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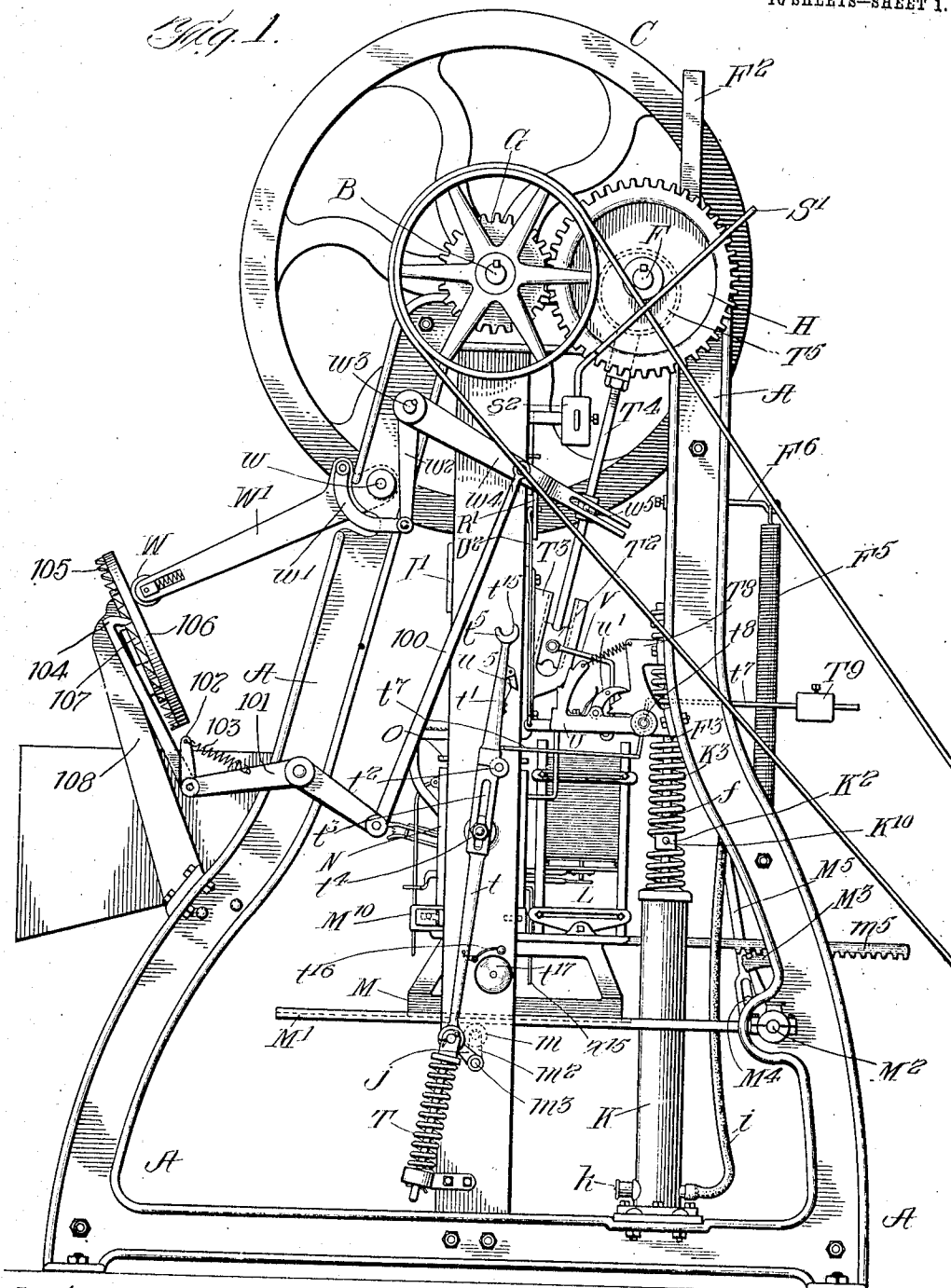
J. E. ANGEL.
PRINTING PRESS.

APPLICATION FILED MAY 22, 1908.

Patented Feb. 16, 1909

10 SHEETS—SHEET 1.

Fig. 1.



