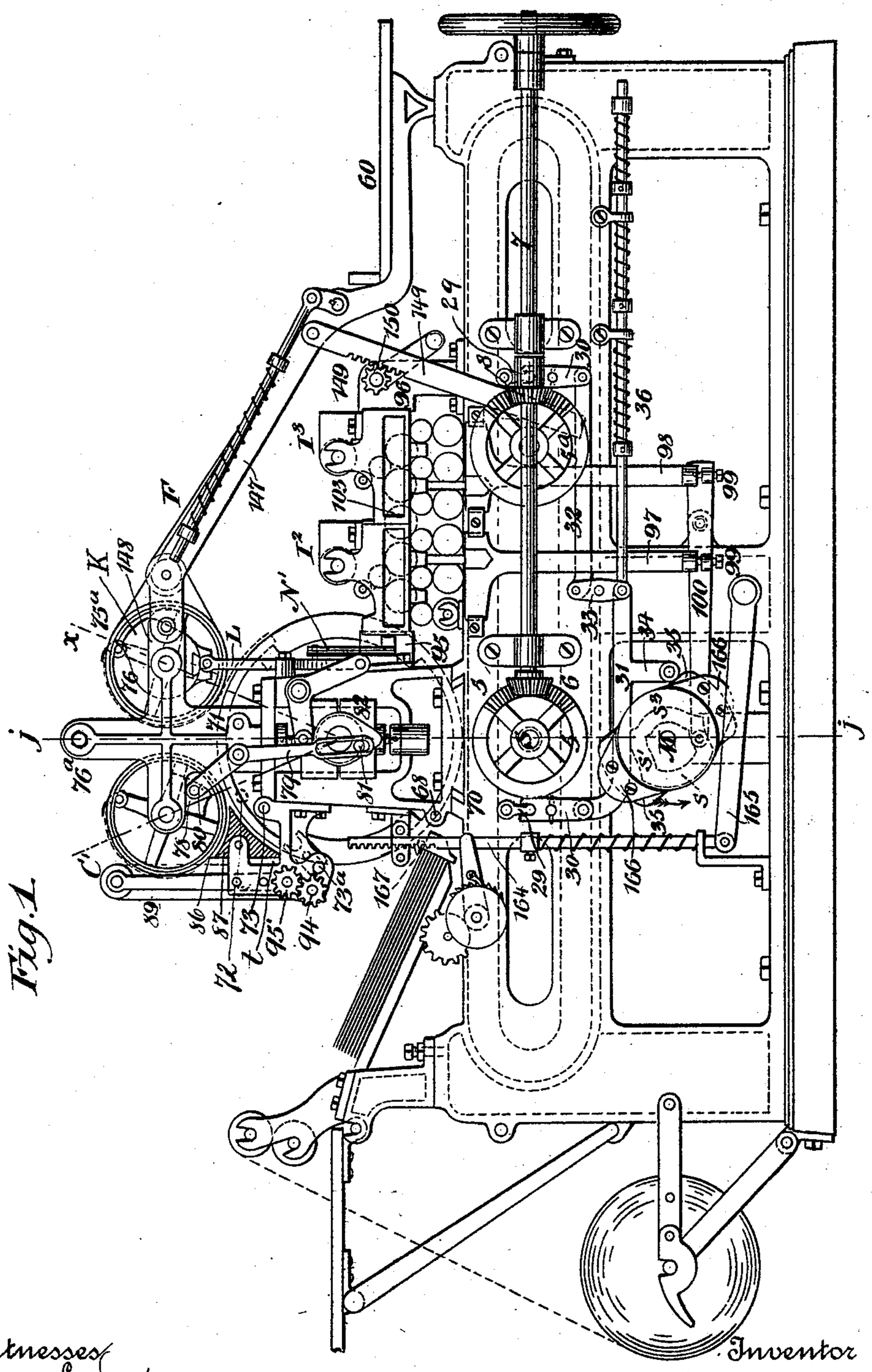


Fig. 1.

Witnesses
Eugene E. Dayton
W. H. Van Meter

Inventor
Matthew Vierengel
By his Attorney
Whittemore & Hopkins

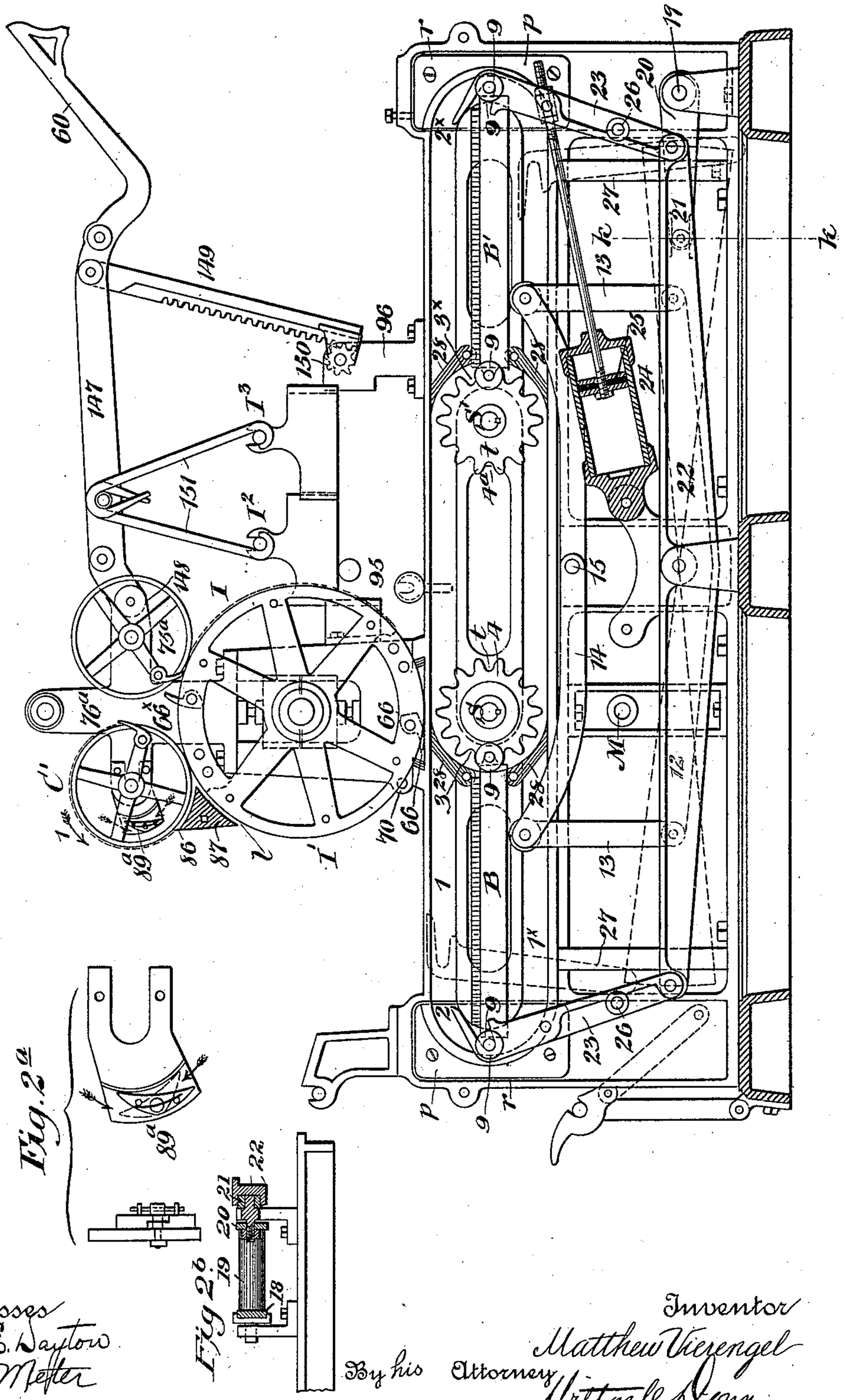
(No Model.)

11 Sheets—Sheet 2.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.



Witnesses
Eugene E. Dayton
W. H. Van Metter

Inventor
Matthew Vierengel
By his Attorney
Whittemore & Howson

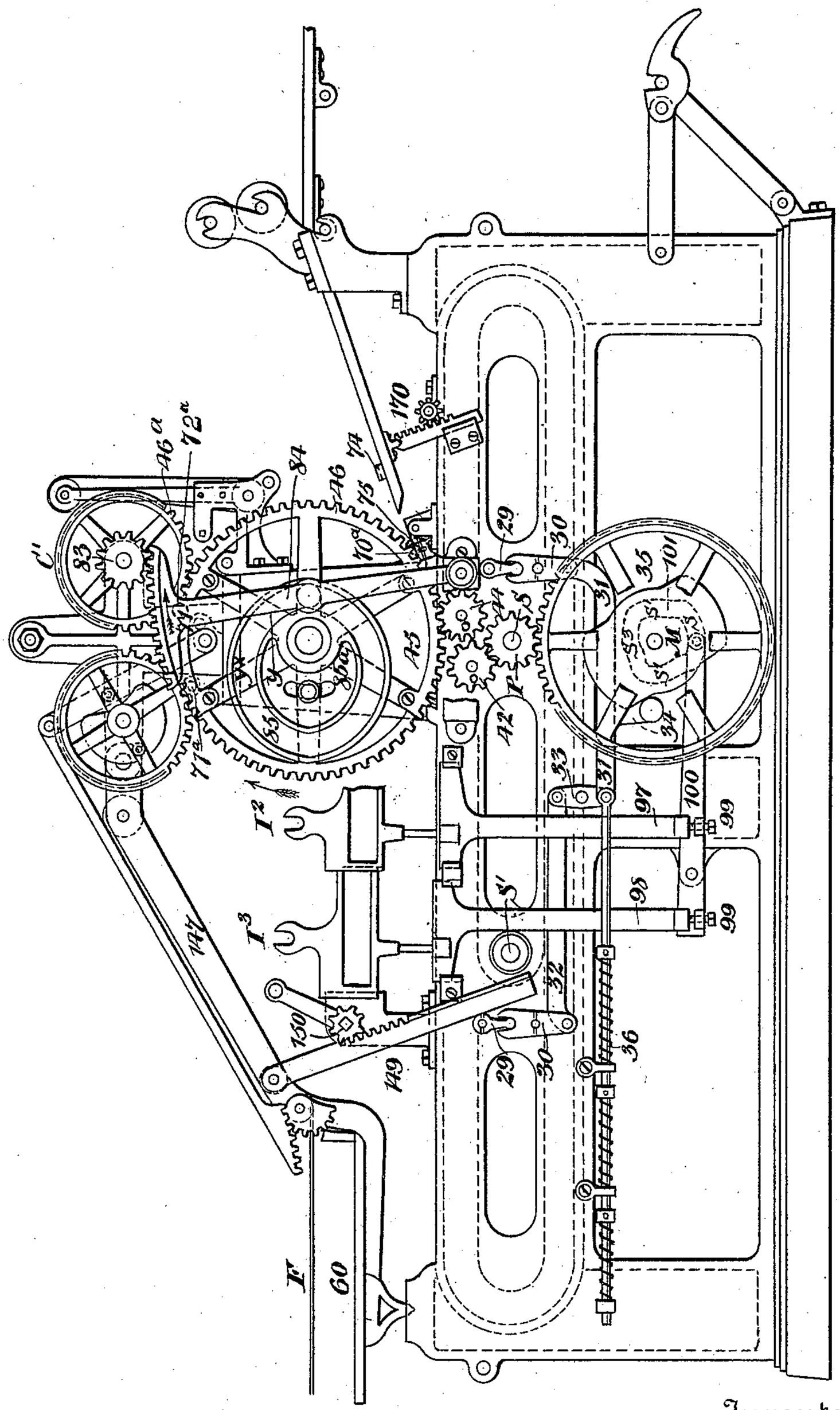
(No Model.)

11 Sheets—Sheet 3.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.



Witnesses
Eugene E. Wayton
W. K. Van Meter

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Wright Brown & Quinby

(No Model.) 11 Sheets—Sheet 4.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

Fig. 4.

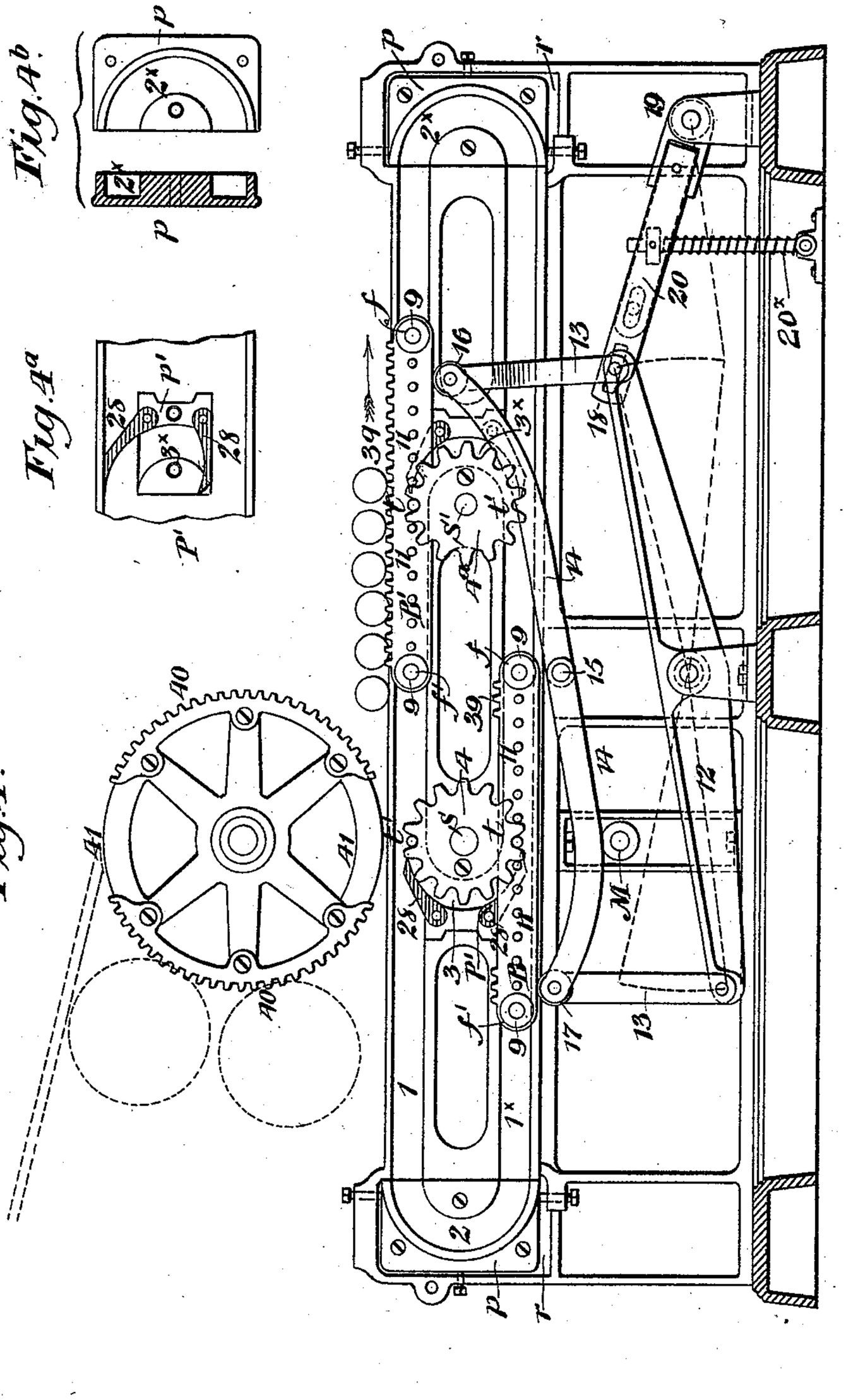

Fig. 4a.

Fig. 4b.

Witnesses
Eugene E. Dayton
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By his Attorneys Milton C. Dunn

(No Model.) 11 Sheets—Sheet 5.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