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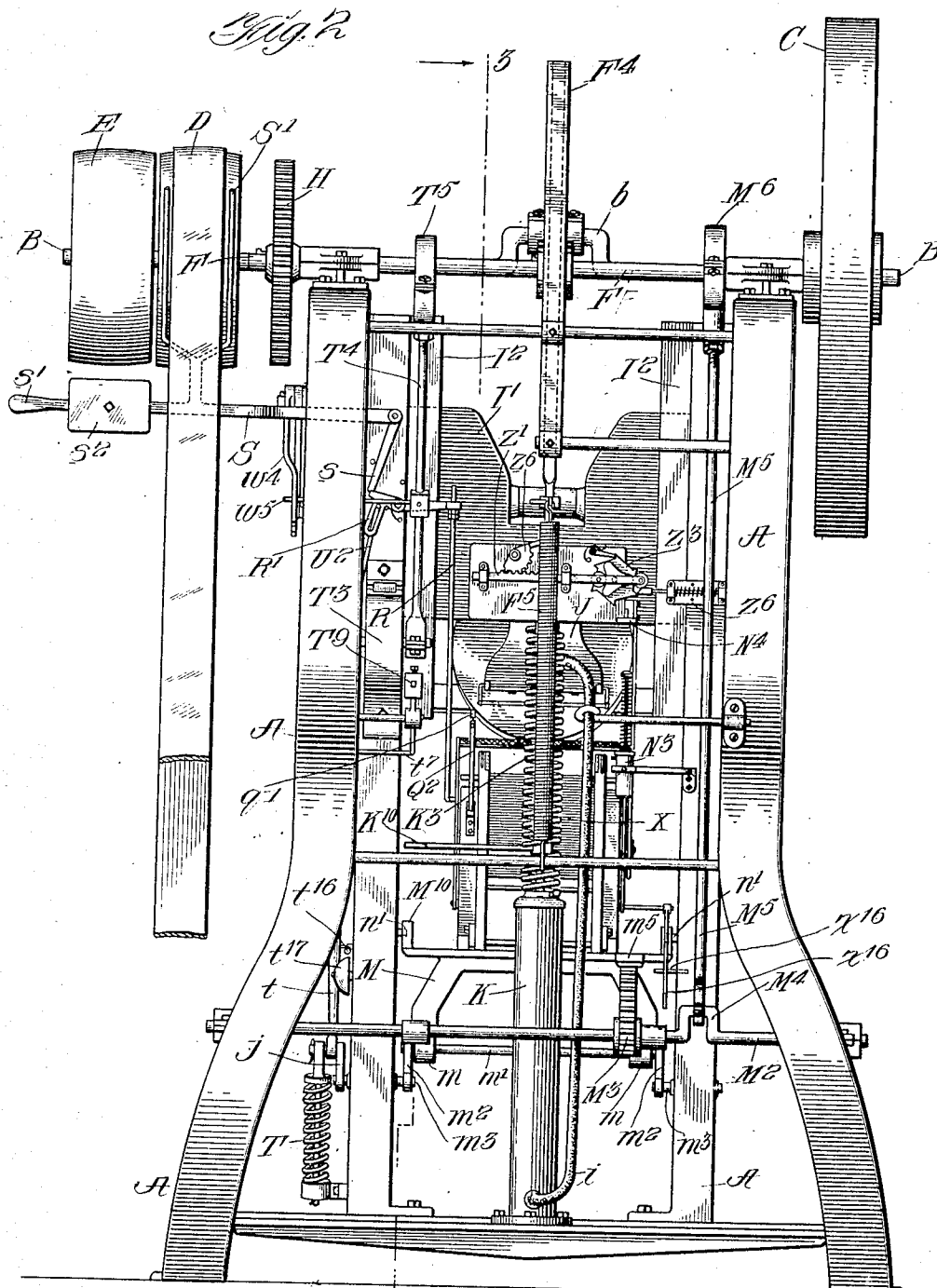
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Paulson & Wright.

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10 SHEETS—SHEET 2.



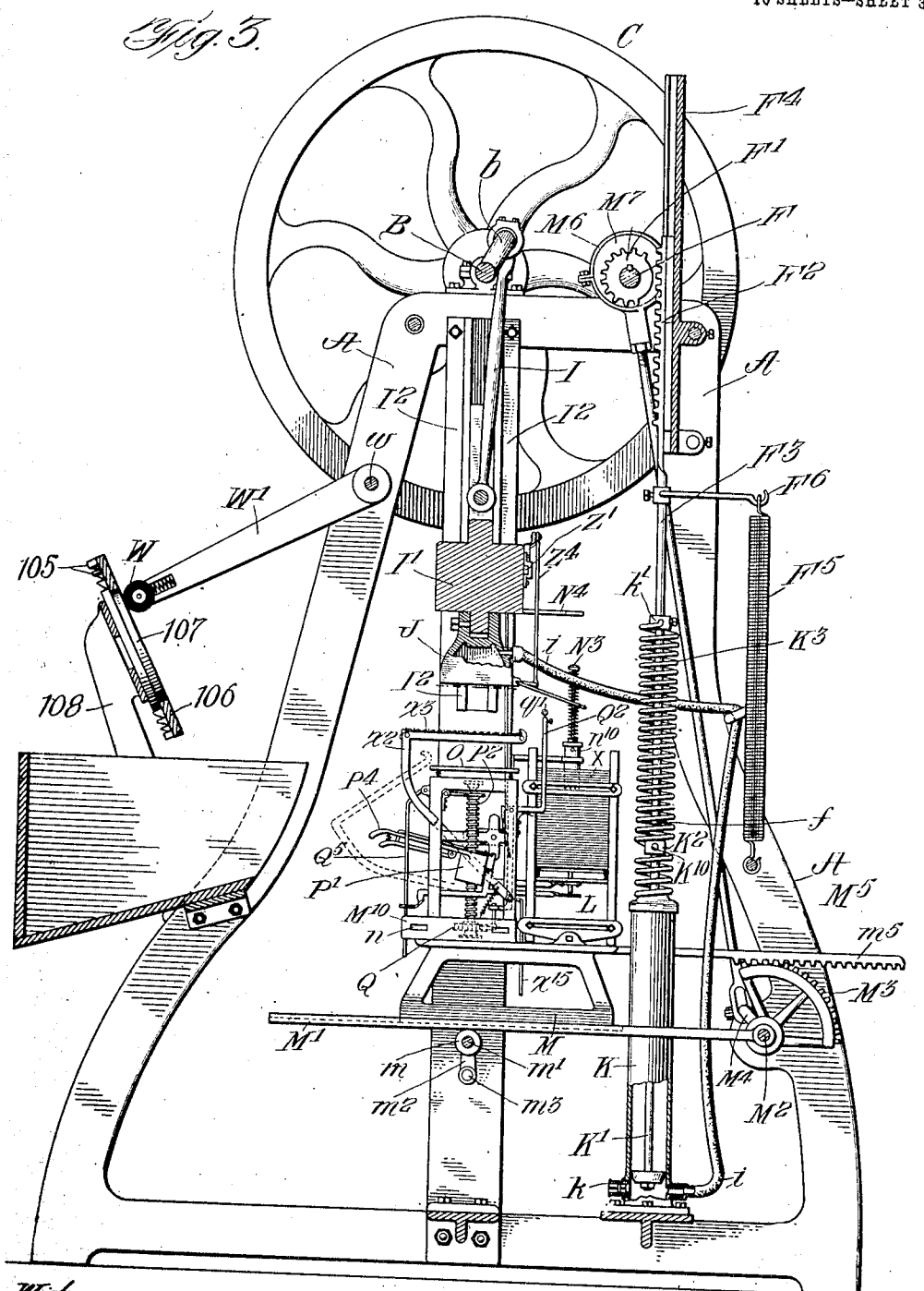
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10 SHEETS—SHEET 3.



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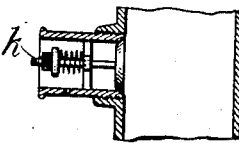
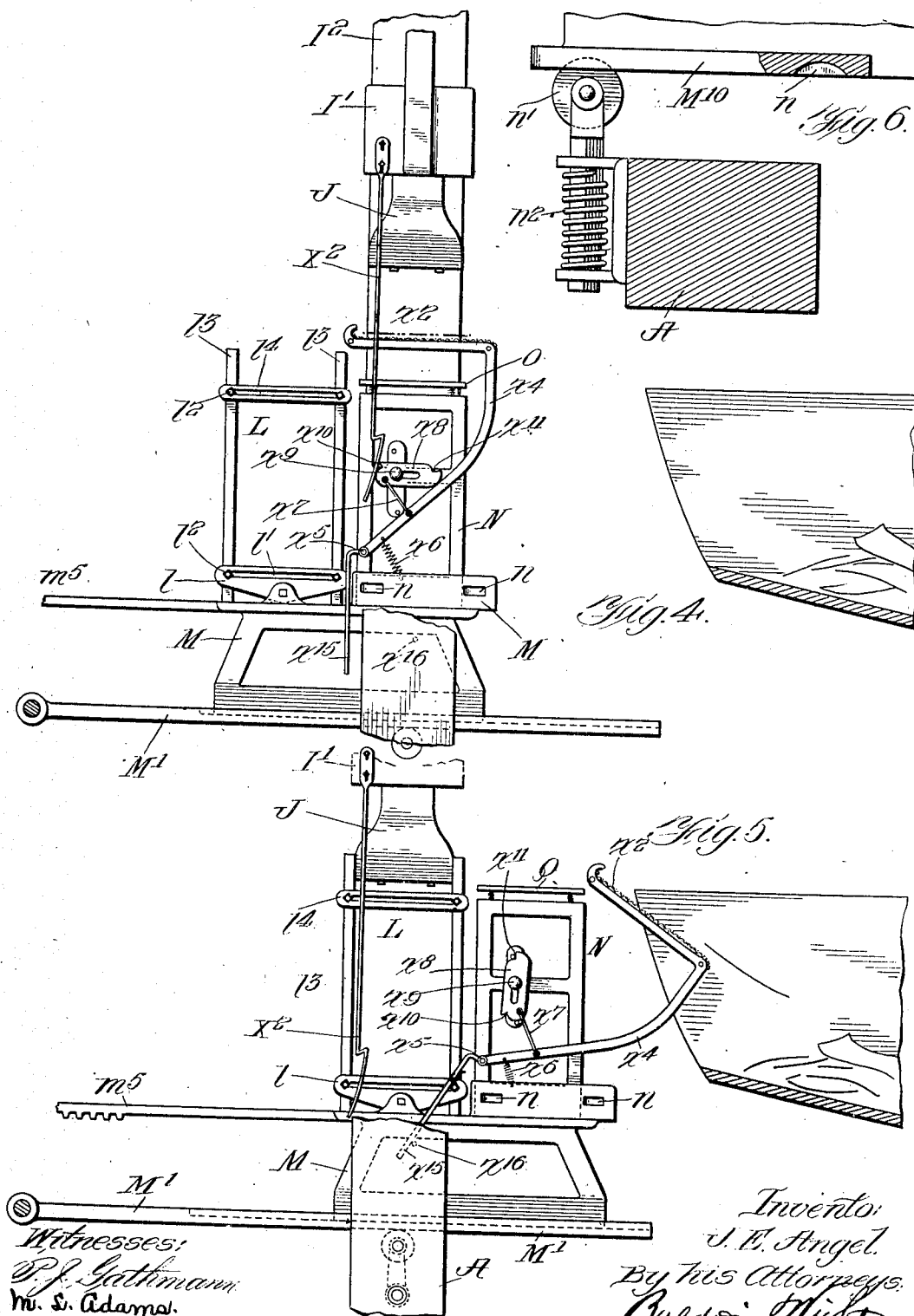


Fig. 2a Inventor:
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10 SHEETS—SHEET 4.