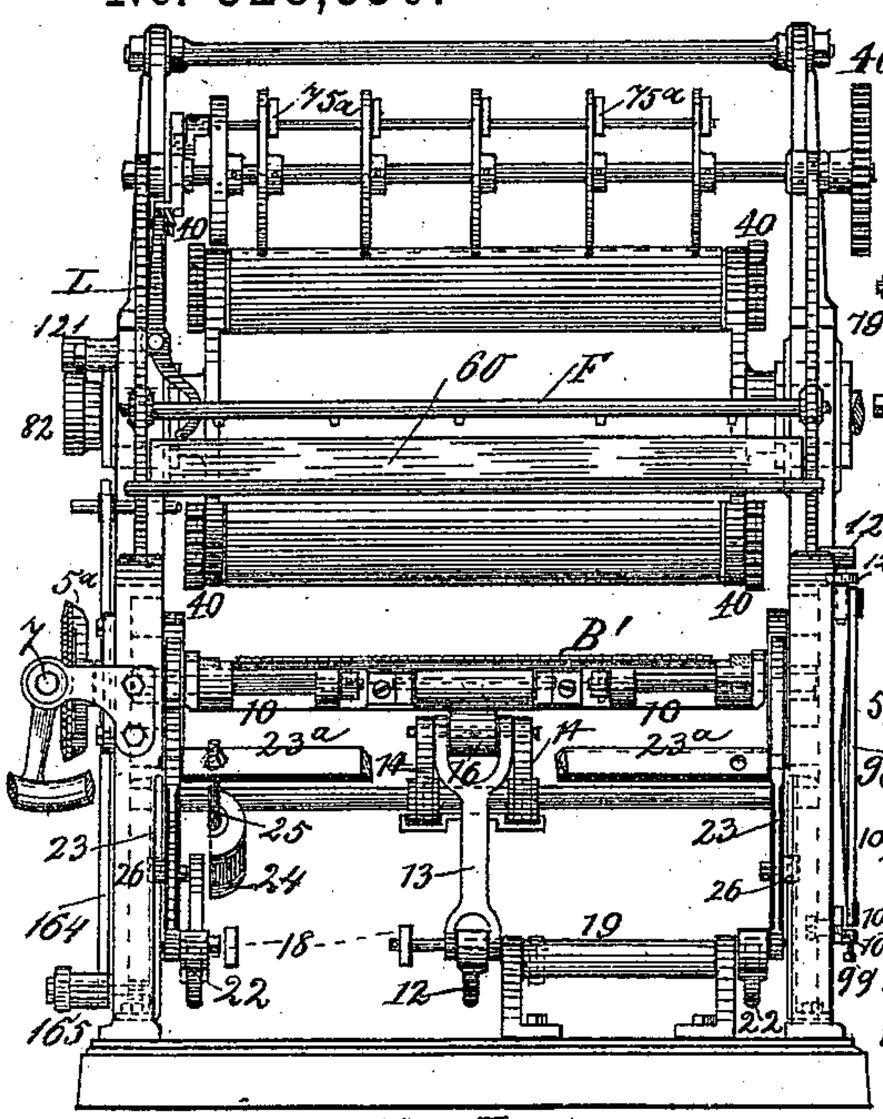


Fig. 5

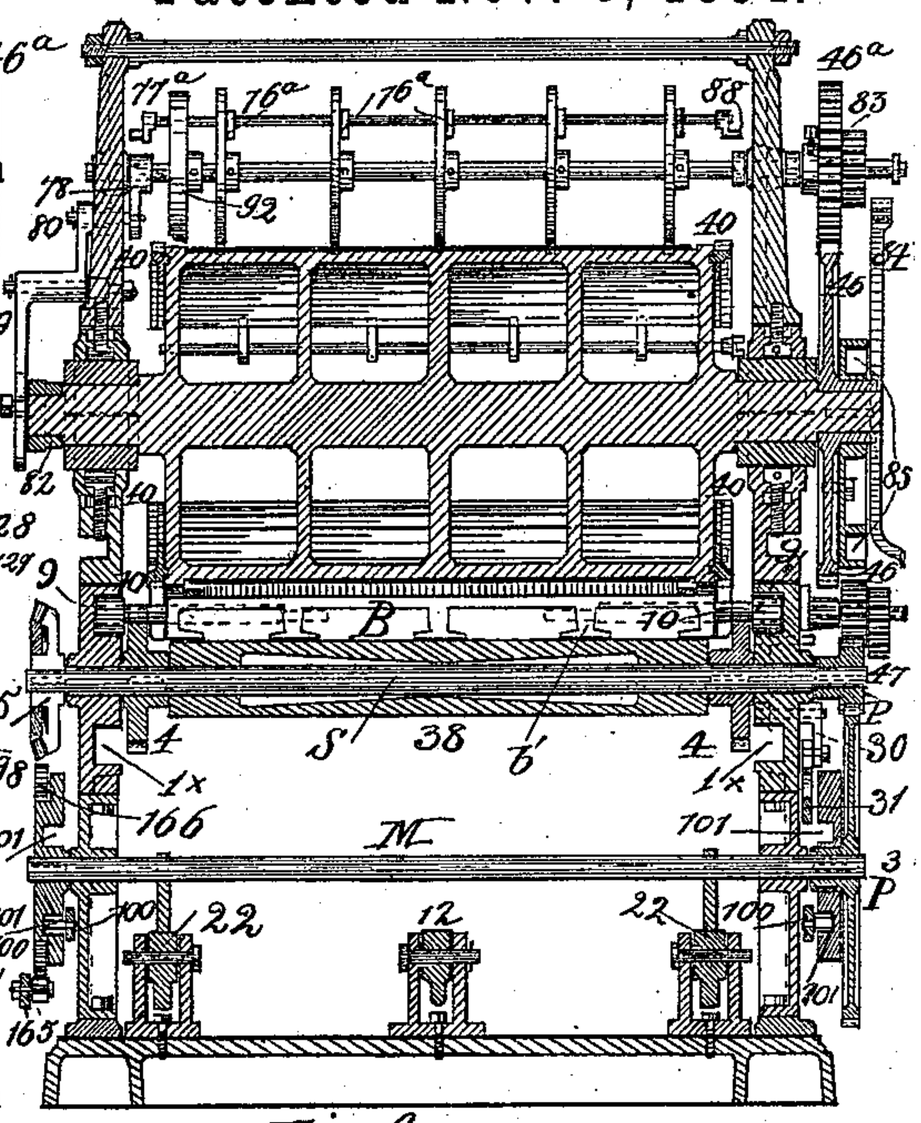
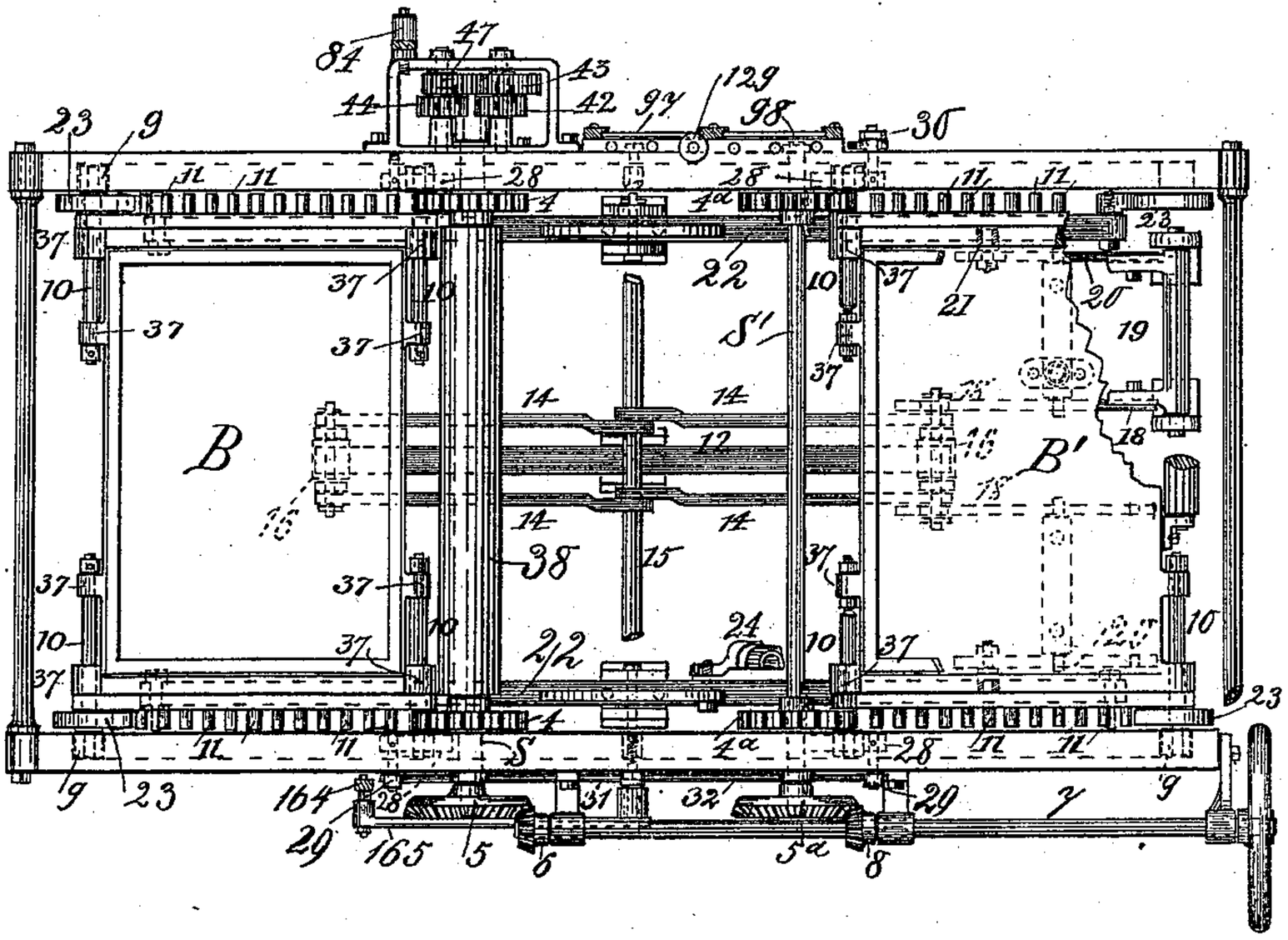


Fig. 6

Fig. 7



WITNESSES:
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Karl Boos.

INVENTOR
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BY Wittemeldons
ATTORNEY.

(No Model.) 11 Sheets—Sheet 6.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

Fig. 9.

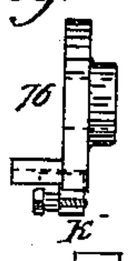


Fig. 10

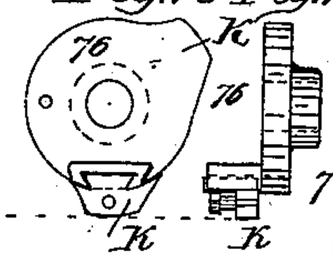


Fig. 11

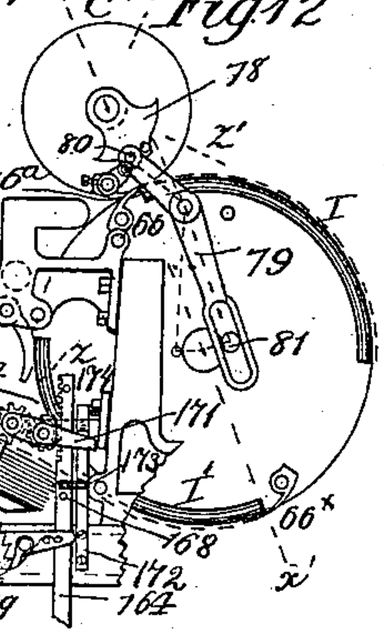


Fig. 12

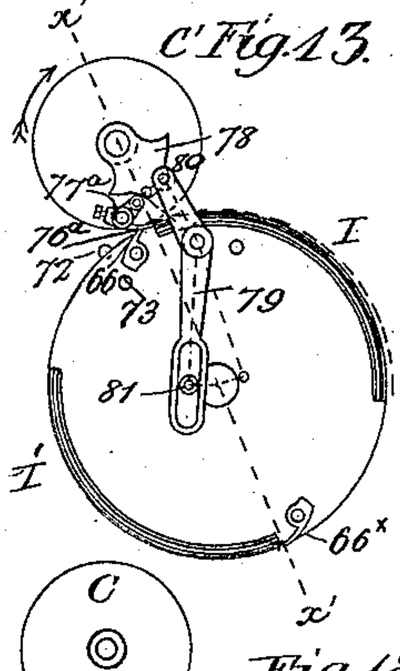


Fig. 13.

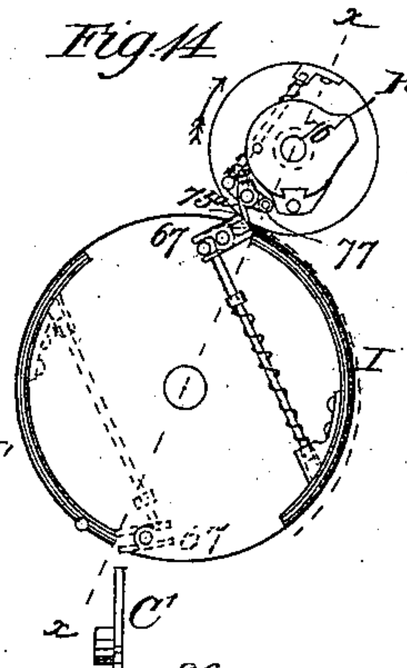


Fig. 14

Fig. 15

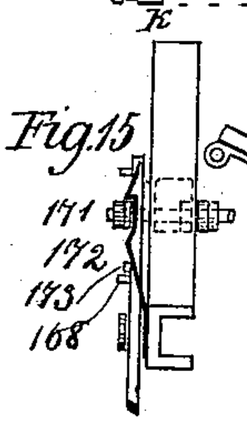


Fig. 16

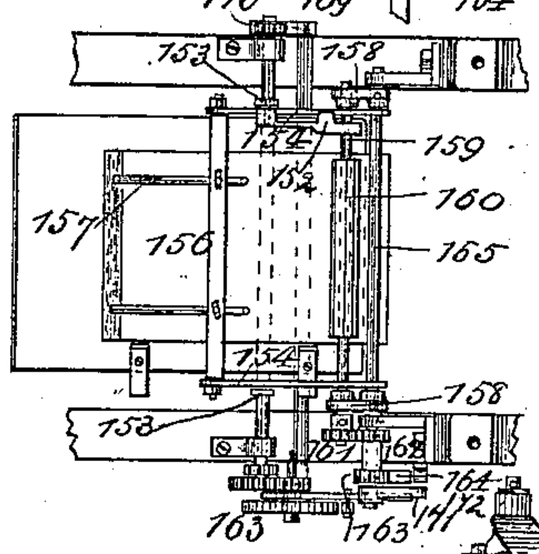


Fig. 8

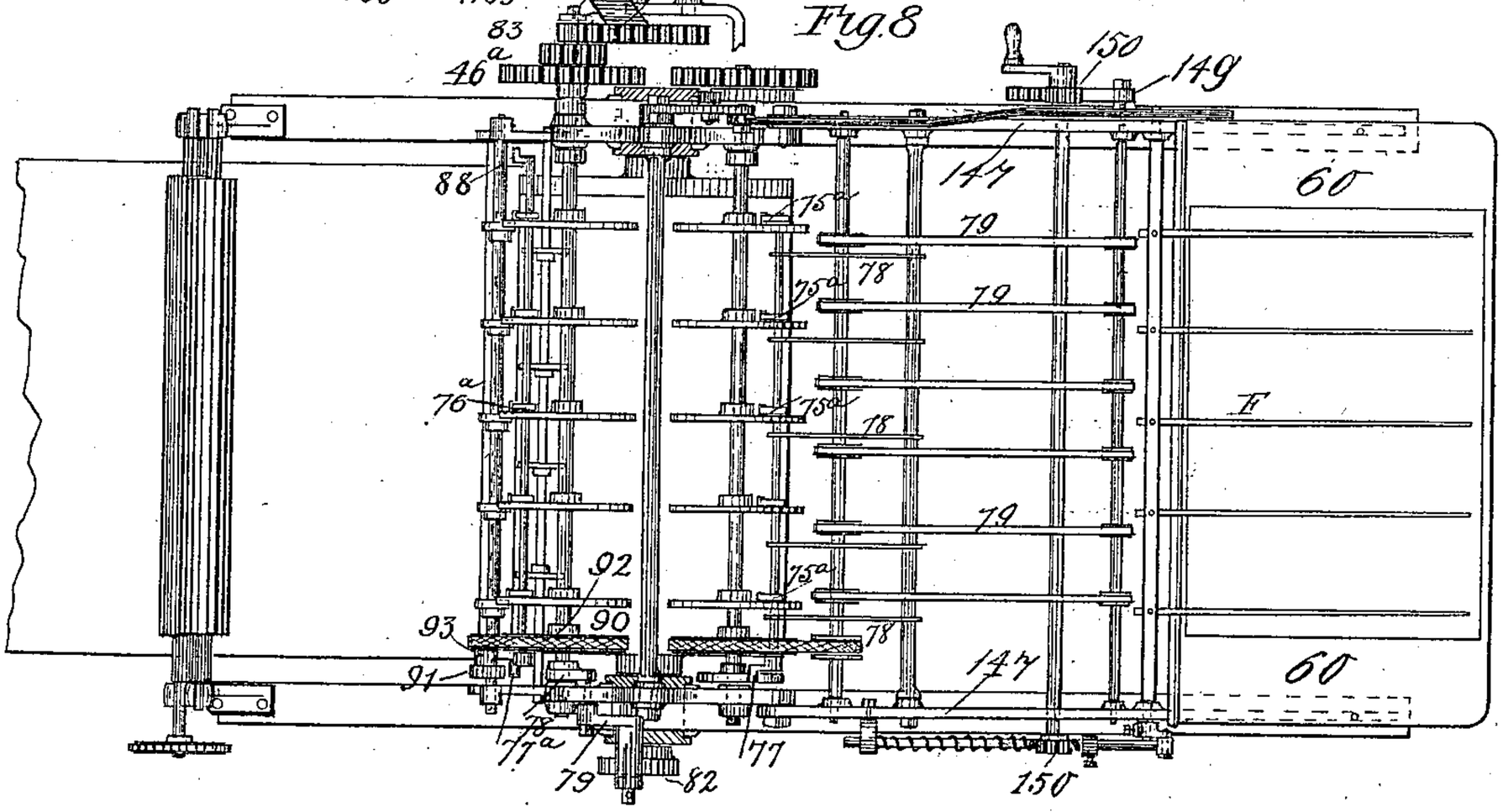
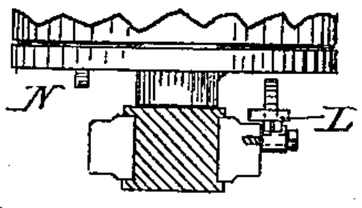


Fig. 17



C

86

87

Fig. 18.

WITNESSES:

Gotthard Opprecht.

Karl Boos.

INVENTOR

Matthew Vierengel

BY

Victor J. Evans

ATTORNEY.

(No Model.)

11 Sheets—Sheet 7.

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PRINTING MACHINE.

No. 528,830.

Patented Nov. 6, 1894.