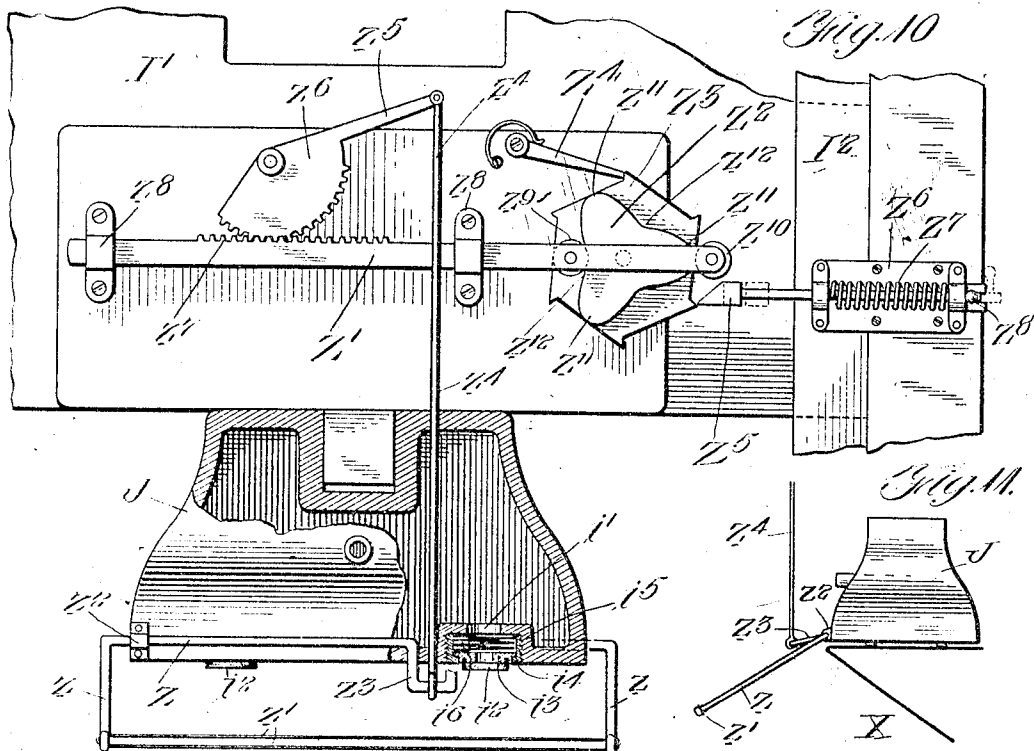
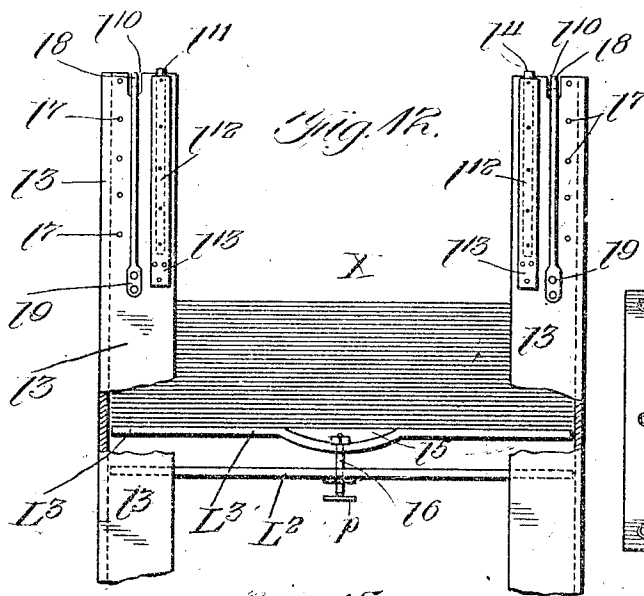
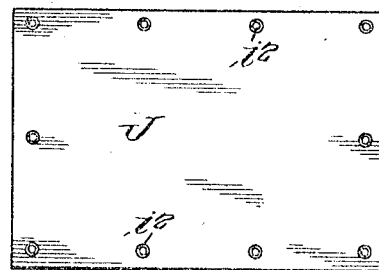


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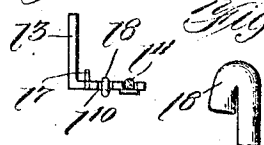


Witnesses:

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Fig. 15.

Fig. 16.



Inventor:

J. E. Angel.

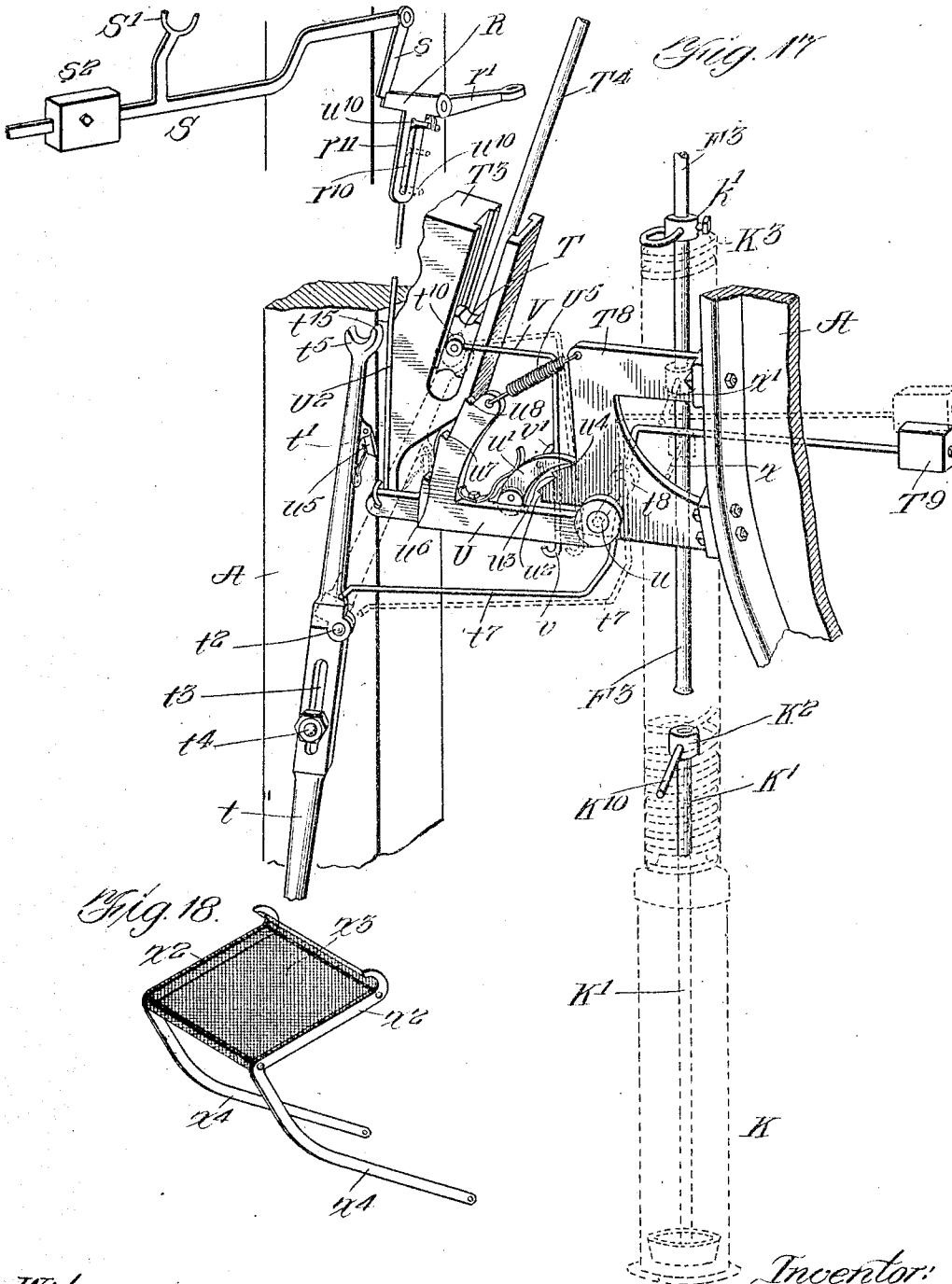
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10 SHEETS—SHEET 7.

912,771.



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APPLICATION FILED MAY 22, 1908.

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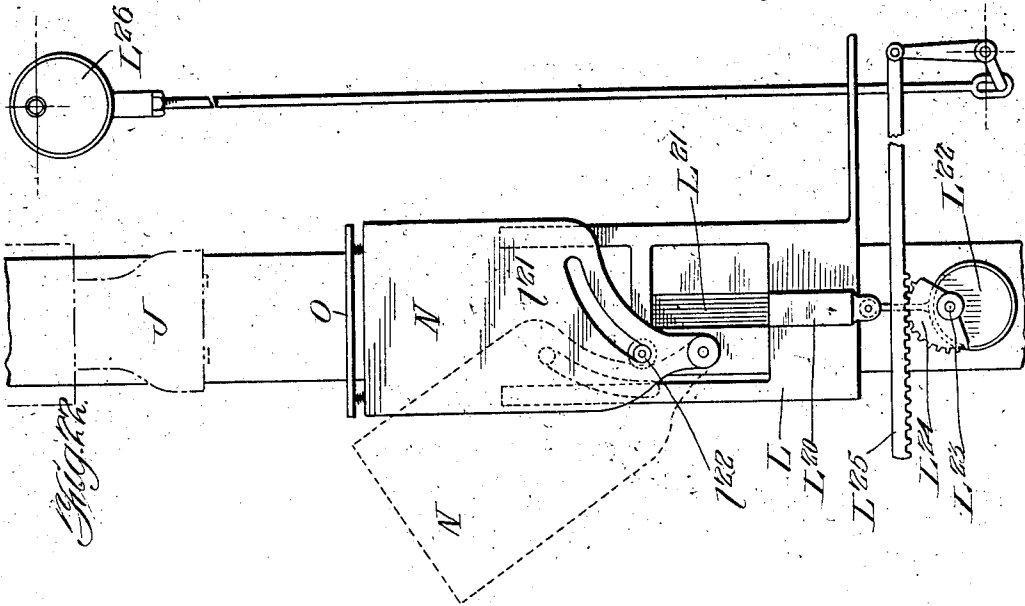
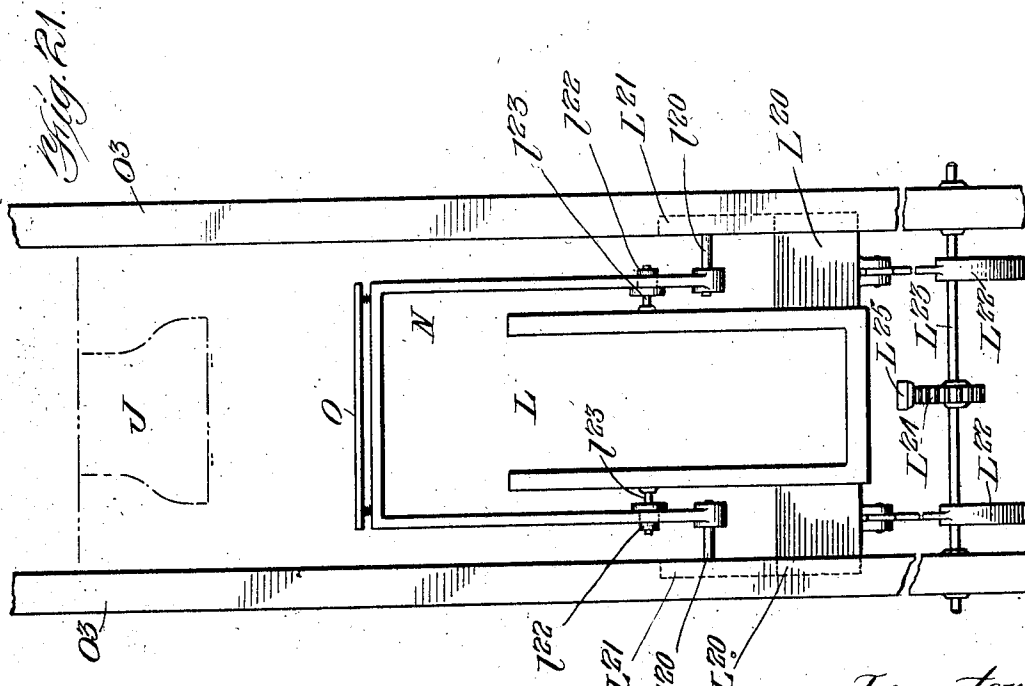
J. E. ANGEL.
PRINTING PRESS.

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Patented Feb. 16, 1909.

10 SHEETS—SHEET 9.

912,771.