Fig. 19

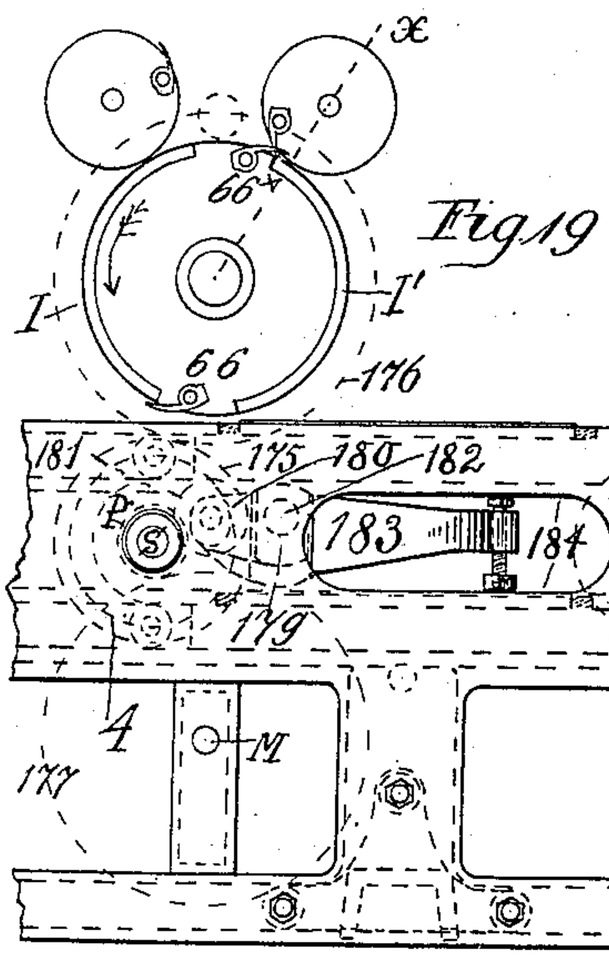


Fig. 20

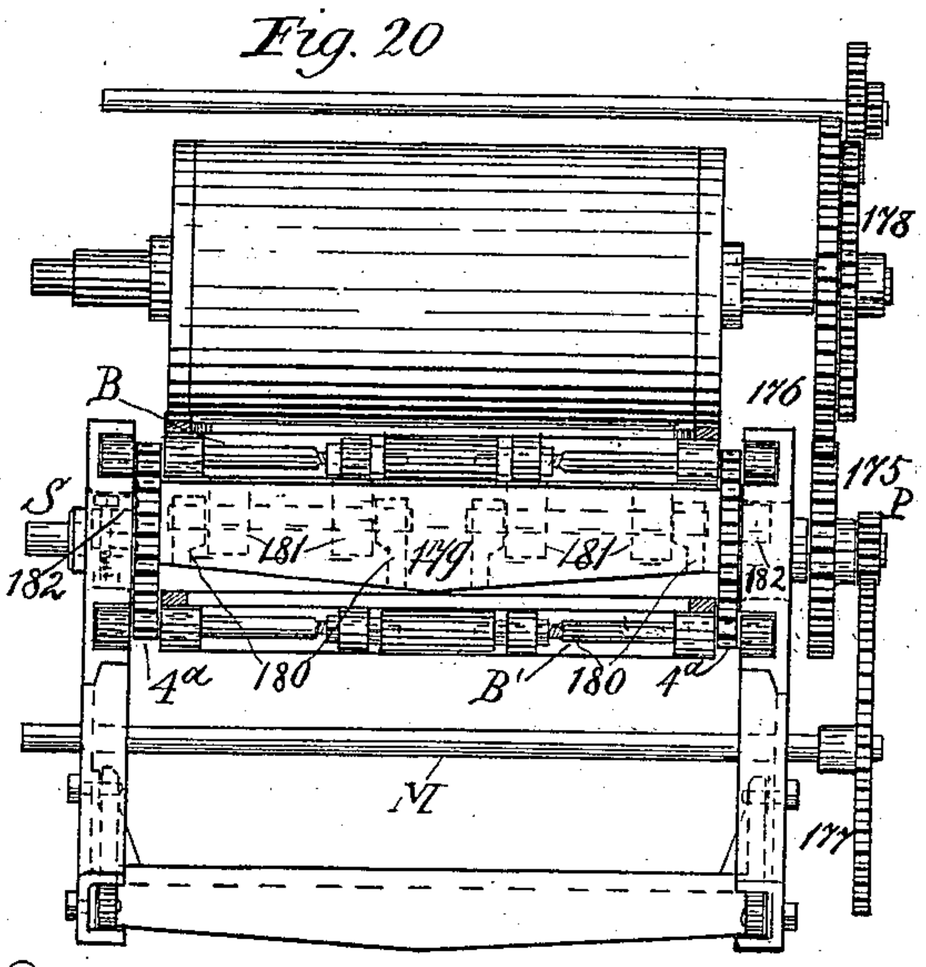


Fig. 21

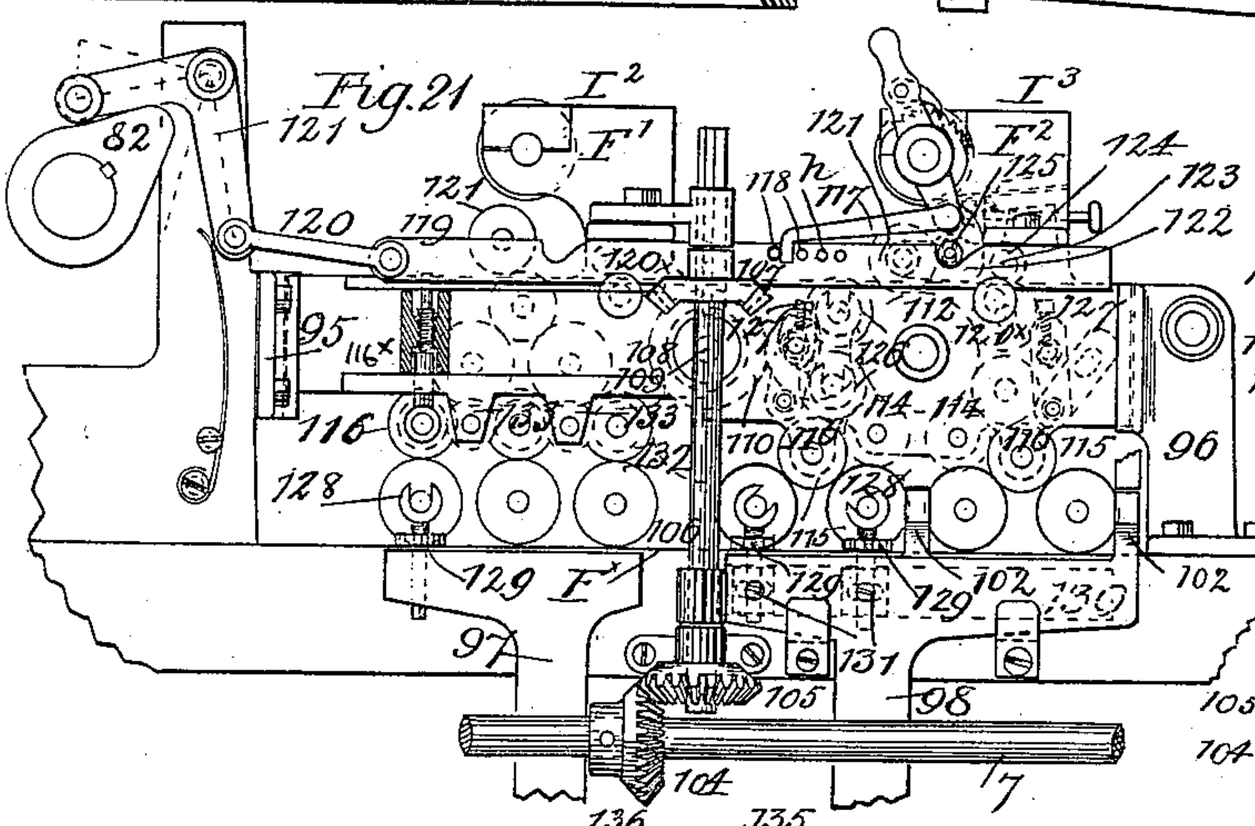


Fig. 22

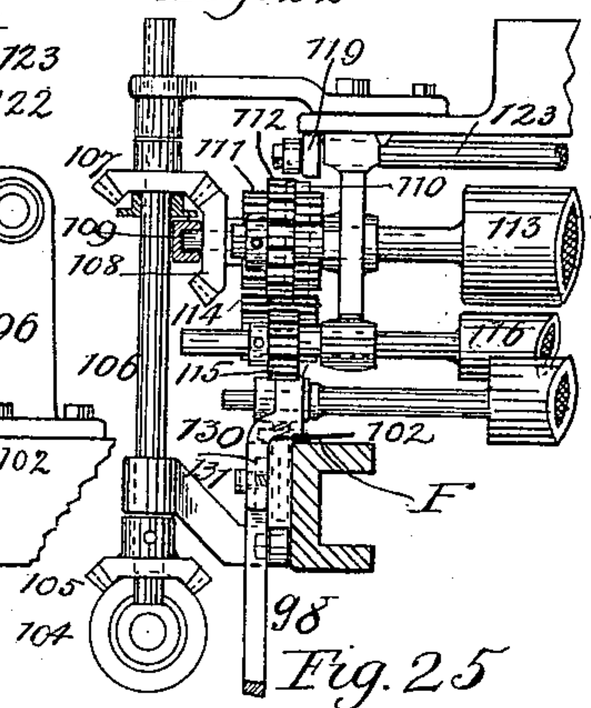


Fig. 23

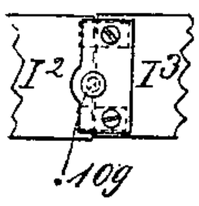


Fig. 24

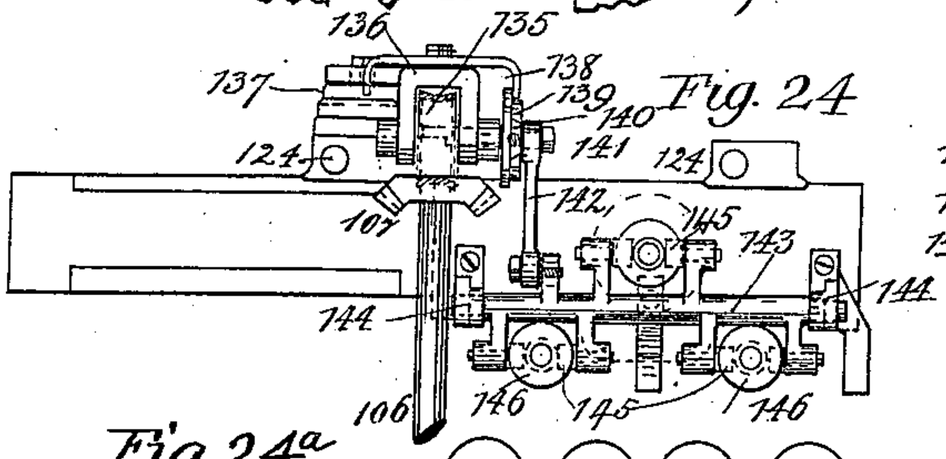


Fig. 24a

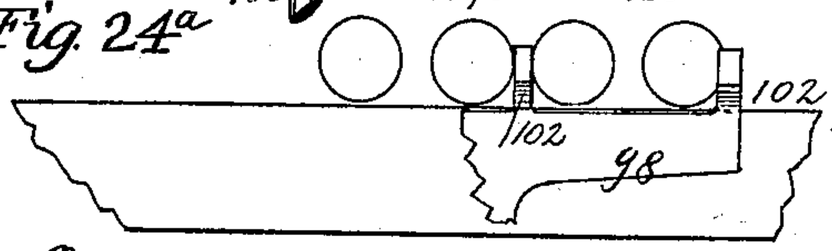


Fig. 25

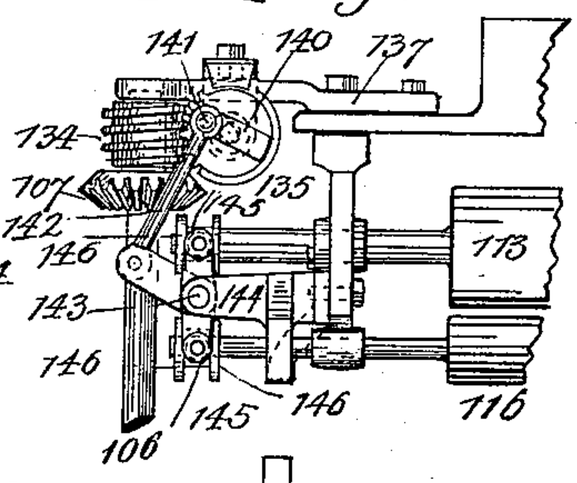
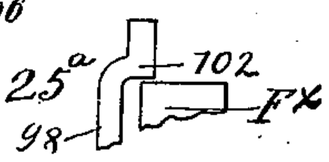


Fig. 25a



WITNESSES:

Gotthard Gyrecht.

Karl Ross.

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ATTORNEY.

(No Model.) 11 Sheets—Sheet 8.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

Fig. 26.

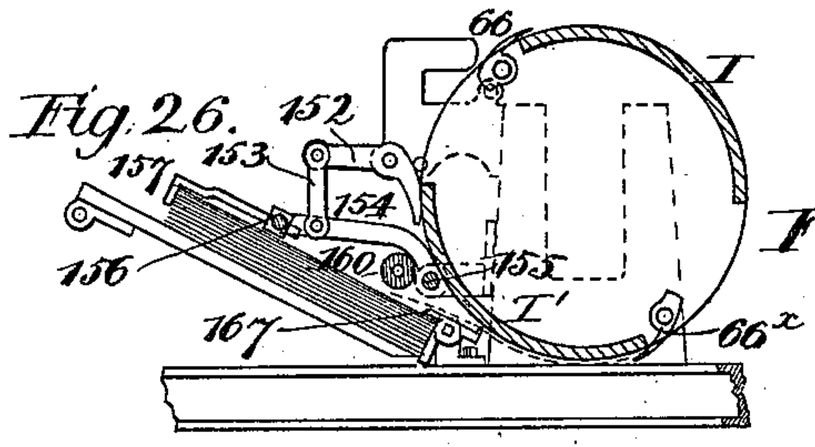


Fig. 27.

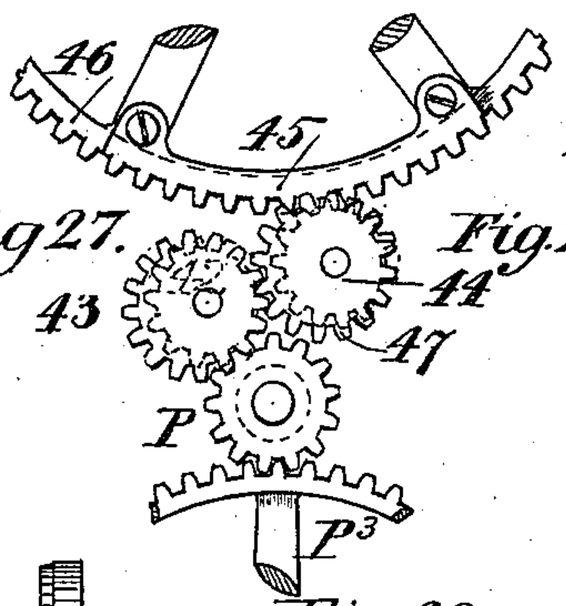


Fig. 28.

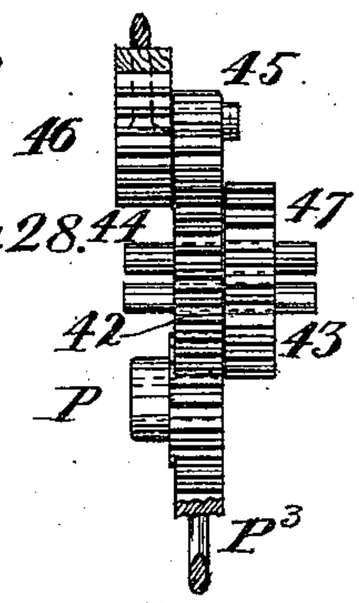


Fig. 29.

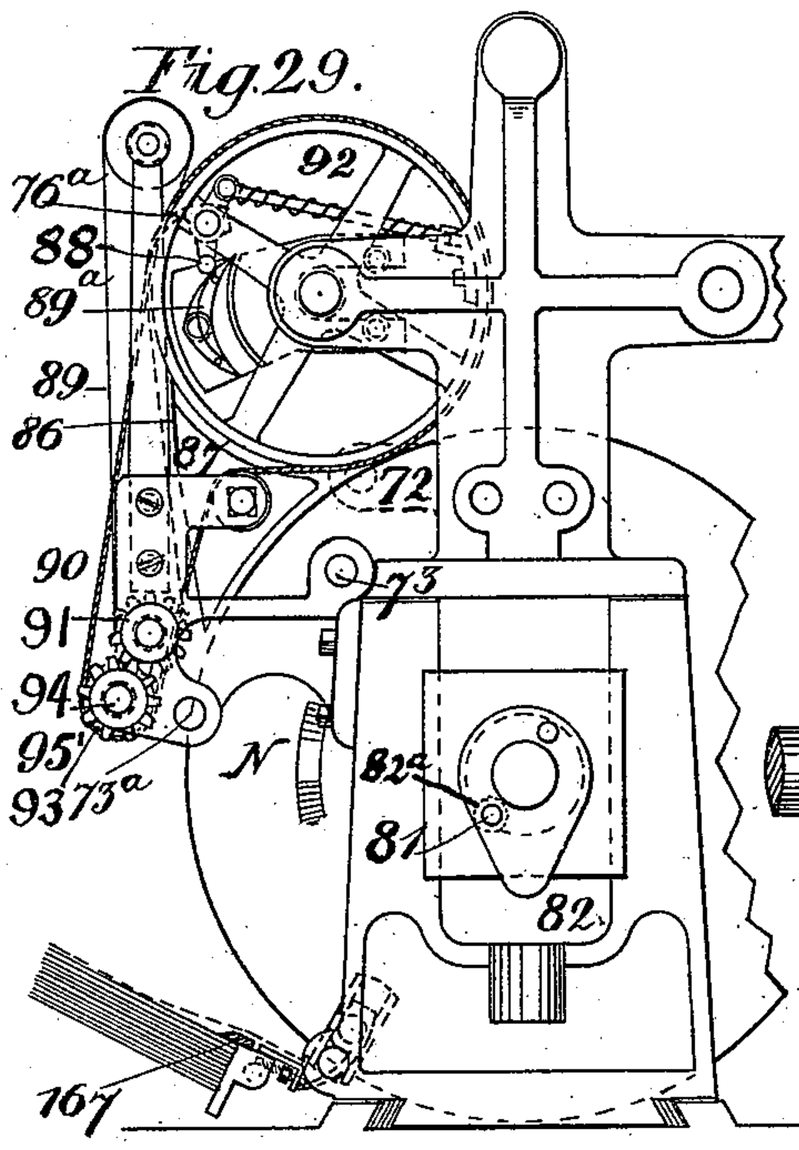


Fig. 30.

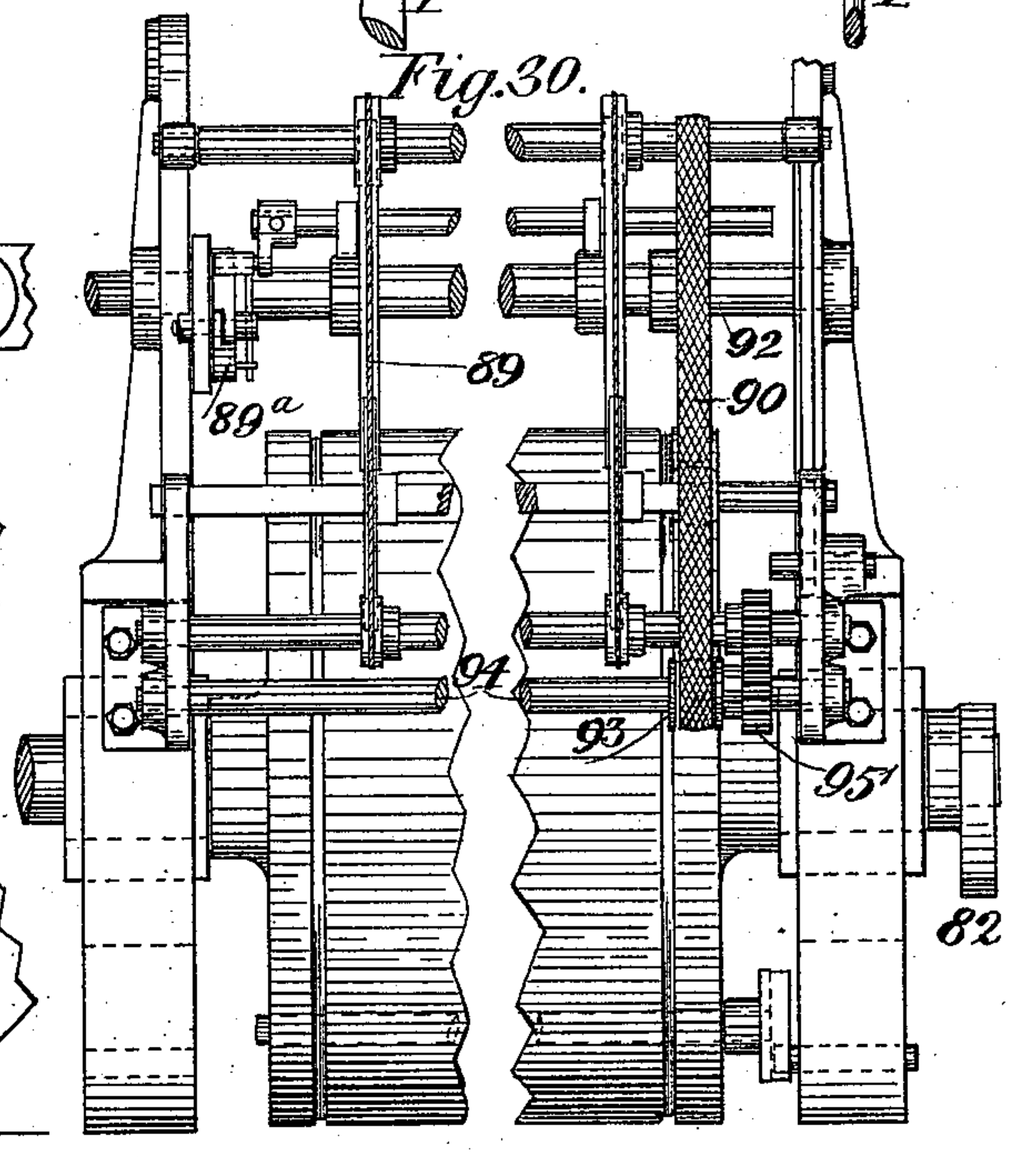


Fig. 31.

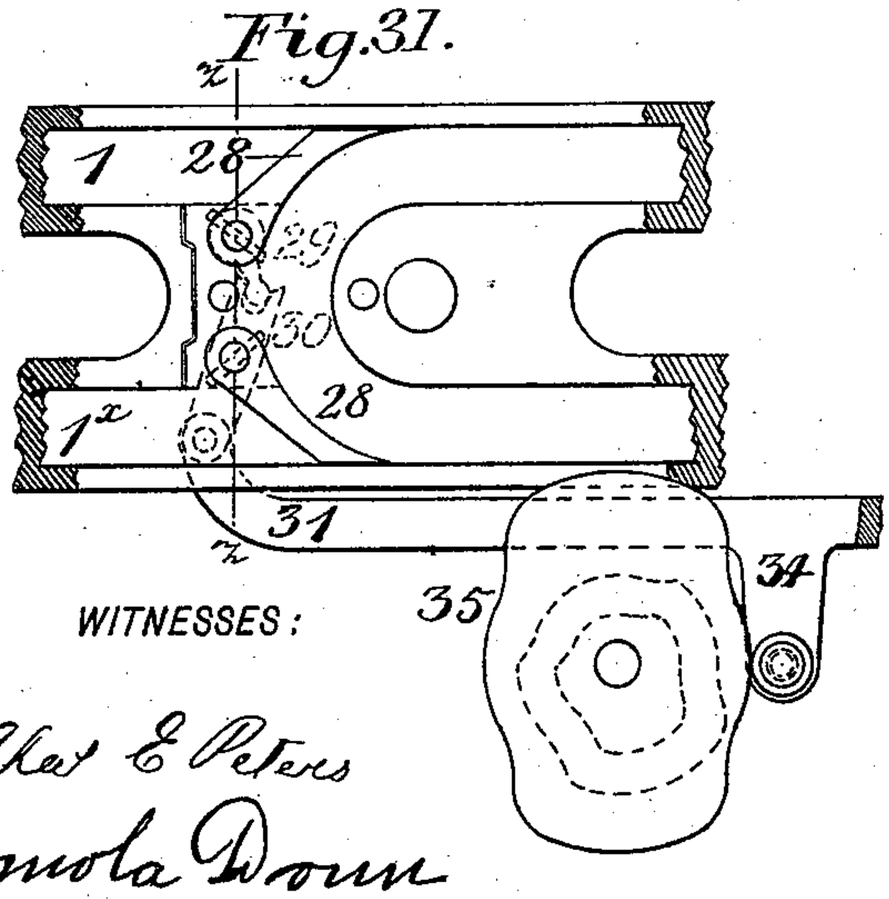
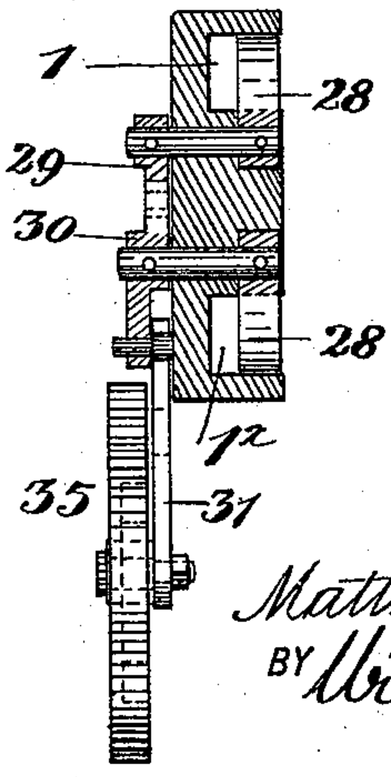


Fig. 32.



WITNESSES:

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Monola Dorn

INVENTOR

Matthew Vierengel

BY Wilton & Dorn

ATTORNEY.

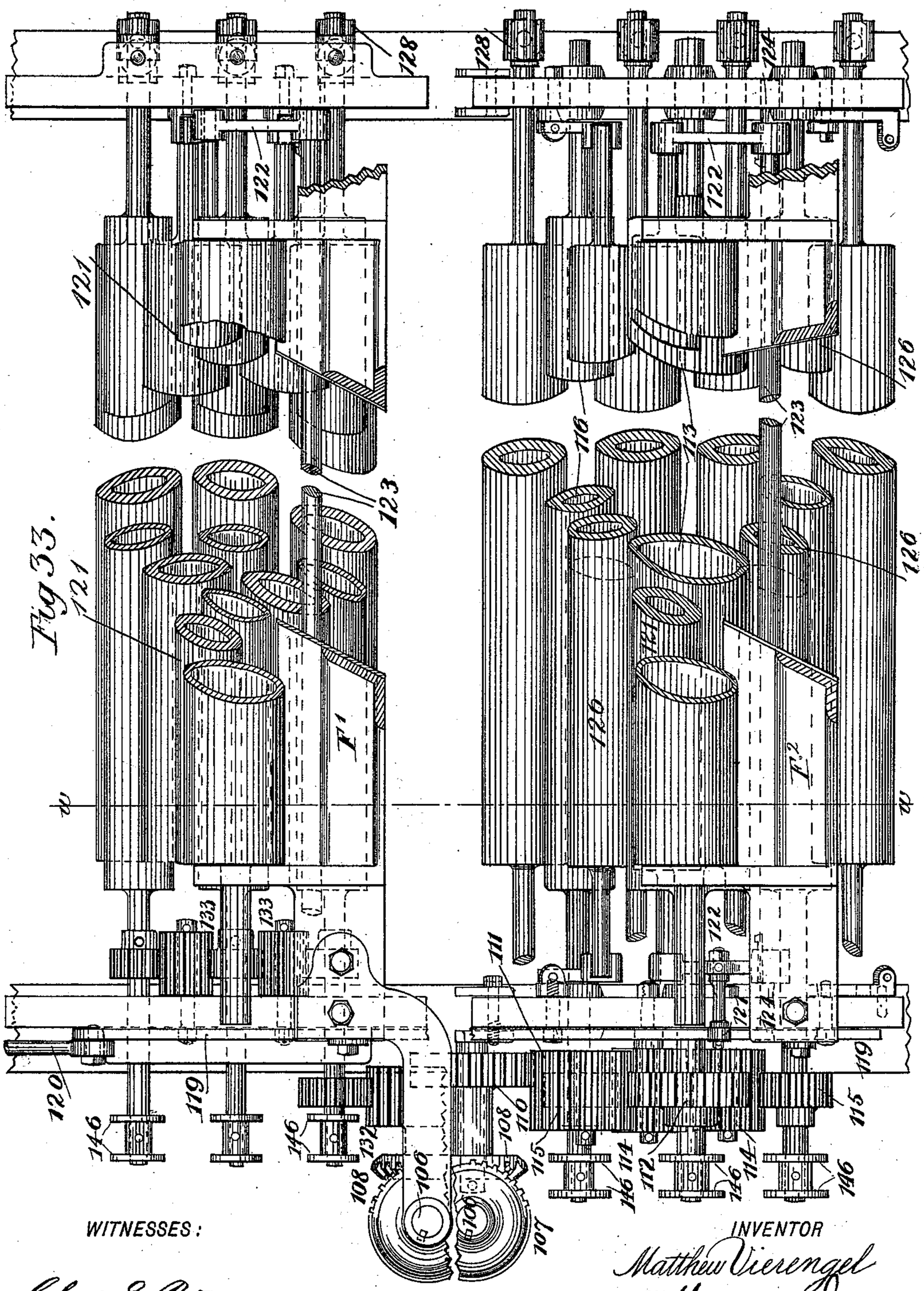
(No Model.) 11 Sheets—Sheet 9.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

Fig 33.



WITNESSES:

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Mowrola Donn

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(No Model.) 11 Sheets—Sheet 10.

M. VIERENGEL.

PRINTING MACHINE.

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Fig. 34.

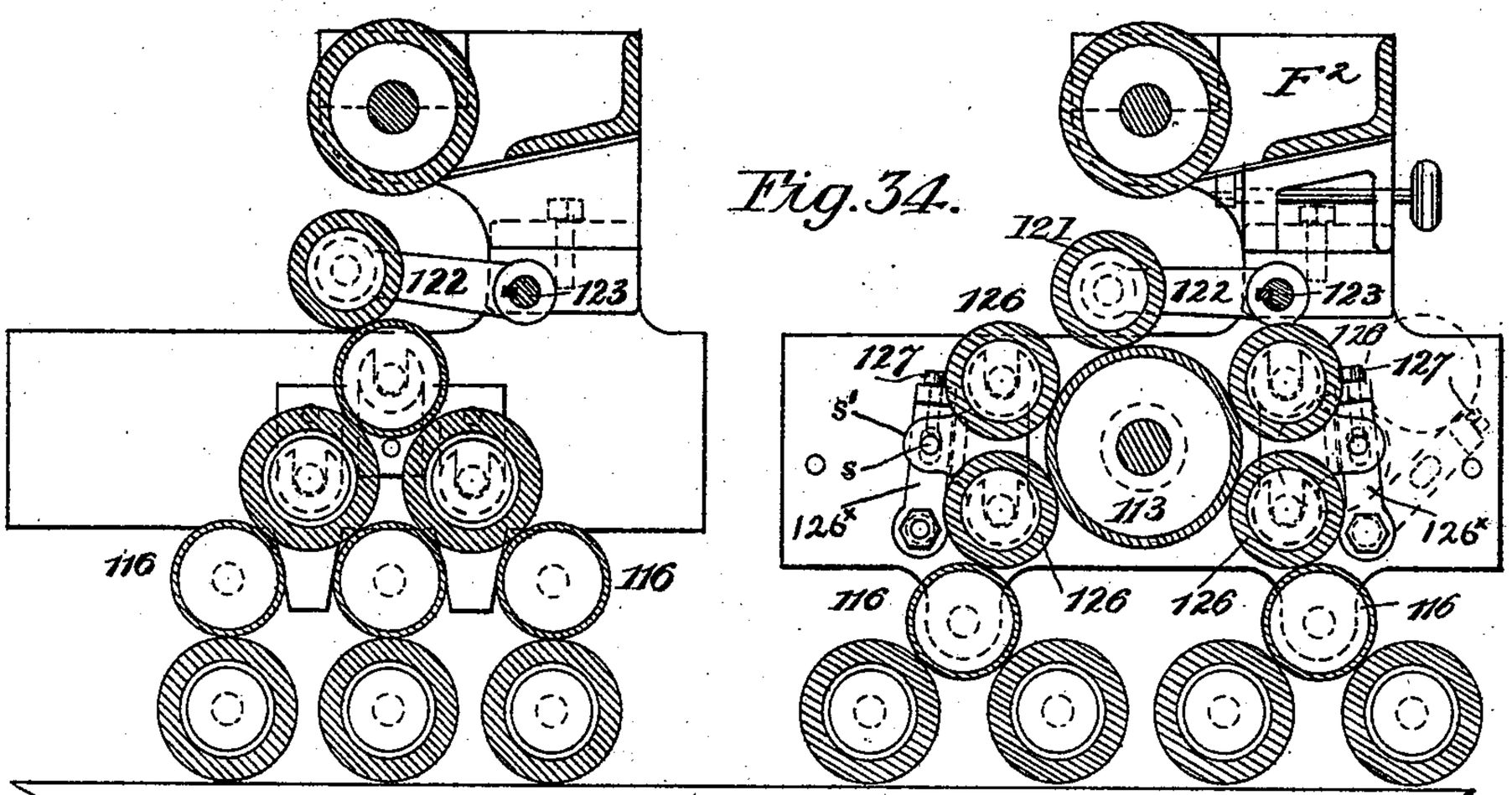
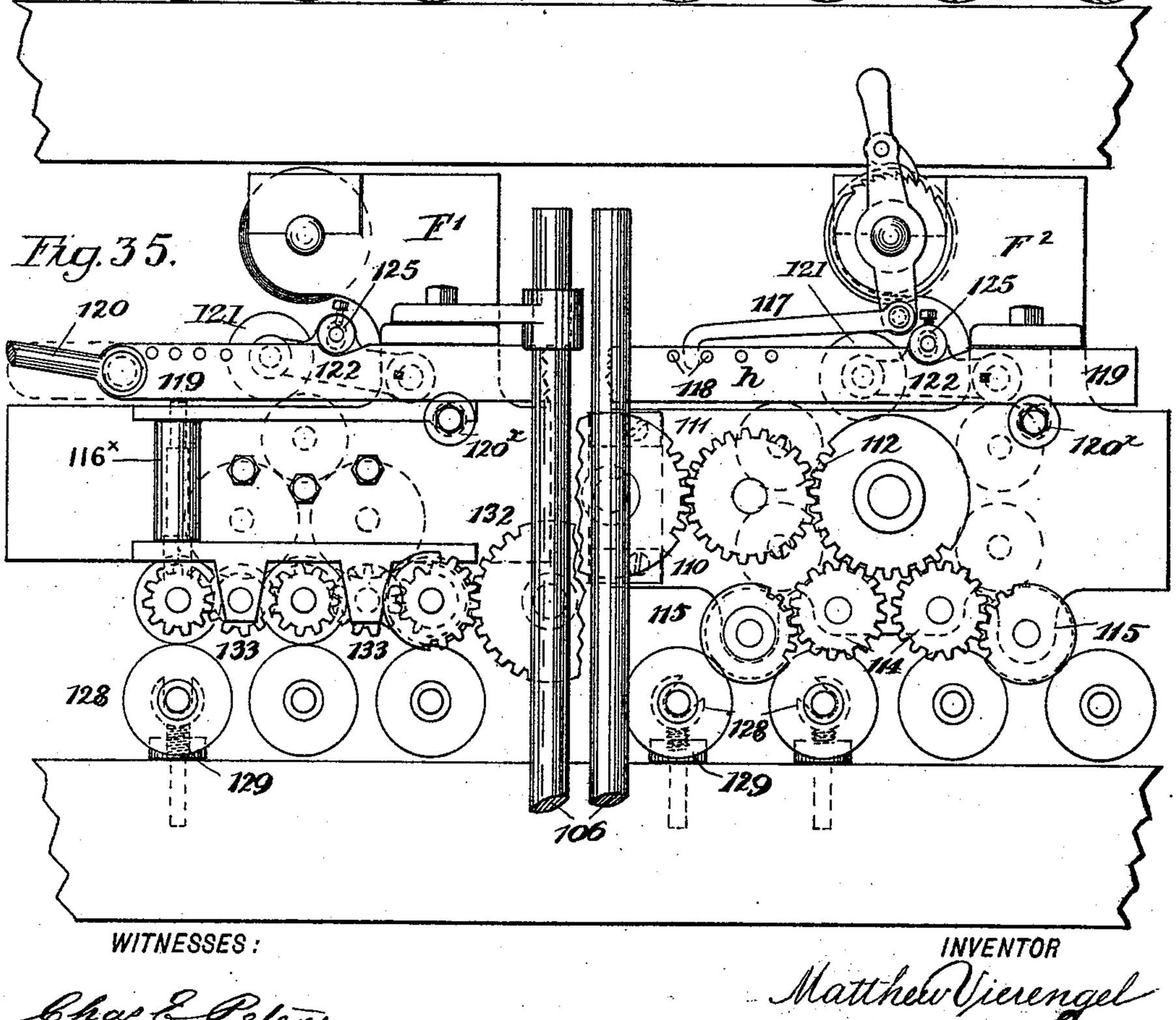


Fig. 35.



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ATTORNEY.

(No Model.) 11 Sheets—Sheet 11.

M. VIERENGEL.

PRINTING MACHINE.

No. 528,830. Patented Nov. 6, 1894.

Fig. 36

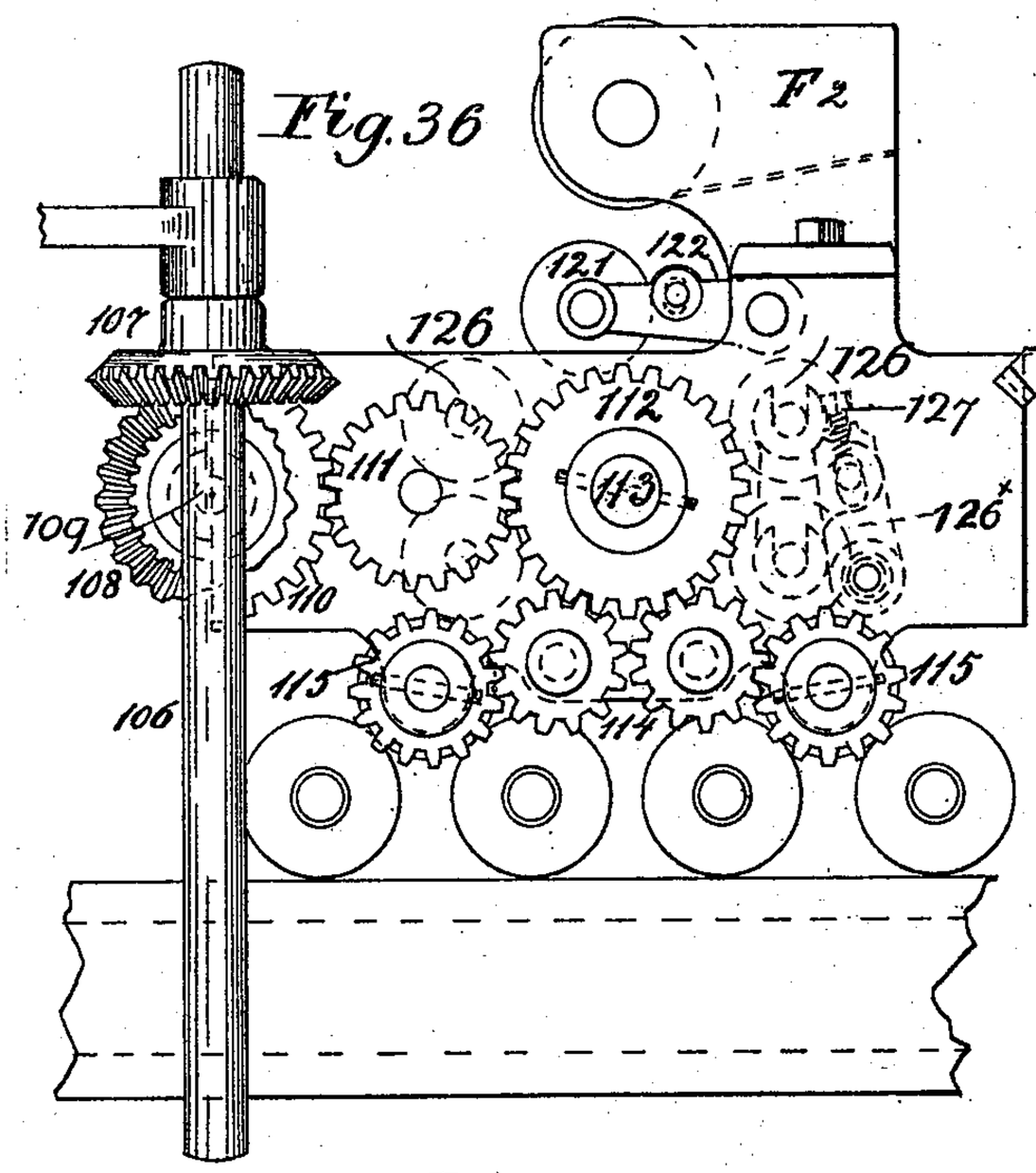


Fig. 37.