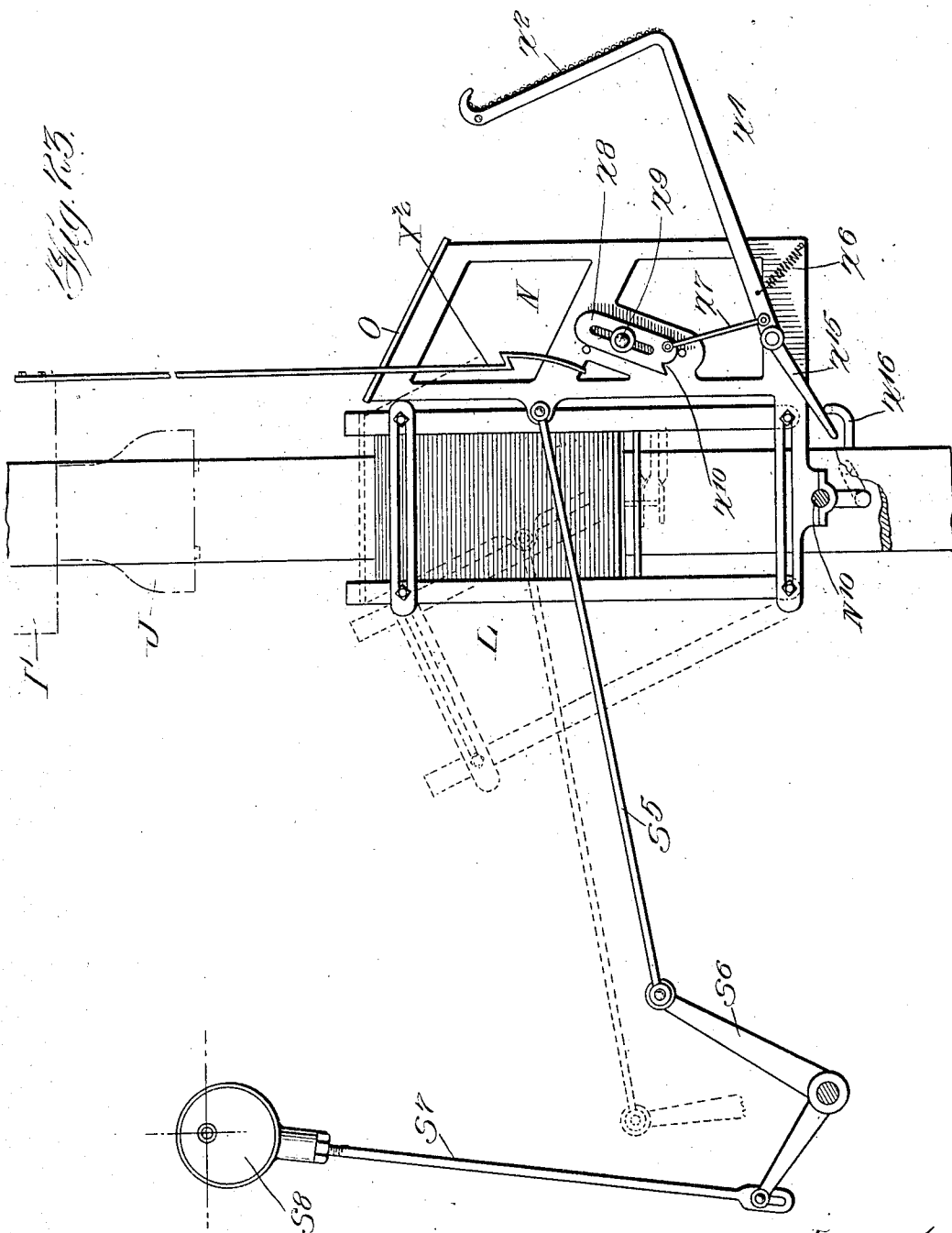
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Patented Feb. 16, 1909.
10 SHEETS - SHEET 10.



Witnesses:
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UNITED STATES PATENT OFFICE.

JOSEPH E. ANGEL, OF MADISON, NORTH CAROLINA, ASSIGNOR OF ONE-HALF TO ABRAHAM H. WOOD, OF MADISON, NORTH CAROLINA.

PRINTING-PRESS.

No. 912,771.

Specification of Letters Patent.

Patented Feb. 16, 1909.

Application filed May 22, 1908. Serial No. 434,264.

To all whom it may concern:

Be it known that I, JOSEPH E. ANGEL, a citizen of the United States, residing in Madison, in the county of Rockingham and State of North Carolina, have invented certain new and useful Improvements in Printing-Presses, of which the following is a specification.

My invention relates particularly to the paper feed mechanism of printing presses and the objects of my invention are to provide novel means whereby sheets of paper of any thickness may be automatically taken, one by one, from a magazine or reservoir, printed and then discharged to a suitable receptacle.

In carrying out my invention in the preferred way I store the sheets of paper to be printed in a magazine or reservoir above a table or support which is automatically elevated step by step, as the work progresses, to hold the top sheet of paper in proper position to be engaged by a pneumatic withdrawing device or "sucker" which is reciprocated above the magazine and which elevates a single sheet above the top thereof and holds it until the magazine has moved from under it and the type bed is moved beneath it, the withdrawing device or sucker being then made to descend and press the paper against the type and the printing in this way is perfected. The sucker thus not only serves to raise the paper, but also to hold it, and, acts as a platen to press it against the type. As soon as the sheet is printed the sucker rises and releases the printed sheet which is received by a deliverer that is operated to convey the printed sheet to a suitable receptacle. The magazine and type bed are then shifted so as to bring the magazine under the sucker so that when it next descends, it will engage a sheet and thereafter the operations are repeated in the manner above described. I may shift the magazine and type bed back and forth in a straight horizontal plane, or I may cause them to swing about a horizontal axis, or I may merely shift the type bed into and out of position under the sucker. I also may so mount the sucker as to swing back and forth while the magazine and type bed are held in a fixed position.

The magazine is provided with devices whereby the raising of a single sheet only is insured and should the sucker fail to raise a sheet at the proper time, mechanism is provided whereby the type bed is lowered so

that the sucker will not then descend upon it. Mechanism is also provided whereby should the paper pile be fed too rapidly upward, the feed is automatically stopped or retarded, and when the pile of paper is nearly exhausted, the machine is automatically stopped by slipping the driving belt. I have also provided mechanism whereby, if the sucker should fail repeatedly to lift a sheet from the magazine, the machine will be stopped automatically by shifting the driving belt.