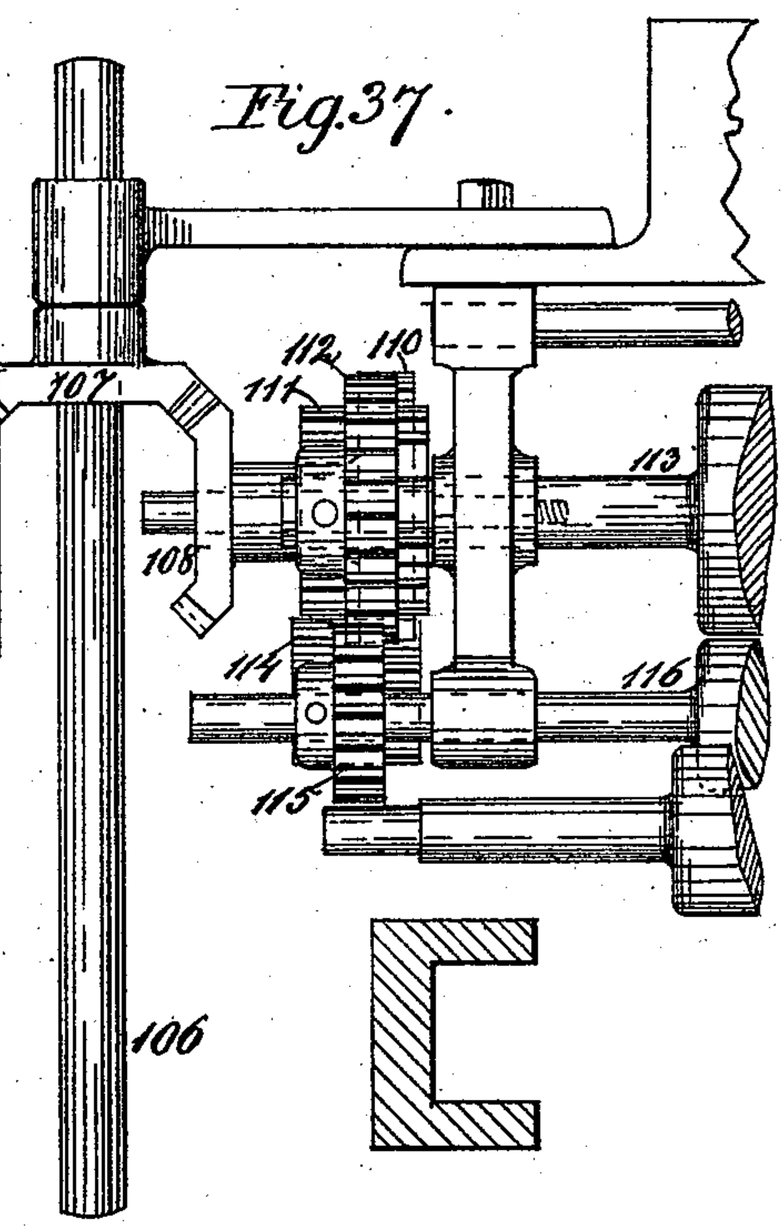


Fig. 38

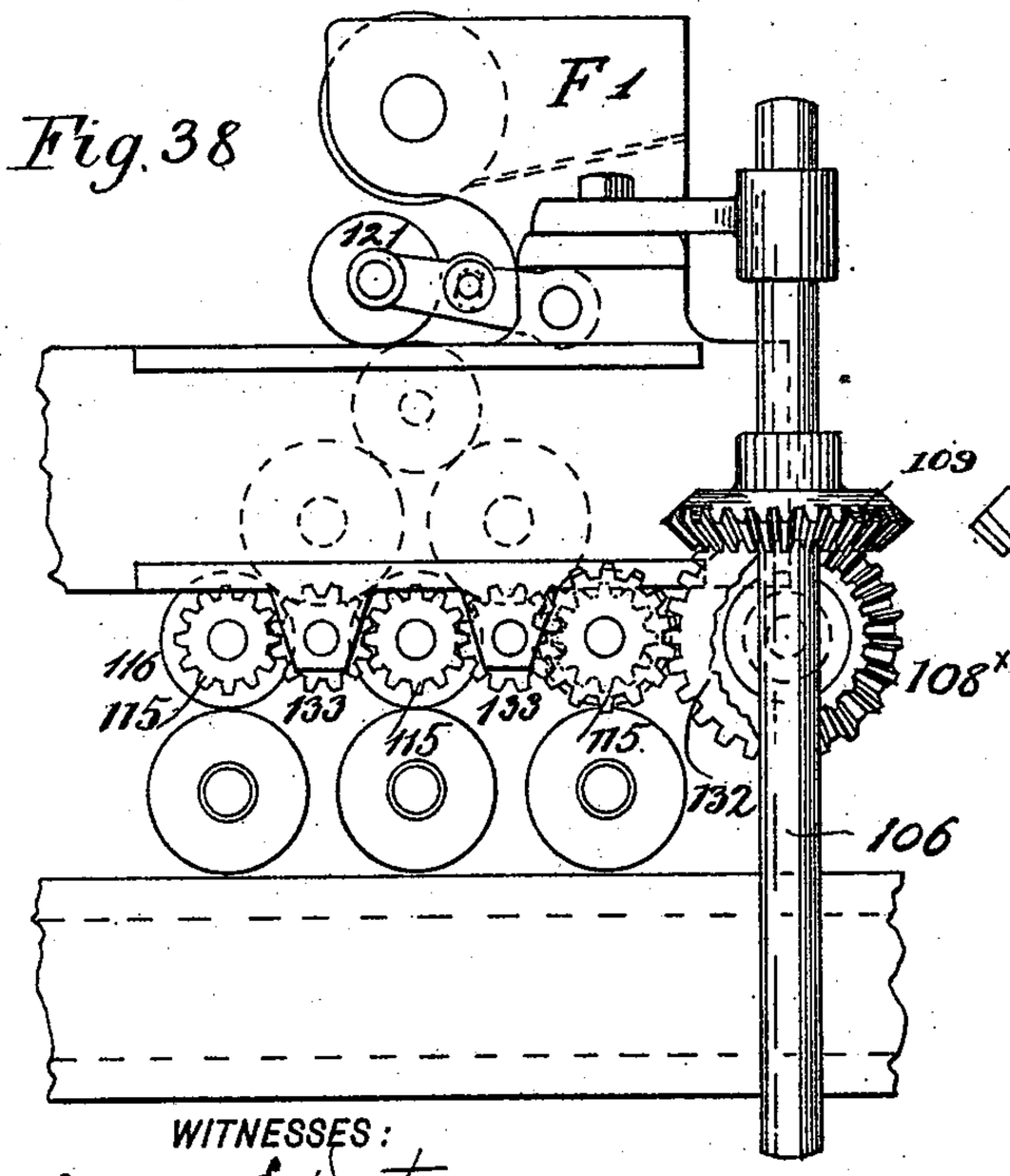
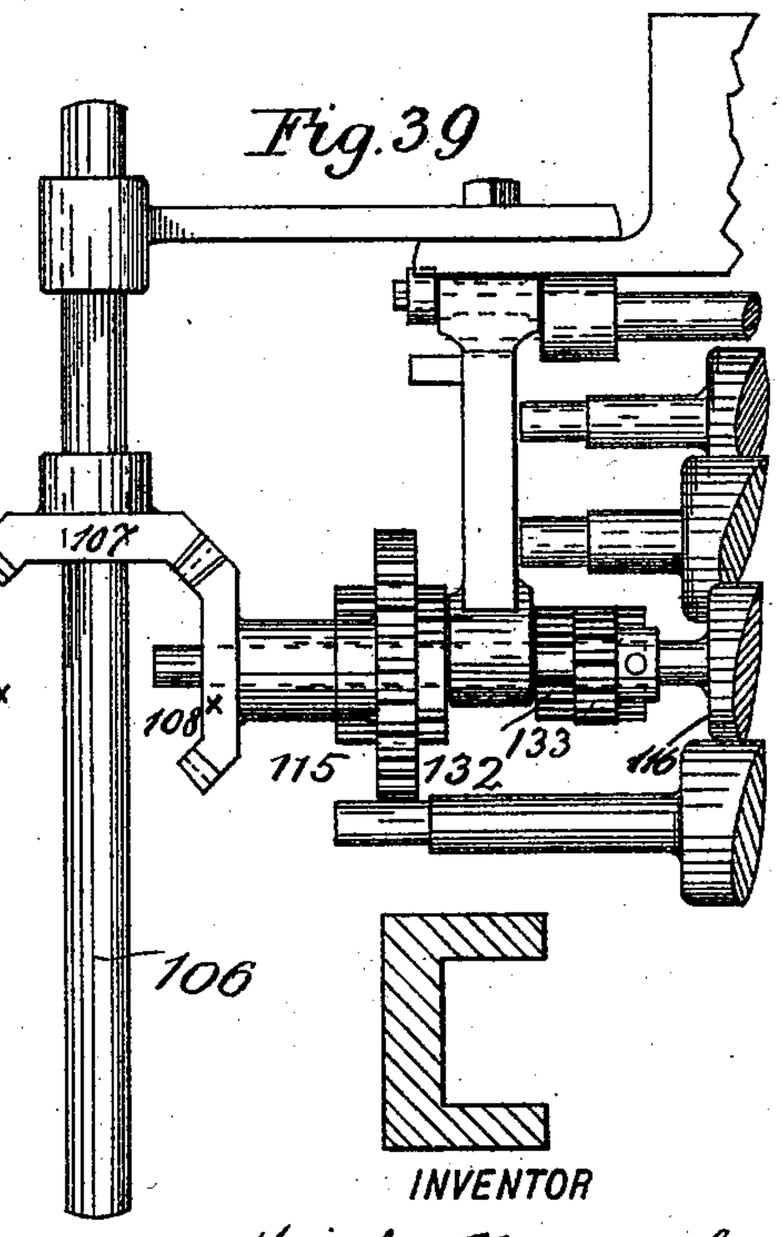


Fig. 39



WITNESSES:

Eugene E. Dayton

W. K. Van Metter

INVENTOR

Matthew Vierengel

BY Written & Dunn

ATTORNEY.

UNITED STATES PATENT OFFICE.

MATTHEW VIERENGEL, OF BROOKLYN, NEW YORK.

PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 528,830, dated November 6, 1894.

Application filed February 9, 1892. Serial No. 420,927. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW VIERENGEL, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Printing-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to cylinder printing machines, and particularly to the motions of the form beds; the impression construction and motions of impression cylinders, and the gripper operating mechanism for such cylinders, and finally to the construction of an organized printing machine capable of being used for a variety of purposes; for example for single printing at a much higher speed than is possible with any known form of cylinder printing machines, for color printing without multiplying the impression cylinders, and perfecting, that is printing on both sides of the sheet for book and newspaper work, &c., also without multiplying the impression cylinders.

The objects of my invention are, first, to produce a printing machine which shall be so organized that it can at will and by shifting or readjusting the devices which operate the grippers on the impression cylinder to take and release the sheet fed to the machine, be converted into a machine for single printing, or color printing or perfecting, as may be desired; second, to provide such an alterable printing machine with a form bed or beds which shall be adapted to travel in guide ways parallel to each other, and in an orbital path—traveling in the upper guide ways when making an impression, and in the lower guide ways on the backward motion, and passing from one to the other without reversing the forms; third, to produce a cylinder printing machine in which a plurality of form beds shall be combined with an impression cylinder and the form beds shall be constructed and arranged to travel in orbital guide ways one after the other by a continuous regular motion and each in harmony with an impression surface on the cylinder—the beds being arranged to balance one another while passing through the vertical portion of the guide ways, so that the weight of the descending bed shall aid in lifting the ascending bed.

Other objects of the invention will be stated in connection with the mechanism and devices hereinafter described by which the several objects are attained.

In the accompanying drawings Figure 1 represents a side elevation of my improved printing machine; Fig. 2, a longitudinal sectional elevation of the same; Fig. 2^a, detached enlarged views of a part of the perfecting mechanism. Fig. 2^b is a detached sectional view of one of the levers 20, that connect with the rock levers 22—the section being taken on line *k k* of Fig. 2; Fig. 3, an elevation of the side of the machine opposite that shown in Fig. 1; Fig. 4, a longitudinal sectional elevation of the machine illustrating particularly the bed motion mechanism; Figs. 4^a and 4^b, detached views of parts of the bed motion mechanism; Fig. 5, a front elevation of the printing machine; Fig. 6, a vertical transverse section of the machine taken on line *j j* of Fig. 1; Fig. 7, a plan of the machine with the cylinder and other parts above the beds removed; Fig. 8, a plan also but with the cylinder and other parts omitted in Fig. 7, in position; Figs. 9, 10 and 11 views in different positions of the cam and accompanying mechanism of the delivery cylinder. Fig. 12 represents in side elevation the impression cylinder and auxiliary turning cylinder and accompanying mechanism as arranged for perfecting, and also parts of an automatic feeding attachment for printing machines. Fig. 13 represents in side elevation the impression cylinder, auxiliary cylinder and accompanying mechanism as arranged for color printing. Fig. 14 represents in side elevation the impression cylinder and delivery cylinder for single printing; Fig. 15, a detached edge view of a part of the automatic feeding mechanism; Fig. 16, a plan of the automatic feeding mechanism; Fig. 17, a sectional top view of one end of the impression cylinder and the devices co-operating therewith to move the slide by which the delivery cylinder gripper cam (see Figs. 9, 10 and 11) is brought into action; Fig. 18, sectional end view and rear elevation of the switch mechanism for taking the sheet off the turning cylinder in perfect-

ing; Fig. 19, a side elevation and Fig. 20 an end elevation of a modification of my invention having in view a three revolution movement of the cylinder and also an improved support for the bed or beds when taking an impression. Fig. 21 represents on an enlarged scale a double inking apparatus applicable to printing machines—one part of the apparatus showing a three roller arrangement, and the other a four roller arrangement. Fig. 22, represents the roller operating mechanism for the same; Figs. 23 to 25ª, views in detail of the sidewise distributing mechanism, &c. Fig. 26 represents a vertical cross-section of the impression cylinder and the automatic feeding mechanism; Fig. 27, an enlarged view in side elevation of the irregular gearing for varying the motion of the cylinder; Fig. 28, an edge elevation of the same; Fig. 29, an enlarged end view of the impression cylinder, and the sheet reversing cylinder—showing also the switch mechanism for operating the grippers of the reversing cylinder, and the devices for giving motion to the tapes that assist in guiding the sheet to the grippers when the reversing cylinder is backing up. Fig. 30 is a rear elevation of the same. Fig. 31 is an enlarged inside view of the guide-ways for the beds, the switches in the said guide-ways and the mechanism for opening and closing the said switches; Fig. 32, a vertical cross-section of the same, taken on line *z z*. Fig. 33, is a plan of the inking stands (one stand being provided with three inking rollers, and the other with four) also showing the mechanism that gives motion to the various rollers. Fig. 34 represents a vertical cross-section of the inking stands the section being taken on line *w w* of Fig. 33. Fig. 35 represents an end elevation of the inking arrangement. Fig. 36 represents a side elevation of the form roller inking apparatus illustrating the gearing connecting the form rollers with the driving shaft of the inking apparatus; Fig. 37, an end view of the same. Fig. 38 represents a side elevation of the three roller apparatus illustrating the mode of connecting the same with the driving shaft, and Fig. 39 is an end view of the same.

Referring to the drawings the frame of the machine is constructed in the usual manner and power can be applied to the driving shaft S or to the bevel wheel shaft 7 by fitting the same with fast and loose pulleys.

The bed motion.—The upper side frames are provided in their inner sides with parallel longitudinal guide ways 1, 1× one above the other which are connected at their ends by true semi-circular guide ways 2, 2× and at equal distances from the ends by intermediate counter part guide-ways 3 3×. It is preferred that the end guide-ways shall be made separate from the side frames of the machine by casting them on a plate *p* as shown in the sectional and side elevations of the machine, and also detached in Fig. 4ᵇ. Thus made the connecting guide-way pieces are set in recesses *r* in the end plates or uprights of the side frames and secured by bolts and adjusting screws as shown. This is the preferred mode of making these parts on account of the facility with which the guide-ways can be turned and finished; but it is obvious that the entire guide-ways may be cast integral with the frame. The semi-circular sides of the intermediate guide-ways 3 3× are also preferably cast on a separate plate *p'* as shown, but they may also be cast with the frame. The driving shaft S passes through the side frames at the center of the curve of the rear intermediate guide way 3; and inside and close to the side frames on either side, toothed wheels 4 4 are mounted on said shaft and revolve with it. At the center of the front intermediate guide way 3× is a shaft S' which carries similar toothed wheels 4ª 4ª. The shaft S on its end opposite the timing pinion P outside of the frame carries a bevel wheel 5 which engages a beveled wheel 6 on a shaft 7, that also carries a beveled pinion 8 which gears into a bevel wheel 5ª on the end of the shaft S' that carries the toothed wheels 4ª. The rear wheels 4 4 and front wheels 4ª 4ª are thus geared to the main driving shaft that also carries the timing pinion P, the function of which is to keep the main shaft, cylinder and beds in proper operative connection. A wheel on the end of shaft 7 serves both as a balance wheel and as a hand wheel for operating the beds when the machine is at rest. The toothed wheels 4 4 and 4ª 4ª drive the form beds and also transfer them from one guide way to the other as will be presently described.

The form beds B B' are supported in the guide ways by friction rollers 9 9 placed on shafts 10 10 projecting laterally from the sides of the bed at the two ends thereof. The friction rollers run in the guide ways and between them and the sides of the bed the space is sufficient for the toothed wheels to engage the shafts on which the rollers are mounted. Between the end shafts 10 10 are laterally projecting pins 11. The intervals between all the pins and the end shafts correspond to the pitch of the toothed wheels which engage the said pins and shafts and thus give motion to the beds. The wheels 4 4ª have two spaces *t t'* on diametrically opposite sides larger than the other spaces between the teeth of the wheel. These spaces *t t'* engage the end shafts 10 and the middle pins of the bed—they being made larger than the others in order to properly engage the end shafts 10 which are larger than the pins because they have to support the entire weight of the ends of the beds.

Two form beds B B' are used in this machine, which, in single printing, carry duplicate forms, but in color printing one carries the form for printing one color and the other the form for another color and when the machine is running as a perfecting press one bed carries the form for printing one side of the

sheet and the other the form for printing the opposite side. The beds have a continuous motion on their rollers 10 in the guide ways traveling in the upper guide ways from the rear to the front of the machine when making an impression, and when at the end of the forward motion descending without reversing (the ends traveling together through the front curved end and intermediate guide ways $2^{\times}$—$3^{\times}$) to the lower guide ways and without interruption traveling back to the rear of the machine and ascending also without reversing by the rear end and intermediate guide ways 2 3 to the upper guide ways to make another impression.

There is no interruption of the movement of the form beds at any time while the press is in motion, and the two form beds are always at exactly opposite points at every moment while running. Thus when bed B is passing under the impression cylinder, bed B′ is traveling back to the rear of the machine by the lower guide-ways, and when one bed is descending from the upper to the lower guide ways at the front end of the machine, the other at the same time is ascending from the lower to the upper at the rear end of the machine. The purpose of this mode of operation is to obtain a balance between the two form beds so that the motion of one will counterbalance the other, and thereby when one bed is descending from the upper guide way to the lower, its weight aids in lifting the other bed from the lower guide ways to the upper.

The beds as stated before are driven by the toothed wheels 4 4^{a} in their horizontal travel, and these wheels also control the ascent and descent of the respective beds when passing from one guide way to the other. This is brought about in the following manner: The bed B′ for example (see Fig. 4) being in the upper guide ways and in the position indicated, viz., with the middle pins in the larger space *t* of the wheels 4^{a} when the space *t′* comes into engagement with the rear shafts 10 10 the bed reaches the end of its horizontal forward motion and the forward rollers 9 9 are at the entrance of the semi-circular guide ways $2^{\times}$ and the rear rollers at the entrance of the forward intermediate guide ways $3^{\times}$. The space *t′* holding the rear end shafts 10 10 the bed descends, the rollers following the guides and the toothed wheels turning with a regular speed control the descent of the rear end of the bed which can move no faster than the wheel turns. The bed descends horizontally (preserving its position with respect to the impression cylinder) and its forward end depending on gravity alone to carry it down is prevented from dropping suddenly by other mechanism which will be presently described.

The spaces *t′* of the wheels hold the rear end of the bed until the latter reaches the lower horizontal guides when the wheels cause the bed to travel back to the rear of the machine in the said guides. While the bed B′ was descending as described, the bed B at the rear end of the machine was being lifted from the lower to the upper guide ways—this being accomplished by the toothed wheels 4 engaging the forward end shafts 10 10 of the bed and lifting this end up through the rear intermediate guide ways 3—the rear end of the bed in this case being lifted by mechanism which will be now described.

In a standard on the bottom frame of the machine and in the center of the same is fulcrumed a rock lever 12 which at each end is pivoted to double links 13 13. The upper ends of these links are pivoted to the upwardly curved ends of connecting beams 14 14 fulcrumed on a shaft 15. Between the upper ends of the links are pivoted anti-friction rollers 16, 17 which bear against the under side of the beds B B′ wheenver the said beds are about one half their length past the toothed wheels 4 4^{a}, that is, when the middle pins of the beds are in engagement with spaces *t* of the wheels as in Fig. 4. The anti-friction rollers bear up against the beds B B′ when the latter are respectively in the upper and lower guide ways. Hence the end of the lever 12 under the front end of the press is elevated and the other end correspondingly depressed as shown in Fig. 4. When therefore the bed B′ descends it forces the front end of the lever down and the other end up thereby raising the bed B correspondingly with the descent of bed B′. In this way the weights of the beds are made to counterbalance each other and the toothed wheels, one pair of which is operating to force the bed B′ down, while the other pair are exerting a lifting force on B are required to exert but little power to carry the bed B up into the upper guide ways 1. Thereby the strain put upon the main driving gears instead of being great enough to lift the ascending bed bodily is diminished by the weight of the counterbalancing descending bed.

One end of the rock lever 12 is connected by a slot and pin joint, to compensate for the vertical curve in which the end of the lever moves, with the vibrating ends of rock levers 18 18 which are joined to the inner ends of rock shafts 19 19. To the outer ends of these rock shafts are joined other rock levers 20 20 which at their vibrating ends carry rollers 21 21 that are placed in guide ways in the ends of rock levers 22 22 on either side near to the side frames of the machine. The said rock levers are fulcrumed at their middle line to standards on the frame of the machine and their ends carry resisting bars 23 23 the upper ends of which are forked and turned toward the guide ways. The levers 22 and bars 23 form the stop motion for arresting the travel of the beds in the guides both on the forward or printing movement and the return movement. In order that they may present an elastic resistance to the motion of the bed the bars at each end may be provided with an air spring con-

sisting of an oscillating cylinder 24 pivoted to a casting as shown and a piston 25 attached to a rod which makes a pivotal connection with a bar 23ª that joins transversely the resisting bars 23 23 at each end of the machine. An air-spring for the bars at one end only is shown, but it is to be understood that the bars at the opposite end are to be likewise provided with an air-spring of the same construction to arrest the rearward motion of the beds. The rock levers 20 are connected to springs 20× (see Fig. 4 only one being shown) which serve to counterbalance the weight of levers 18, 20 and 12 and to exert a constant upward pressure, but they are not indispensable, as the beds while traveling horizontally produce somewhat the same effect on the levers as may be best seen in Fig. 4.

In place of the air spring any suitable form of spring or other device suitable for arresting the motion of the bed may be substituted for the air spring.

The open ends of the forks on the bars being turned toward the beds, by oscillation of the levers 22 they are caused to move up or down as the case may be until they are in line with the horizontal guide ways as indicated by the dotted lines in Fig. 2—it being understood that when the forks at one end of the press are in line with the upper guide way, those at the other end are in line with the lower guide way, and vice versa. While moving up and down the heads of the forks are intended to travel in line with the guide ways, that is to move in a semi-circular curve parallel to the end guide-ways 2 2×. They are prevented from turning backward beyond the guide ways 2 2× by the spring connections and their movement forward is limited by rollers 26 pivoted on them coming in contact with fixed upright guides 27. The forks are thus caused to travel from a point a little distance from the ends of—say the upper guide-ways—backward and around the semi-circular end guide-ways to about the same distance from the end of the lower guide-ways and at the rear end of the machine they travel in the same manner and to the same extent from the lower to the upper guide ways. The positions of the two forks when the motions of the two beds have been completely arrested and the beds are half-way between the upper and lower guide-ways are shown by the solid lines in Fig. 2, while the positions of the front forks when the bed has left them to return to the rear end of the press, and that of the rear forks when the bed has left them to pass under the impression cylinder are indicated by the dotted lines in the same figure. The forks are directly in line with the toothed wheels 4 4ª. Consequently their position with respect to the beds is such that when the beds approach them they pass between the sides of the beds and the carrying rollers 10 10 in the guide ways and therefore the short shafts on which the rollers are mounted pass into the forks. Thus the beds instead of passing into the semi-circular vertical guide-ways while under full headway are first intercepted by the forks and bearing these backward meet with the resistance of the air or other springs and thereby their forward motion is gradually arrested and is fully stopped by the time they arrive at the half-way point between the upper and lower guide ways. From this point they begin to move in the opposite direction, each being propelled by the toothed wheels 4 4ª as before described, and driven by the air springs which cause the forks to follow it until the rollers 26 reach the guides 27. This action of the air spring greatly aids the toothed wheels in propelling the beds especially at the point where the front toothed wheels 4ª 4ª are lowering the bed B′ downward to the lower guide ways as in Fig. 2.

The rollers on the ends of the beds that are driven around from one set of horizontal guide-ways to the other by the bed propelling wheels 4 4ª, that is, the front end of the bed in one case and the rear end in the other, are guided in their vertical movements by switches 28 28 pivoted to the plates p' set in recesses in the side frames between the upper and lower guide-ways as heretofore described. The switches are thus within the guide ways and in line with the rollers 9 9. They are positively operated by mechanism presently described so as to be turned out of the way of the rollers that run up or down in the end guide ways, and when these have passed to turn across the guide-ways to intercept the following rollers. This mechanism is as follows:—The pivots of the switches are carried through the side frames, and the upper pivots carry fingers 29 29 that are engaged by the forked oscillating levers 30 30 on the pivots of the lower switches as shown in Fig. 1. The oscillating levers are connected by rods 31 32 with a link 33. Rod 31 has an arm 34 carrying a roller which rests against the face of a double cam 35 on main shaft M and is also connected with a spring rod 36 which carries three independent springs for safety so that one spring would act if the other two should weaken. By means of the double cam and spring rod, and the connecting rods and links the levers 30 30 are oscillated twice during each revolution of the main shaft and thereby the front and rear switches 28 28 are each opened and closed four times during a complete revolution of each of the beds. The arrangement of the connecting rods is such that both sets of switches are opened and closed simultaneously. The operation is as follows: When the forward end of bed B and the rear end of bed B′ approach the propelling wheels 4 4ª respectively the high faces of cams 35 bear against the arms 34, and thereby through the connections cause the points of the switches to turn toward each other and out of the way of the rollers on the bed shafts and remain in that position until the said rollers and the ends of the beds pass the said propelling

wheels when as the low faces of the cams begin to bear against the arms 34, the spring rods force the said arms in the opposite direction and thereby the switch points are caused to turn away from each other and across the guide ways to the position shown in Fig. 2 before the shafts of the rollers on the opposite ends enter the large spaces *t'* of the wheels, so that the switches now lie in the path of the said rollers on the oncoming ends, and the rollers come against the curved faces of the switches at or about the time the shafts enter the spaces *t'* of the propelling wheels. The end of the bed B' is therefore held between the teeth of the wheels 4^a 4^a and the curved faces of the switches and thus held they pass down the vertical intermediate guide ways. Therefore it is impossible for these ends to hammer against the sides of the guide ways or to jar or fail to pass smoothly and certainly from one to the other of the guide ways. The other ends of the beds being held by the forked levers of the stop motion mechanism the beds are held firmly and in a perfectly horizontal position while passing up or down.

The beds B B' are of equal length and for the purpose of describing their motions with respect to the cylinder the front ends or those ends which are always in advance when an impression is being made are marked *f f* while the rear ends are marked *f' f'*. The beds are constructed with longitudinal ribs *b'* on their under sides, which ribs have bottom flanges that furnish a broad bearing surface for the bed, when passing over the supporting roller under the impression cylinder, and at the ends on both sides the roller shafts 10 10 are journaled in strong brackets 37 37 fixed to the ends or four corners of the beds. The entire weight of the beds is supported by these shafts and rollers during their revolutions in the guide ways; but as these support the ends only, to avoid any possibility of the bed yielding when the impressions are taken at which time they are subjected to the greatest strain, and to relieve the shafts 10 10 of this extra strain the main driving shaft S which is immediately under the impression cylinder axis carries a roller 38 which is mounted loose on the said shaft so as to rotate independently. The roller is about the same width as the beds which bear on it when passing under the cylinder and by it is supported in the line of the impression. The beds also carry racks 39 39 on their upper side edges which by engaging the toothed segments 40 40 rotate the cylinder when the beds pass under it. The toothed segments on the cylinder which are of equal length are separated by blank spaces 41-41 one half the length of the toothed segments. The impression surfaces I, I' of the cylinder correspond to the toothed segments while the parts of the surface corresponding to the spaces 41 41 are blank so that the cylinder is arranged to rotate at such a speed that the two impression surfaces I, I' respectively come into position to make an impression as the front ends of the beds B B' arrive at the impression line of the cylinder.

In order that each bed may make one complete revolution around the guide-ways—that is from one impression to the next—shafts S S' carrying the bed propelling wheels must make five revolutions while the cylinders rotate once; but six or seven revolutions may be given if it is desired to run the beds farther out by lengthening the guide-ways. This is necessary in order to use a small impression cylinder running at a comparatively slow speed—that is to say about three-fifths as fast as that of the beds in general. If the cylinder were made to run at a uniform speed with the beds its diameter would have to be five times the diameter of the propelling wheels. It could be made that way, but it is preferred to make it three times the diameter of the wheels 4 4^a and run it at a slower speed. This is preferred because in the first place the cylinder can be made much smaller, and second it enables the cylinder motion to be varied, slowing it down at the moment of taking the sheet and thereby insuring a perfect register, and bringing it up to its normal speed when the impression is about to be made. As the beds run at a uniform speed and drive the cylinder only while making the impression the irregular motion of the cylinder must take place when the bed racks are out of gear with the cylinder—that is in the interval between the making of one impression and the next. To this end when one impression is completed a train of irregular gearing between the driving pinion P and the cylinder is brought into operation which slows the motion of the cylinder for one half the interval between the impressions, during which the cylinder grippers take the sheet from the feeding table, and then increases the speed of the cylinder during the remaining half of the interval so as to bring it up to the full speed by the time the second form bed comes into position to engage the cylinder segments and thereby avoids a shock or jar by the bed racks coming into gear with the cylinder segments. The mechanism for bringing this about is as follows, referring particularly to Figs. 3, 4, 27 and 28: The driving pinion P meshes with a toothed wheel 42 on a shaft supported in a bracket fixed to the outside of the side frame of the machine. The timing pinion P is one half the diameter of the bed propelling wheels 4 4^a and the wheel 42 is one sixth the diameter of the cylinder. An elliptical gear wheel 43 is mounted on the same shaft as wheel 42 and fixed to the said wheel by a pin or other device so as to revolve with it. On a parallel shaft supported in the same bracket is another toothed wheel 44 which is in position to engage a toothed segment 45 on a wheel 46 fixed to the end of the cylinder shaft outside of its frame or bearing and on the same shaft with wheel 44 is mounted another elliptical gear wheel 47 likewise fixed to wheel 44

by a pin or other device so as to revolve with it. The elliptical gear wheels are in mesh with each other in such relation that the shorter axis of wheel 43 gears with the longer axis of wheel 47 and thereby gives an irregular motion to the wheel 44 and thence to the cylinder through the segment 45. These segments 45 correspond to the spaces between the cylinder segments, so that the irregular motion is communicated to the cylinder only during the time betwen the releasing of one cylinder segment by one bed and the engagement of the next segment by the following bed, and the adjustment of the elliptical wheels 43 47 is such that when the last tooth of a bed rack disengages a cylinder segment the long axis of elliptical wheel 43 which is in gear with the driving pinion, is about to engage the short axis of wheel 47 and as at this moment the wheel 44 comes into engagement with a segment 45 the cylinder is then controlled by the irregular gears and its motion is slowed until one half the segment 45 passes a vertical line drawn through the axis of the cylinder—that is until the cylinder is in the positions shown in Figs. 1, 3 and 4 where as indicated in Figs. 1 and 3 a gripper (66) on the cylinder is in position to take a sheet from the feed board. Thus as will be seen the cylinder takes the sheet while moving at its slowest speed, a result which makes it possible to obtain a perfect register as there is no liability of the grippers slipping before taking hold of the sheet as is apt to occur when the cylinder is running at full speed.

When the cylinder passes the point above mentioned its speed is increased by the larger axis of the wheel 43 approaching the shorter axis of wheel 47, and it reaches its maximum speed corresponding to the motion of the bed when the rack of the oncoming bed engages the cylinder segment preparatory to the making of another impression.

The impression cylinder.—The impression cylinder as before described has two impression surfaces I I′ separated by blank spaces 41 41 and each impression surface has a set of grippers 66 $66^{\times}$ which are operated (opened and closed) by tumblers 67 and spring rods of the usual construction, but located at opposite ends of the cylinder as indicated in Fig. 14. The tumbler pins 68 which turn the tumblers to close the grippers are placed in holes 70, and those for opening the grippers to deliver the printed sheet in holes 71 for single printing; but for color printing and perfecting the tumbler pins are arranged specially and placed in holes 72 on one side and 73 on the other in the one case, or 73^{a} in the other as will be more fully described presently.

The tumbler pin holes 70, 71 and 72 are located in the side frames of the cylinder housings or in brackets or arms connected with or forming part thereof, and the holes in one side frame adjacent to one end of the cylinder, are exactly duplicated in position in the side frame on the other side adjacent to the opposite end of the cylinder.

The operation of the cylinder in single printing will be first described.

The feed board is arranged for automatic feeding (the mechanism of which will be presently described) but it can be adapted for hand feeding as is shown in Fig. 3. The sheets are placed against the stops 74 and fed against the feed gage 75 in the usual manner. As represented in Fig. 3 the cylinder is in position for taking a sheet from the table—the grippers 66 being just about to close. The cylinder revolves in the direction of its arrow and takes the sheet and carries it against the form passing under it. When the impression has been made and the grippers carry the head of the sheet to the dotted line $x\,x$ Fig. 1 and 14 joining the centers of the impression cylinder and delivery cylinder the tumbler pin 68 in hole 71 on one side—say the right hand side—opens the grippers and simultaneously the delivery cylinder grippers 75^{a} catch the head of the sheet as indicated by dotted lines Fig. 2 and the delivery cylinder carries the sheet up to the point indicated in Fig. 1 when the high point of the cam 76 on the shaft of the delivery cylinder coming against the pin 77 (as shown in Fig. 8) opens the gripper 75^{a} and the sheet passes over the bridge fingers 78 onto the tapes 79 from which it is taken by the fly F to the receiving table 60 in the usual manner. The second set of impression cylinder grippers 66^{a} follows with another sheet after the impression is made and its grippers when they reach the delivery point are opened by a tumbler pin 68^{a} in a hole 71^{a} on the other side, say the left hand side of the cylinder. See Fig. 3.

Color printing.—For two color printing only one set of grippers is used to take the sheets from the feed table, the other set which carries the sheet to take the impression from the second color form, takes the sheet from an auxiliary cylinder C′ which receives it from the impression cylinder after the first impression is made. The grippers used for taking the sheet from the feed table—say grippers 66 which carry the sheet against the impression surface I and which are opened by the tumbler pin 68 in the hole 70 on the right hand side of the frame would in single printing be opened by the pin in hole 71 on the same side of the frame, but as the head of the sheet is to be carried to the auxiliary cylinder instead of being taken off by the delivery cylinder the tumbler pin is removed from hole 71 and placed in hole 72 on the same side so that the grippers 66 shall not be opened until they reach the pin in hole 72 when the head of the sheet will be in position to be taken by the grippers of the auxiliary cylinder.

To prevent the delivery grippers from taking the sheet that is carried first to the turning cylinder the high part K of the cam 76

that operates the grippers is made to slide so as to be out of the path of the roller and keeps the grippers closed when passing line $x\,x$. (See Figs. 9 10, 11, 14 and 17.) For this movement a lever L is pivoted on the cylinder housing (Fig. 1) which on its lower end is cam shaped. This lever is worked by a cam N (see Fig. 17) and its lower end being pressed outward by cam N causes the upper end to move in and push the sliding part of cam 76 in the path of the gripper roller which then closes, and takes the sheet. Spring N′ Fig. 1 acts the opposite way and keeps the cam out of the way when the sheet has to pass to the turning cylinder.

When the machine is arranged for single printing, and a sheet is delivered at every impression, the sliding part K of cam 76 is prevented from moving in and out, by means of a set screw or other suitable device for holding it against the action of the spring N′. The cam N is located in such a position that when the forward end of, say, the impression surface I′ is near the line passing through the centers of the delivery and impression cylinder, it will strike the lever and cause it to operate the slide K.

The grippers 66 are arranged to be operated exactly the reverse of grippers $66^{\times}$; that is, the tumblers of the latter set of grippers being placed at the opposite end of the cylinder from that last described and it being intended that these grippers shall be closed when passing the feeding table and opened when they arrive at the delivery cylinder, the tumbler pin is then removed from the hole 70 on the left hand side of the machine and placed in the hole 71 on the same side so as to open the grippers $66^{\times}$ when they reach the delivery point to transfer the sheet to the delivery cylinder. The grippers $66^{\times}$ are open when they arrive at the point where they take the sheet from the turning cylinder, that is just beyond the line $x'\,x'$, and as soon as the head of the sheet is carried under them by the turning cylinder, the said grippers are closed by the tumbler pin in hole 72^{a} on the left hand side of the machine.

The auxiliary cylinder C′ which is half the diameter of the impression cylinder is preferably composed of a number of wheels or disks mounted on a shaft supported in bearings in arms projecting from the stand or cap above the impression cylinder and opposite the delivery cylinder. It carries grippers 76^{a} which are mounted on a shaft that carries at one end an arm 77^{a} with a roller at the free end which bears against a cam 78 mounted loosely on the cylinder shaft. A lever 79 fulcrumed to the impression cylinder housing on one side has its upper end connected with a pin 80 on the cam 78 and its lower slotted end held by a pin 81 placed eccentrically in the cam 82 in holes 82^{a} in the said cam in the position indicated in Figs. 1, 12, 13 and 29 which is mounted on the end of the impression cylinder, and gives motion to a part of the inking apparatus as will be described hereinafter. The pin 80 it is to be noted here is placed above the high portion of cam 78 and the eccentric pin 81 is placed on the left hand side of the axis of the impression cylinder. In this respect the arrangement of the lever with respect to the cam and cylinder is different from that of the same devices when adjusted for perfecting as will be presently described. The eccentric pin 81 vibrates the lever 79 and thereby the cam 78 is oscillated carrying the high portion of the cam against the arm 77^{a} to open the grippers 76^{a} and the low part against the arm to permit the usual gripper-spring to close the same.

As represented in Fig. 13 the impression cylinder grippers 66 and auxiliary cylinder grippers 76^{a} are not quite at the opening and closing point, but a very slight further movement of the impression cylinder carries the tumblers of grippers 66 against the tumbler pin in hole 73 and opens those grippers and releases the sheet and at the same moment the arm 77^{a} passes from the high part of cam 78 to the low part of the same and the grippers 76^{a} close and take the sheet. As the auxiliary cylinder during the above operations is moving in the direction of its arrow the sheet is drawn by its grippers off the impression cylinder and carried around the auxiliary cylinder as indicated by the dotted lines Fig. 1.

The auxiliary cylinder makes one revolution carrying the sheet and just before it reaches the line $x'\,x'$ joining the centers of the two cylinders, the lever 79 meanwhile having moved to the position indicated by the dotted center line in Fig. 13, and the cam 78 having moved to the left correspondingly, the arm 77^{a} passes on the high part of the cam thus opening the auxiliary cylinder grippers at the line $x'\,x'$ just at the moment the impression cylinder grippers $66^{\times}$ the impression cylinder having made half a revolution close and take the sheet. The impression cylinder now has control of the sheet on its impression side I′ and it is carried by the cylinder and receives an impression from the second color form carried by the bed B. When the impression cylinder grippers $66^{\times}$ holding the sheet pass the feeding point they remain closed as the tumbler pin on the left hand side is out of the hole corresponding to 70, but as the pin on the same side is in the hole corresponding to 71 (the delivery point) the grippers $66^{\times}$ are opened and the head of the sheet is taken by the delivery cylinder grippers and the sheet having received the two color impressions, is delivered from the machine in the manner heretofore described in single printing.