By the above described mechanism, the machine will normally raise sheets of paper one by one from a magazine, print them and deliver them to a suitable receiver, but should the machine fail for any reason to properly feed, the feed operating mechanism will be automatically arrested, or if necessary, the machine will be stopped.

In addition to the mechanism above mentioned, my machine involves other features of construction, among which may be mentioned the means for automatically operating the inking roller, the means for holding a folded sheet of paper in position on the sucker, and the devices for so operating this holding means that it will properly operate to move into holding position immediately after the sucker has lifted a sheet from the reservoir and then be automatically withdrawn to allow the folded printed sheet to be delivered.

In the accompanying drawings I have shown the best way now known to me of carrying out my invention. The preferred mechanism is illustrated in the first 18 figures of the drawings, while some of the contemplated modifications are illustrated in the other figures, but I wish it understood that other modifications of the mechanism may be made without departing from my invention. I have merely illustrated a few of the many ways in which it may be embodied.

Figure 1 shows a front elevation of the machine. Fig. 2 shows an end elevation of the right hand side thereof. Fig. 2^a is a detail view of the inlet valve of the pump. Fig. 3 shows a vertical central section on the line 3—3 of Fig. 2. Fig. 4 is a detail view showing particularly the mechanism for delivering the printed sheet to a receptacle and the relation thereof with the sucker, the magazine and the type bed, the mechanism being shown in position for the deliverer to receive a printed sheet. Fig. 5 is a view similar to

Fig. 4 showing the deliverer in the act of depositing a printed sheet in a receptacle. Fig. 6 is a detail view of a stop cooperating with the horizontally moving magazine and type bed. Fig. 7 is a view on an enlarged scale and in perspective of the mechanism for elevating the pile of paper and the means for arresting this feed mechanism and for stopping the operation of the machine. Figs. 8 and 9 are detail views of the nut forming part of the feed mechanism shown in Fig. 7. Fig. 8 shows the relation of the nut with the feed screw. Fig. 10 is a detail view showing particularly the means for holding a folded sheet on the sucker. Fig. 11 is another view of the same mechanism. Fig. 12 shows the construction of certain parts of the magazine and illustrates particularly the devices for retarding the withdrawal of the sheets so that only one sheet at a time will be withdrawn. Fig. 13 is a detail view of one of the suction openings of the sucker. Fig. 14 is a plan view of the bottom face of the sucker. Figs. 15 and 16 are detail views of the retarding devices of the magazine. Fig. 17 is a detail view in perspective illustrating particularly the mechanism for arresting the printing operation and for stopping the machine by shifting the driving belt. Fig. 18 is a perspective view of the delivering device. The remaining figures of the drawings show modifications. Fig. 19 shows an organization in which the sucker is arranged to reciprocate vertically and also to swing back and forth over the magazine and type bed, which latter are held in fixed positions. Fig. 19 shows a section on the line 19—19 of Fig. 20, and, Fig. 20 shows an end elevation of the mechanism shown in Fig. 19. Fig. 21 is an end elevation, and Fig. 22 is a side view of an organization in which the type bed is arranged over the top of the magazine and is mounted to swing back and forth into position over the magazine and also to one side thereof. Fig. 23 illustrates an organization in which the type bed and magazine are mounted to swing about a horizontal axis.

The main frame A of the machine may be of any construction suitable to support the moving parts. The driving shaft B carries a fly-wheel C and fast and loose pulleys D, E, and the driving shaft is geared with a counter-shaft F by spur wheels G, H. The driving shaft is formed with a cranked portion *b* to which is jointed a piston rod I connected at its lower end with a cross head I' mounted to reciprocate vertically in suitable guides I² of the frame. To this cross head is attached a pneumatic withdrawing device or sucker J which is designed to elevate sheets of paper one by one from the magazine, press them upon the type and drop the printed sheets to the deliverer in the manner hereinafter described. The withdrawing device, or as it will be hereinafter called, the sucker, as

shown, has a hollow body to which is connected a flexible pipe *i* connected also with a pump K. Its bottom is flat and is provided with a number of holes *i'* which are fitted, as shown in Fig. 13, with rubber rings *i²*, or, as shown in Fig. 10, each rubber ring is carried by a metallic ring *i³*, held in place by a flanged threaded ring *i⁴* engaging the inwardly projecting hollow boss *i⁵* in which the hole *i'* is located. In this construction a spring *i⁶* presses the rings *i²*, *i³* outwardly. In either case the rings yield when the sucker is pressed upon the paper or when the sucker descends with the paper upon the type and a tight engagement is effected so that the pneumatic action will be complete, and when printing, the paper is made to fit smoothly on the type.

The pump K is operated from the counter-shaft F by means of a mutilated pinion F' thereon which meshes with a vertical rack bar F² which is prolonged into a shank F³ that terminates at the point *f*, indicated in Fig. 3. The rack bar reciprocates vertically in suitable guides F⁴ and is lifted by the mutilated gear, but is made to descend by a spring F⁵ attached to an arm F⁶ projecting from the shank of the rack bar and connected at its lower end to the frame A. The pump cylinder has an inlet at its lower end controlled by a spring pressed valve *k*, the tension of which may be regulated in any suitable way, and the tube *i* is connected to the lower end of the cylinder as shown. The piston rod K' is connected at K² with a coiled spring K³, the upper end of which is connected at *k'* to the shank of the rack bar F².

Normally the operation is as follows:—As the shaft F rotates, the piston rod is raised through the medium of the mutilated gear F' and the rack bar F², and the spring K³ which is connected to the piston rod but the return movement of the piston is effected by the spring F⁵ and also by the spring K³. This kind of connection is for the particular purpose hereinafter described.