Perfecting.—For perfecting the same auxiliary cylinder C′ is used but it now becomes a turning cylinder for reversing the side of the sheet after it has received the first impression on one side. It is no longer driven from the cylinder wheel 46 but its

wheel 46ª which for two color printing is in gear with cylinder wheel 46, is loosened on its shaft and moved outward until it disengages wheel 46 and a pinion 83 fixed to the wheel 46, is put into gear with a sector rack lever 84 which has its lower end pivoted to the bracket that carries the irregular gear wheels heretofore described. (See Figs. 3 and 7.) The turning cylinder as it will now be called as set for taking the sheet after the impression on one side is made, is shown in Fig. 12 and it will be observed that it is in the same position as in the two color printing arrangement (Fig. 13) but the pin 80 that holds the end of the slotted lever 79 is placed in the hole to the left of the high part of the cam 78 and the pin 81 that holds the slotted end is placed in a hole in the cam 82 to the right of the cylinder axis. This arrangement leaves the cam in position to open the grippers 76ª just before they reach the line x' x' through the centers of the cylinders and to close them when they reach the line with the impression cylinder grippers 66 as shown in said figure to take the sheet and carry it around the turning cylinder, as in the two color printing heretofore described. The object in thus adjusting the lever and cam is to swing the cam far enough out of the way when the turning cylinder "backs up" as hereinafter described and has nearly completed that motion to prevent the turning cylinder grippers from opening against the latter or rear half of the impression surface I'—say at or about the point z.

The turning cylinder in Fig. 12 is about in position to take the sheet from the impression cylinder grippers, after it has received the impression on one side from the form on bed B' and carry it around preparatory to turning it and transferring it again to the impression cylinder with the blank side out. The direct motion of the turning cylinder is received from the sector lever 84 engaging the pinion 83 when moving in the direction of the back of the press. The sector lever is moved by a top cam 85 fixed to the cylinder wheel 46 a roller on said sector lever running in the said cam as shown in Fig. 3. The cam is constructed to act on the sector lever to commence to move it in the direction of its arrow when the grippers 76ª on the turning cylinder are at about the point z' (see Fig. 12) and when the sector lever has moved the turning cylinder and its grippers to the position they occupy in Fig. 12 where the grippers take the sheet the roller of the sector lever is at about the point y of the cam. As the impression cylinder advances in the direction of its arrow, the cam from the point y is shaped to give the turning cylinder by means of the sector lever the same speed as the impression cylinder—this movement continuing until the roller of the sector lever reaches the highest point of the cam. At this time the turning cylinder has advanced far enough on its direct movement for the bottom end of the sheet to have passed the ends of the spring fingers 86 which are attached to the switch 87 and bear lightly against the turning cylinder as shown in Figs. 1 and 18. At this moment the sector lever roller passes the high part of the cam and the motion of the lever being thereby reversed the turning cylinder is rotated backward and the sheet is "backed up" that is its bottom end is caused to pass over the spring fingers 87 and the sheet is taken off the cylinder and caused to pass down between the switch 87 and tapes 89 to a point t (Fig. 1). The gripper end of the second impression surface having by this time reached the point t the grippers 66× are closed by a tumbler pin placed in a hole 73ª. The forward end of the sheet is caught by the grippers 66× and drawn down on the impression surface I' in reversed position that is with the printed side against the impression surface and the blank side is carried against the second form B and another impression is taken therefrom by the sheet, which thereupon is carried to the delivery point, the grippers opened by the tumbler pin and the sheet printed on both sides is taken off by the delivery cylinder.

The turning cylinder grippers 76ª are opened when backing up the sheet, to release it by the following mechanism—referring to Figs. 2ª, 5, 6, and 29: On the end of the turning cylinder gripper shaft opposite the cam 78 is a crank and roller 88 in position to come in contact with a switch cam 89ª on a projection of the arm in which the shaft is mounted. This switch cam consists of two fingers pivoted at the center to the arm in the position shown in Fig. 2ª—the lower finger being controlled by a spring which keeps it thrown outward and the upper correspondingly inward, so that when the turning cylinder is running ahead the gripper roller 88 passes under the outward bent finger thereby forcing the inward bent finger out whereby it passes the cam without opening the grippers; but when the turning cylinder is backing up in the direction of arrow 1 the roller 88 passes over the inward bent part of the cam which causes the roller to turn the shaft and open the grippers 76ª and thereby release the sheet before the grippers pass the spring fingers 86. After the sheet is thus released the turning cylinder continues to rotate backward until the sector lever is at the point indicated in Fig. 3 when the grippers 76ª are at the point z'. The tapes 89 are driven coincidently with the turning cylinder by a belt 90 and intermediate gear 91. The belt 90 runs over a pulley 92 on the turning cylinder shaft and to a pulley 93 on a shaft 94 under the lower tape wheel that carries a gear wheel 95' in mesh with a gear wheel on the lower tape wheel shaft. Motion is thus given to the tapes from the turning cylinder shaft and the use of a cross belt is avoided, but the tape wheels may be geared to a wheel on the turning cylinder shaft and driven directly if preferred.

If a short sheet is to be printed on both sides it will be necessary to arrange the cam 85 and sector lever 84 so that the latter will commence to move the turning cylinder a little later in the course of its throw. Otherwise the free end of the sheet on the cylinder would be carried over so far that on the reverse movement of the cylinder the said end would not be "backed up" far enough to reach the impression cylinder grippers at the point *t*. For this purpose the cam 85 is made adjustable on its axis by means of a slot 85ª formed in its web and a set screw passed through said slot into an arm of the wheel 46. (See Fig. 3.) By this means the cam 85 can be turned upward and secured so that the sector lever roller will advance say to the point $y^{\times}$ in turning the cylinder, to take the sheet from the impression cylinder and thereby the turning cylinder grippers will be caused to stop at about say the point z^2 or just far enough to carry the free end of the sheet above the spring fingers and then by a reverse movement to back the sheet up from this point as heretofore described.

To adjust the grippers on the turning cylinder to agree with the changed position of the cam and the lever for taking the shorter sheet, the turning cylinder is connected with the hub of wheel 46ª by a set screw (see Fig. 6) and by loosening this set screw the said cylinder can be turned until its grippers are in proper position for taking the sheet corresponding to the changed adjustment of the cam and lever.

The inking apparatus.—The inking mechanism is divided into two parts I^2 I^3 which may be operated together as a whole for single printing but in color printing and perfecting the parts are worked independently.

In perfecting and color printing each part of the inking apparatus feeds its corresponding bed. For this purpose they are constructed to move up and down being held between guides 95 96 see Figs. 1 and 21 the first on the cylinder housings and the latter fixed to the top of the side frames, while the two parts join each other with a sliding connection as indicated in Figs. 1 and 23 the fountains serving as braces to prevent vibration of the stands and one guiding the other when moving up and down. Stanchions 97 98 connect with their respective parts I^2 I^3 and the lower ends of the stanchions rest on and are guided by set or adjusting screws 99 on opposite sides of the fulcrum of levers 100. The ends of levers 100 are provided with rollers which work in cams 101 101 on main shaft M. By this means these two parts are caused to rise and fall alternately as represented in Fig. 3. The rollers of the levers rest on the middle stills of cams 101 and both parts of the inking apparatus are at the same level. As soon as the highest parts *s* of the cams reach the rollers the levers will be depressed and the part I^3 raised high enough to clear the oncoming form and at this time the other part I^2 is down in its inking position and will feed the ink to its form. When the form has passed, the lever rollers travel to middle still points *s'* of the cams and lower the part I^3 to the level of part I^2. When the next form approaches the inking apparatus the lever rollers reach the lowest part of s^3 of the cams and the lever is raised, the stanchion next to the cylinder lifted and with it the part I^2 is elevated out of its inking position, stanchion 98 is lowered and with it part I^3 is depressed to ink its form. When the lever roller is on either of the middle still portions of the cams the tops of the stanchions are at the same time even with the side frames of the machine, and the two parts of the inking apparatus are supported on the top $F^{\times}$ of side frames of the machine by shoulders 102 on the respective stanchions, which when the latter are lowered bear on the tops of the side frames as shown in Figs. 22 and 25ª. The object of this construction is to avoid letting the entire weight of the ink stand frames and fountains with their accessories rest on the form rollers when the support afforded by the levers is removed at such times. A slight play is allowed by the set screws under the stanchions to compensate for the idle motion of the lever when both forms are down in the inking position.

The above described mode of operating the inking apparatus is peculiarly adapted for two color printing and also for perfecting. As may be readily understood one part of the apparatus may be used for feeding ink of one color and the other for another color each being a perfect inking apparatus of itself.

For perfecting where great care is required in inking the forms to prevent smutting or off-setting and where it is important to adapt the quantity of ink fed to the nature of the work the two part inking apparatus is especially valuable as thereby the forms can be suitably inked to the matter printed on the respective sides. For single printing the inking apparatus may be used as a whole by placing a composition ink roller 103 between the two middle rollers presently referred to thereby obtaining a six or eight roller inking apparatus for one form. By lowering screws 99 99 a few turns the motion of lever 100 will not be transmitted to the stanchions and the whole inking apparatus is at rest.

Figs. 21 to 25ª, and Figs. 33 to 35, inclusive illustrate a three roller and a four roller inking apparatus each of which is entirely distinct from the other but are placed in juxtaposition to indicate the method of driving them from the same shaft by merely shifting a wheel. They are not it must be understood used together, but if two three roller apparatuses are used the driving shaft connects with them at one point, and if two four roller apparatuses at another point as will presently be described.

The four roller apparatus is shown complete with turning and sidewise distributing movements which can also be used with slight

modifications in the three roller inking apparatus shown in Fig. 1 but the four roller arrangement is preferred and will now be described.

The rotary motion of the rolls is obtained from a miter wheel 104 on a horizontal shaft 7 that engages a bevel wheel 105 on an upright shaft 106 which is held in bearings the lower one of which is fixed to the side frame and the other on an arm fixed to one of the ink fountains F'. A wheel 107 is held by a feather on the shaft so as to turn with said shaft and at the same time slide up and down with the fountain that carries the shaft bearing. The wheel 107 meshes with a wheel 108 that runs loose on a stud 109 (see dotted lines Fig. 21) and the wheel 108 has a pinion 110 fastened to it which engages and drives a broad faced intermediate wheel 111 that is mounted on a stud fastened in the frame of the inking apparatus. The wheel 111 drives the wheel 112 fastened on the shaft on the roller 113 and it is made broad in order that the wheel 112 may remain in gear with it when the ink roller 113 is reciprocated for side distribution as described presently. Wheel 112 drives two broad faced wheels 114 114 which mesh into wheels 115 on smaller ink rollers 116 and rotate the same. The rollers 116 in turn drive the form rollers and thus complete the connection between the fountain and the form.

The feeding of the ink from the fountain is accomplished in the following manner: The fountain F^2 is constructed to regulate the flow in the usual way. The fountain roller is turned by a ratchet lever and pawl which latter engages a ratchet wheel fixed on the fountain roller. Connected with the ratchet lever is a hook 117 the point of which is held between pins 118 in holes *h* in a reciprocating sliding bar 119 connected by a link 120 with bell crank lever 121 the roller on the opposite arm of which bears against the cam 82 that moves the bar 119 through the bell crank lever and link in one direction, the return motion being produced by a suitable spring as shown. The bar 119 moves on flanged rollers $120^{\times}$ which guide it, while a projecting end of the fountain case (see Figs. 22 and 33) holds it down on the rollers. By means of the hook 117 and pins 118 the throw of the ratchet lever and pawl can be regulated, that is caused to turn more or less as the roller is required to supply more or less ink. Thus by shifting the pin 118 behind the hook to a hole more or less distant from the point of the hook, the motion of the bar on its return will be more or less lost before the pin comes in contact with the hook and its motion thereby transmitted to the ratchet lever, and hence the pawl will be caused to move the roller by only so much as the pin 118 moves the hook on the return throw of the bar. In other words the movement of the hook and with it the lever and pawl will always be the same corresponding to the throw of the bar when moved by the cam, but the movement in the opposite direction which turns the roller will be less or greater depending on the position of the pin 118 behind the point of the hook.

The roller 121 is pivoted in lifting brackets 122 fastened to the ends of a shaft 123 which oscillates in holes 124 on each side of the ink frame. To this shaft is also fastened another lifting bracket on the opposite side of the frame. These two brackets are the movable bearings for the supply roller 121 and they raise the supply roller to the fountain roller to receive ink when the roller 125 is caused to move up the incline to the upper edge of the sliding bar 119, by the motion of the bar toward the cylinder. The roller 125 is regulated by a slot and set screws in the usual way. When the supply roller is down as shown in Figs. 21 and 34 it is turned by ink roller 113 and distributes on the same. Rollers 126 are mounted in bearings pivoted to arms $126^{\times}$ which are pivoted at their lower ends to the inside of the frame of the inking stands and on either side of roller 113. These arms are slotted in the upper ends to receive a stud *s* which is pivoted in a lug *s'* on the bearings. A set screw 127 is passed down through the top of the arm into the stud *s*, and thereby the bearings can be moved up or down as may be necessary, and the lower rollers 126 126 thereby adjusted to the rollers 116. The arms $126^{\times}$ being thrown over their centers toward roller 113, the lower rollers 126 rest against rollers 116 and are held against them by their own weight. The upper rollers 126 serve as distributing rollers only, while the lower rollers 126, make connection between rollers 113 and 116, each of the latter connecting with and driving two form rollers and supply the latter with ink. By placing the rollers 126, 126 in connected bearings, they can both be adjusted simultaneously by means of the set screw 127. The studs of the slotted bearings on the brackets 128 are socketed in the blocks 130 placed between the stanchions and the side frames (a horizontal groove being formed in the stanchions to furnish a seat for the blocks as indicated by the dotted lines Fig. 21) and these blocks are held by set screws 131 in the stanchions as clearly indicated in Figs. 21 and 22. By means of the said blocks and set screws the form rollers can be readily adjusted with relation to the distributing rollers 116.

The three roller inking apparatus requires an up and down regulation of rolls 116 only. This is effected by set nuts $116^{\times}$ placed between two parallel parts of the inking stand frame on each side and engaging the screw threaded studs of the brackets or bearings of rollers 116. Only one of these adjusting nuts is shown but it must be understood that each of the rollers 116 in the three roller apparatus is similarly provided. The rollers 116 are to be driven in this apparatus from the shaft 106. This is accomplished by means of the wheel 107 which is adapted to be moved down

the shaft 106 until it engages a beveled wheel 108×, mounted on a stud projecting from a part of the side frame of the apparatus, and carrying on its hub a wheel 132 in engagement with a wheel 115 on the shaft of the adjacent roll 116. (See Figs. 38 and 39.) Rolls 116 are connected by intermediate gears 133 as shown in Fig. 38—the shafts of said rolls all carrying gears 115—so that the motion of said rolls is derived from the shaft 106 and the geared connection made by merely dropping the pinion 107 until it meshes with the beveled wheel 108×.

The side-wise distribution of the ink is effected by the following mechanism (referring to Figs. 24 and 25): A worm 134 fixed on the hub of the bevel gear wheel 107 turns a worm wheel 135 which revolves between an overhanging bracket 136 screwed to a bracket 137. The worm wheel has a square hole in it in which is inserted a short shaft (the shaft being in two parts with the meeting ends spliced or halved together in the wheel—this construction being adopted to permit the two parts to be inserted in the holes from opposite sides of the wheel—being held in the wheel by a hook 138). The shaft is provided with a dovetailed slotted hub 139 in which is placed a dovetailed slide 140 which at one end is fitted with a screw stud 141, by means of which the said slide can be adjusted to set the said screw stud a greater or less distance from the center of the hub. The screw stud also serves as a crank pin to which the pitman 142 is connected the other end of the pitman being connected to an arm on a rocking bar 143 that oscillates in bearings 144 fastened to the ink frames. The rocking bar 143 has arms projecting upward and downward and these arms are provided with rollers 145 which are placed between disks 146 on the ends of the ink roller shafts to reduce friction and contribute to easing the motion of the rock shaft. By the rotation of the worm wheel the crank stud through the pitman gives a rocking motion to the bar and this through the connection of its arms gives an endwise motion in opposite directions to the contiguous ink rollers 113 116 and thereby effects sidewise distribution of the ink on the said rollers. By adjusting the slide to place the pitman stud a greater or less distance from the center of the wheel this endwise motion is rendered greater or less, and by moving it until the stud is on the center of the wheel the motion is stopped.

The fly.—The fly F and the receiving table 60 are both connected with a frame 147 pivoted to projecting arms 148 on the top of the cylinder housings. The free end of said frame is arranged to swing up out of the way to expose the front of the printing machine when it is desired to examine the form or forms—its normal position when the machine is running being that shown in Fig. 1. For this purpose it is provided with rack bars 149 on each side, which are engaged by pinions 150 provided with a crank by means of which it can be raised to the position shown in Fig. 2. This motion of the said frame can be utilized for lifting the ink fountains from the rollers by providing hooks 151 for hooking the fountains to said frame as shown in Fig. 2 and thus facilitate changing the inking rolls.

In Figs. 15, 16 and 26 is illustrated an automatic feeding attachment for printing machines which is specially applicable to my present invention, because in single printing where two sheets must be fed at every revolution of the cylinder the feeder may not be able to feed fast enough to keep up with the machine on account of the high speed at which it is possible to run it and the rapidity with which the two impression surfaces come into the feeding position. It consists of the following mechanism: To the frames in which are housed and pivoted the tape pulleys and gear wheels at the rear side of the cylinder housings over the feed tables are pivoted horizontal levers 152 the inner ends of which are formed into bent arms that are in position to be struck by the geared segments on the impression cylinder as it revolves or by a suitable cam on the cylinder; and the outer ends are pivoted to links 153 which support bars 154 mounted loosely at their inner ends on a horizontal shaft 155 supported above the front edge of the feeding table in brackets attached to the cylinder housings and at their outer ends supporting the pivotal ends of a transverse bar 156 from which project rods that carry a rear edge sheet straightener 157. On the shaft 155 are pivoted arms 158 that carry a shaft 159 on which is mounted a feeding roller 160. One end of the feed roller shaft carries a pinion 161 that engages a toothed wheel 162 on the projecting end of the shaft 155, the toothed wheel having a hub that carries another pinion 163 that engages a vertical rack bar 164 held in suitable guides and pivoted at the lower end to a lever 165 which is fitted with a roller that runs against a cam 166 on the main shaft M by which the downward motion of the rack bar is produced—the upward motion of the same being given by a spring as shown. The rack bar by its up and down motion rotates the feed roller first in one direction and then in the opposite direction. By its upward motion the feed roller is caused to rotate from the cylinder and thereby withdraw the front edge of the sheet from under the separator 167 and then by its downward motion the roller is reversed and it moves the sheet over the top of the separator and its edge against the feed gage where it is taken by the cylinder grippers. The movement of the rack bar up and down is timed to correspond to the arrival of the grippers 66 and 66× at the sheet feeding position, in single printing. The lifting of the table to keep the sheets at the proper height for the operation of the feeding roller is produced by a pin 168 on the rack bar acting on a lever

that carries a spring pawl that turns at intervals a ratchet wheel 169 carrying a pinion that through intermediate wheels acts on rack bars 170 (Fig. 3) which support the feed table. By means of the lever pawl ratchet wheel gearing and rack bars when the rack bar descends its pin 168 through the described mechanism moves the feed table up say the thickness of one sheet.

The drawing of the edge of the sheet from under the sheet separator requires fewer revolutions of the feed roller than to push the sheet over the separator and against the feed gage. This necessitates arranging the rack bar and feed roller so that the latter will not bear on the paper during a part of the upward motion of the rack bar. For this purpose on the extreme end of the shaft 155 that supports the arms in which the feed roller shaft is pivoted, is an arm 171 that projects backward across the side of the rack bar and against the face of a pawl spring 172 that projects upward from the side of the machine parallel to the rear edge of the rack bar. On the rack bar is a finger 173 that also lies across the face of the spring. When the rack bar is pulled down by the cam during which it turns the feed roller in the direction to feed the sheet to the impression cylinder and when it about reaches the end of its downward movement a pin 174 near its upper end bears on the arm 171 and forces it down thereby turning the feed roller up off the paper and the arm forces the spring back until it is engaged by the shoulder of the pawl spring as shown in Fig. 15. Now when the rack bar moves upward it turns the feed roller in the direction to draw the edge of the sheet from under the separator, but the roller turns idly until the finger 173 forces the pawl spring back and thereby releases the arm 171 from the control of the spring whereupon the feed roller drops on the top sheet and during the remainder of the upward motion of the rack bar the feed roller turns against the top sheet and thereby withdraws its edge from under the separator. It will be understood that the feed roller takes hold of the sheet to be fed by the action of friction only, and in order that it may catch it securely its surface should be of rubber, sand paper or composition. The bar 156 drops down on the top sheet when the roller descends and holds the top sheets so that when the feed roller is drawing the front edge of the sheet from under the separator the resistance of the bar causes the sheet to curve upward transversely instead of slipping backward.

In color printing and perfecting where but one sheet is fed to each revolution of the cylinder and where consequently grippers $66^{\times}$ do not take a sheet from the table it is necessary to take one half of cam 166 off (it being made in two parts) so that the rack bar will not be pulled down when the second impression is taken.

Figs. 19 and 20 show another mode of running the cylinder. The cylinder has two impression surfaces I I′ and two sets of grippers, the same as heretofore described and delivery and turning cylinders are used in a similar way; but the cylinder makes three revolutions to one complete revolution of the beds and in uniform speed with the beds driven direct from the main driving shaft S by a wheel 175 fastened to it and meshing into a wheel 176 on the cylinder shaft by which the cylinder is revolved. The driving wheel 175 and the cylinder wheel 176 are correspondingly enlarged to make up for the space between the cylinder surface and the pitch of the propelling wheels 4 4^{a}. Outside of wheel 175 the Pinion P meshes with a spur wheel 177 on the main shaft of the machine which shaft makes one revolution to an entire revolution of the beds. A toothed wheel 178 the size of the cylinder is fastened outside of the wheel 176 and drives the delivery and turning cylinders and carries the cam for the latter as before described.

The operation is as follows: The cylinder revolves in the direction of its arrow and if its grippers 66 and the impression edge of the bed come together, after one and one half revolutions the said grippers will be exactly opposite the point they occupy in the drawings (Fig. 19). Hence at the same moment grippers $66^{\times}$ and the following bed or form must at the same moment be in the position grippers 66 and first form or bed occupy in the same figure and the sheet carried by grippers $66^{\times}$ on the further movement of the cylinder will take an impression from the following form, and by one and a half more revolutions the grippers $66^{\times}$ would be in the position shown in the said figure, that is at the delivery point *x x*.

In Figs. 19 and 20 is also shown another and stronger impression support than that heretofore described. It consists of a strong cast metal block 179 provided with projections 180 at the ends in which are journaled four or more supporting rollers 181 for the bed. This block has two strong projections 182 182 on each side, the ends of which extend partly through openings in the side frames and serve as journals or trunnions for the impression support. On each end of the block is an arm 183 which is curved outward and carried into an opening 184 in the side frames of the machine. These ends have set screws and jack nuts by which the ends are adjusted and thereby by turning the block on its axis the impression support is adjusted to the bed.

In Fig. 1 brackets and rollers are shown which are to be used when the paper is fed from a roll instead of in single sheets.

It is to be understood that the form beds may be arranged to carry the type, plate, stone or other printing surfaces.

I claim—

1. The combination in a printing machine of an impression cylinder provided with a

plurality of impression surfaces each of which is fitted with sheet grippers, mechanism for opening and closing the grippers of each surface and a plurality of independently driven form beds, coacting with the said impression surfaces of the cylinder, substantially as specified.

2. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is provided with sheet grippers, a plurality of form beds traveling in orbital guide ways coacting with the impression cylinder, mechanism for taking the sheet from one impression surface and returning it to another impression surface, suitable delivery mechanism, and means for opening and closing the sheet grippers, said means being adapted to coact with the said form beds, impression surfaces and the mechanism for taking and returning the sheet to the impression cylinder and releasing it to the delivery mechanism, substantially as specified.

3. In a printing machine an impression cylinder having a plurality of impression surfaces each of which is fitted with a set of grippers for taking the sheets from a feed table, transferable gripper operating mechanism for actuating the grippers of the several impression surfaces said impression surfaces coacting with a form bed or beds, a delivery mechanism and an auxiliary cylinder provided with grippers for taking the sheet from one impression surface and returning it to another to receive a second impression, substantially as specified.

4. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is fitted with a set of sheet grippers, a plurality of form beds coacting with the said impression surfaces, an auxiliary cylinder provided with grippers, mechanism for operating the said grippers to cause them to take the sheet from one impression surface and deliver it to a following one, suitable delivery mechanism and transferable devices for operating the grippers of the several impression surfaces, whereby the grippers of each impression surface may be caused to take a sheet and deliver it to the delivery mechanism, or those of one surface caused to take a sheet from the feed table and deliver it to the auxiliary cylinder and those of the next surface take it from the auxiliary cylinder and deliver it to the delivery mechanism, substantially as specified.

5. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is fitted with a set of sheet grippers, an auxiliary turning cylinder provided with grippers for taking the sheet from an impression surface, means for causing the auxiliary cylinder to return the sheet to a following surface, suitable delivery mechanism, a plurality of form beds coacting with the said impression surfaces and transferable gripper operating devices adapted to cause consecutive or alternate sets of grippers to take and deliver the sheets substantially as specified.

6. The combination of an impression cylinder provided with a plurality of impression surfaces, a plurality of form beds coacting with the said cylinder, an auxiliary cylinder provided with grippers and adapted to rotate in one direction or to oscillate on its axis, means for giving said motion or motions to said cylinder, means for operating the sheet grippers of the auxiliary cylinder, suitable delivery mechanism and suitable means for causing the impression cylinder grippers to coact with the several impression surfaces, the auxiliary cylinder and delivery mechanism in causing one or more impressions to be given to a sheet, substantially as specified.

7. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is fitted with a set of grippers a plurality of form beds coacting with said impression surfaces suitable delivery mechanism, an auxiliary cylinder provided with sheet grippers, a cam and lever actuated by the impression cylinder to open the auxiliary cylinder grippers, and devices for operating the impression cylinder grippers which are transferable to change the machine to print single or two colors, substantially as specified.

8. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is fitted with a set of grippers a plurality of form beds coacting with said impression surfaces, suitable delivery mechanism, an auxiliary cylinder provided with grippers, means for opening the said grippers to take the sheet from the impression cylinder, mechanism for giving reverse motions to said auxiliary cylinder, means for opening the grippers of said auxiliary cylinder on its reverse motion, means for taking the sheet from the auxiliary cylinder and conducting it in a reverse position to the impression cylinder, and a set of gripper operating devices for each of the impression surface grippers which are transferable to convert the machine from a single or color printing machine, printing one side of a sheet into a perfecting machine printing both sides, substantially as specified.

9. The combination in a printing machine of an impression cylinder, suitable form bed or beds coacting therewith, suitable delivery mechanism, an auxiliary turning or reversing cylinder provided with grippers, a shiftable device for opening the auxiliary cylinder grippers to take and release the sheet at different points, and means of shifting the said device, substantially as specified.

10. The combination of an impression cylinder provided with a plurality of impression surfaces each of which is fitted with a set of grippers, a plurality of form beds coacting with said impression surfaces a plurality of transferable gripper operating devices by the arrangement of which with respect to the im-

pression surfaces the machine may be adapted to print single or in colors or on both sides of the sheet, an auxiliary cylinder provided with grippers for taking the sheet from an impression surface and delivering it directly or through suitable reversing and carrying mechanism to a succeeding impression surface and mechanism for shifting the point at which the auxiliary cylinder grippers take the sheet from the impression cylinder, substantially as specified.

11. The combination in an organized printing machine of a form bed or beds a single impression cylinder having impression surfaces that coact with the form bed or beds, suitable delivery mechanism, an auxiliary turning or reversing cylinder provided with sheet grippers, means by which the auxiliary cylinder may be rotated or oscillated in contact with the impression cylinder to bring about the coaction of the sheet grippers of the two cylinders in the operation of transferring the sheet from one to the other, substantially as specified.

12. In a printing machine the combination of an impression cylinder having two impression surfaces each of which is fitted with grippers, two form beds coacting with the said impression surfaces, suitable delivery mechanism, an auxiliary cylinder provided with grippers for taking the partly printed sheet from one impression surface and returning it to the following one to receive a second impression (on the same or reverse side), means for operating the auxiliary cylinder to cause it to return the sheet to the cylinder either with the printed side out or reversed, and a series of gripper operating devices on each side of the machine which are adapted to be arranged to change the sheet taking and delivery points of the grippers of the respective impression surfaces, whereby a sheet may be fed, imprinted and delivered by both impression surfaces at every revolution of the cylinder or one sheet may receive two impressions on the same or reverse sides at every such revolution, substantially as specified.

13. The combination in an organized printing machine of means for converting the machine into a two color machine or a sheet perfecting machine, a single impression cylinder adapted to carry a sheet against the forms, a suitable number of form beds, means for taking the sheet from the impression cylinder after receiving the first impression and returning it to the same for a second impression, a delivery mechanism provided with sheet grippers and means for preventing the said grippers from opening when the machine is arranged to print either in two colors or to perfect the sheet when the sheet passes the delivery point after receiving its first impression, substantially as specified.

14. The combination of an impression cylinder provided with a plurality of impression surfaces, and a plurality of gripper operating devices that may be separately arranged and adjusted to open and close the grippers to take and release the sheet at intervals, with an auxiliary turning cylinder provided with grippers for taking the sheet from the impression cylinder after receiving an impression, and returning it to receive another impression, and mechanism substantially as described for giving reverse motions to said auxiliary cylinder, of a cam and lever for opening and closing the auxiliary cylinder grippers, to take the sheet from the impression cylinder, and a cam for opening the said grippers to release the sheet when the cylinder reverses the sheet and returns it to the cylinder to receive another impression, and means for taking the sheet off the cylinder and guiding it to the impression cylinder, substantially as specified.

15. The combination in an organized printing machine of a single impression cylinder adapted to carry a sheet to one or more forms, suitable form bed or beds, suitable delivery mechanism provided with sheet grippers, means for preventing the said grippers from opening when the sheet passes the delivery point after receiving an impression, an auxiliary cylinder provided with grippers for taking the sheet and returning it in the same or a reversed position, and means for opening the auxiliary cylinder grippers to take the sheet at one point and release it at another point, substantially as specified.

16. The combination of an impression cylinder provided with a plurality of impression surfaces, and a plurality of gripper operating devices for opening and closing the grippers to take the sheets at intervals, of an auxiliary turning cylinder constructed and arranged to take the sheet from the impression cylinder after receiving an impression, and return it in a reversed position to the impression cylinder to receive another impression, of a switch provided with spring fingers to take the sheet off the auxiliary turning cylinder, and tapes for guiding the sheet while being returned to the impression cylinder, substantially as specified.

17. The combination of an impression cylinder provided with a plurality of impression surfaces with spaces between a form bed or form beds coacting with the impression cylinder a timing pinion geared to the driving mechanism of the machine, and suitable mechanism interposed between the timing pinion and the cylinder for changing the speed of the cylinder between the impressions substantially as specified.

18. The combination of an impression cylinder provided with a plurality of impression surfaces a form bed or beds coacting therewith having a continuous uniform motion, a timing pinion and irregular gears adapted to engage the cylinder, whereby the regular motion of the driving mechanism is changed to an irregular motion of the cylinder between the impressions substantially as specified.

19. The combination of an impression cyl-

inder provided with a plurality of impression surfaces with blank spaces between, a plurality of form beds, a driving pinion, and mechanism substantially as described, for driving the impression cylinder between the impressions and alternately slowing the speed thereof to take a sheet, and bringing it up to the speed of the bed again, substantially as specified.

20. The combination of an impression cylinder provided with a plurality of impression surfaces and toothed segments attached to the cylinder in line with the impression surfaces, a plurality of form beds, the driving mechanism of a printing machine, and a series of regular and irregular wheels interposed between the driving mechanism and cylinder to drive the cylinder between the impressions and alternately slow down the cylinder to take a sheet and speed it up to the motion of the beds, substantially as specified.

21. The combination with a form bed arranged to travel with a continuous motion forward and back in an orbital path without reversing the beds, of switches pivoted in the guide-ways adjacent to the bed driving pinions, and mechanism for positively closing the switches to allow the advancing ends of the beds to pass and to open them to intercept the following ends substantially as specified.

22. The combination with an impression cylinder provided with a plurality of impression surfaces each of which is provided with gripper mechanism and a plurality of form beds that travel with a continuous motion forward and back in an orbital path without reversing the forms, of switches pivoted in the upper and lower guide ways adjacent to each of the driving wheels and mechanism connected with both sets of switches for simultaneously and positively closing the said switches to allow the advancing ends of the beds to pass, and to open them to intercept the following ends of the bed and guide the beds in their passage from one guide way to the other, substantially as specified.

23. The combination of the side frames of a printing machine provided with orbital guide-ways, form beds movable in said guide-ways and provided with pins on their sides held in said guide-ways, toothed wheels for driving said beds switches pivoted in line with the upper and lower guide ways and arranged to be moved across the guide ways to intercept the rear ends of the moving beds in both guide-ways to guide the beds in ascending and descending and means for positively operating the two sets of switches simultaneously substantially as specified.

24. The combination of an impression cylinder provided with a plurality of impression surfaces, a plurality of transferable gripper operating devices, an auxiliary cylinder provided with grippers for taking and returning the sheet to the impression cylinder, mechanism for continuously rotating the auxiliary cylinder to take the sheet from one impression surface and return it to a following surface, a delivery cylinder provided with grippers for taking the sheet from the impression cylinder means for throwing the delivery cylinder grippers out of action after the sheet has received its first impression and into action after receiving the final impression, and a plurality of form beds arranged to coact with the impression cylinder substantially as specified.

25. The combination of an impression cylinder provided with a plurality of impression surfaces, a plurality of interchangeable gripper operating devices, an auxiliary cylinder provided with grippers for taking and returning the sheet to the impression cylinder, mechanism for reversing the motion of the cylinder, means for taking the sheet from the auxiliary cylinder and conducting it to the impression cylinder, a delivery cylinder provided with grippers for taking the sheet from the impression cylinder after receiving the final impression, and a plurality of form beds arranged to act successively in conjunction with the impression surfaces of the cylinder to make a series of impressions on one side of a sheet, substantially as specified.

26. The combination of a plurality of form beds, a cylinder provided with a plurality of impression surfaces, a turning cylinder for taking the sheet from one impression surface after receiving an impression on one side from one of the forms, turning the said sheet and redelivering it to a succeeding impression surface in a reversed position to receive an impression on the opposite side from another form, and means for conducting the sheet after reversal from the turning cylinder to the impression cylinder, substantially as specified.

27. The combination with a plurality of form beds constructed and arranged to travel in orbital guide-ways as described, of counterbalancing rock-levers the ends of which bear against the under side of the beds when at opposite points of the orbital guide-ways, the construction and arrangement being such that the descending bed assists in raising the ascending bed through the rock-levers and the latter support the beds while traveling in the lower guide-ways, substantially as specified.

28. The combination with a plurality of form beds constructed and arranged to travel in orbital guide-ways as described of rock-levers arranged to bear against the under side of the form beds the arrangement being such that the ends of the levers are caused to bear against and support the beds while approaching the ends of the machine on both the forward and back motions of the bed, and when the beds arrive at the ends of their forward and back motions respectively, the momentum and weight of the descending bed is conveyed by the levers to the ascending bed and aids the latter in traveling from the lower to

the upper guide-ways, substantially as specified.

29. The combination of a plurality of form beds, devices for driving the same in an orbital path, and a lever for counterbalancing the beds while moving vertically and also while traveling horizontally to lessen the friction in the guide ways, substantially as specified.

30. The combination with a form bed having a continuous motion forward and back in an orbital path of motion arresting bars at each end of the machine connected with rock levers, the bars at the front end of the machine being arranged to arrest the bed on the forward motion and support the front end while passing from the upper to the lower guide ways and the bars at the opposite end arranged to arrest the rearward motion of the bed and carry the rear end thereof upward to the upper guide ways, substantially as specified.

31. The combination of a plurality of form beds, devices for driving the same in an orbital pathway and vertically movable motion arresters controlled by air springs or other suitable devices which engage the advancing ends of the beds, and in connection with the driving devices sustain the beds in a horizontal position when passing through the vertical parts of the orbital pathway, substantially as specified.

32. The combination with a plurality of form beds having continuous motion forward and back in an orbital path of motion arresters at each end of the machine pivoted to rock levers so as to move up and down alternately to carry their forked ends into alignment with the upper and lower guide ways in which the beds travel, the arrangement being such that the bars at the front end of the machine arrest the motion of one forwardly moving bed at the same moment that the bars at the opposite end arrest the motion of a rearwardly moving bed, substantially as specified.

33. In a printing machine the combination with a plurality of impression surfaces and form beds coacting therewith of a separate inking apparatus for each form comprising a fountain, fountain roll supply roll and form rolls arranged in a frame and means for lowering each apparatus separately to ink its proper form and to raise it out of the way of the other form, substantially as specified.

34. In combination with an impression cylinder provided with a plurality of impression surfaces a plurality of form beds coacting with said impression surfaces a plurality of inking apparatuses each of which is arranged to move into position to ink its appropriate form bed independently of the others and means for causing said inking apparatus to coact with the said form beds substantially as specified.

35. In combination with two inking apparatuses each of which is movable into position to ink a form independently of the other a single vertical shaft for giving both rotary and sidewise distributing motions to the rollers of the two apparatuses, and means for conveying the motions of the said shaft to the two apparatuses, substantially as specified.

36. In an inking apparatus for printing machines the combination with ink roller 113 of rollers 126, 126 mounted on connected bearings, a bracket for supporting the bearings of the said rolls, and a set screw in the said bracket for adjusting the said bearings and rolls, substantially as specified.

37. In a cylinder printing machine the combination with the form bed or beds of an adjustable impression support having arms projecting into openings in the side frames of the machine, and set screws in the openings for adjusting said supports, substantially as specified.

38. In combination with a cylinder printing machine having a plurality of forms arranged to travel in orbital guide ways perpendicular to the plane of the impression cylinder, an adjustable impression support, having arms projecting into openings in the side frames of the machine and set screws in the openings for adjusting the said support, substantially as specified.

39. The combination with the impression cylinder of a feed board arranged adjacent to the impression cylinder, a feed roller, means for reversing said feed roller on its axis at intervals, a rack bar and pinion for operating the said roller, a lever and cam operated by the printing machine for giving motion to the said rack bar to cause the feed roller to act on the sheet to be fed to the machine, a rear edge sheet straightener having an arm in position to be acted on by the toothed segments of the impression cylinder to lift the said straightener to allow the sheet to be fed forward, sustantially as specified.

40. In a printing machine the combination with an impression cylinder provided with sheet grippers, an inclined feed table hinged at its rear end and having its front end adjustable vertically to compensate for the thickness of the pile of paper placed on it, and also for the decreasing thickness of the said pile as the sheets are fed to the machine, mechanism for adjusting the front edge of the said table, a feed roller hung over the feed table and adapted to withdraw the front edge of the sheet from under the divider by one motion and feed it forward by a reverse motion to the grippers of the impression cylinder, and means for reversing said roller on its axis at intervals, substantially as specified.

In testimony that I claim the invention above set forth I have affixed my signature in presence of two witnesses.

MATTHEW VIERENGEL.

Witnesses:

FREDK. HAYNES,

CHAS. E. PETERS.