The magazine L for holding a pile of sheets of paper is mounted on a support M upon which is also mounted a frame N carrying the type bed O. The support M is carried on rails M' attached at their inner ends to a horizontal shaft M² carrying a toothed segment M³ and formed with a crank M⁴ with which is connected a rod M⁵ extending upwardly to a strap M⁶ surrounding an eccentric M⁷ on the counter-shaft F. The outer ends of the rails M' are supported by rollers *m* mounted on a horizontal shaft *m'* carried by arms *m²* pivotally connected, as shown at *m³* in Fig. 2, with the frame A. Mechanism is provided, as will be hereinafter described, whereby the rollers may be raised and lowered to correspondingly raise and lower the rails M', and thus raise and lower the paper magazine and the type bed. The support M

is provided with a rack bar m^5 engaging the segment M^3 and the arrangement is such that the support M is reciprocated horizontally in such way as to bring the magazine and the type bed alternately into a position below and out of the path of the sucker. The magazine L is rigidly connected with the support M . It preferably comprises lower side plates l , slotted horizontally at l' and connected by means of bolts l^2 in these slots with angle irons l^3 which constitute the corners of the magazine. The upper portions of the angle irons are in like manner connected by bolts l^2 with the upper side plates l' . By these devices the size of the magazine may be adjusted to accommodate sheets of paper, cards, envelops, etc. of various sizes. The magazine is provided with a rigid bottom L^2 above which is a false bottom L^3 supported by springs L^4 interposed between the rigid and false bottoms, as indicated in Fig. 7. Both the rigid bottom and the false, or yielding, bottom are adapted to move vertically in and be guided by the angle irons l^3 . The false bottom is recessed or grooved at l^5 and through this portion projects a bolt l^6 for a purpose hereinafter explained.

In order to insure that only one sheet of paper, card, or envelop shall be withdrawn from the magazine at a time, I have provided retarding devices which act upon the edges of the paper, card or envelop, and while they permit a single sheet carried by the sucker to be withdrawn, they prevent the withdrawal of all others. By reference to Figs. 12, 15 and 16, it will be seen that the corner pieces, or angle irons l^3 each carries a vertical series of inwardly projecting pins l^7 and each corner piece carries a hook l^8 , the lower end of the shank of which is secured at l^9 to the outside of the corner piece, while the upper hooked end thereof, which is preferably in the form shown in Fig. 16, extends through a slot l^{10} in the upper edge of the corner piece, and projects into the path of the paper as it is raised. Furthermore, each corner piece is provided with a strip of rubber or other soft anti-slipping material l^{11} which is arranged in a vertical slot in the corner piece and is secured to a thin, flat spring l^{12} secured at its lower end l^{13} to the angle iron. The strip l^{11} acts upon the edges of the sheets and retards their upward movement, but the pressure exerted thereby, or the retarding action, is not such as to prevent or retard materially the withdrawal of the topmost sheet engaged by the sucker. In like manner the hook l^8 by reason of its thin spring shank will yield to permit the withdrawal of the topmost sheet, but should any following sheets fail to be retained by the strips l^{11} and the pins l^7 , the hooks will insure their retention.

In connection with the devices for preventing the withdrawal of duplicate sheets

from the magazine, I may also employ a blowing device N^3 . This consists of a pump having a discharge port n^{10} at its upper end just above the top of the pile of paper sheets. The piston rod extends upwardly and in the path of an arm N^4 projecting from the cross head I' . As the cross head I' descends the piston is depressed drawing air in at the port n^{10} , but as the cross head I' rises, air is blown out through the port n^{10} so that should two or more sheets by any possibility be raised by the sucker they will be blown apart and separated by the jet of air issuing from the nozzle n^{10} .

The type bed O is spring supported on the frame N and this frame with the magazine frame, on which it is supported, are firmly connected with the support M , and as the shaft M^2 is oscillated, the magazine and type bed are moved back and forth alternately into position below the sucker. In order to insure that the magazine and type bed shall stop in proper position to be acted upon by the sucker, I have provided flanges M^{10} of the support M with recesses n in its side plates which are engaged by rollers n' carried by spring pressed shanks n^2 in the main frame A . These rollers engage the recesses n at the ends of the movements in both directions.

The pile of paper X , (Fig. 12) rests on the false bottom L^3 which is supported by the bottom plate L^2 which latter is rigidly secured at p to an arm P to which is pivotally connected at p' a nut P' of the form shown in Figs. 8 and 9. This nut engages a vertical screw P^2 and as the screw is rotated, the nut is raised and the pile of paper correspondingly raised. As illustrated in Figs. 8 and 9, the nut is formed with a hole p^2 which is larger in diameter than the screw P^2 . The hole p^2 has a threaded portion p^3 on one side of its lower portion, and a threaded part p^4 on the opposite side of its upper portion, so that when the nut is tilted in the manner shown in Fig. 8, the screw will engage the threads p^3 and p^4 , but when the nut is turned so that its axis coincides with the axis of the screw, the threads p^3 and p^4 will be disengaged from the screw and the nut will freely move up and down without being impeded by the screw. The nut is formed with an arm P^1 carrying a latch handle P^6 to which is connected a bent rod P^6 adapted to engage a latch lug p^6 on the top of the nut. When the rod P^6 is thus engaged with the latch lug p^6 , the nut is tilted and engaged by the screw P^2 , but by properly operating the latch handle P^6 , the latch rod P^6 may be disengaged from the lug p^6 , and then by depressing the handle or arm P^1 , the nut may be disengaged from the screw and lowered, thus lowering the pile of paper or supporting plates L^2 , L^3 . At its upper end the screw P^2 is mounted to turn in a bearing P^7 attached to the top of the frame N and at

its lower end the screw is mounted to turn in a bearing P^8 attached to the bottom of the frame N . Near its lower end the screw P^2 carries a ratchet wheel Q engaged by a
 5 detent q and by a feed pawl Q' connected to an operating lever Q^2 , arranged as clearly indicated in Fig. 7, and carrying on its upper
 10 end a roller q' which is adapted to be struck by the sucker when it descends at the time that it is over the paper magazine, the
 15 arrangement being such that the supporting plates L^2 and L^3 with the pile of paper are raised one step at each operation so that the top sheet of paper will always be in proper
 20 position to be engaged by the sucker. It is very difficult to make this feed absolutely correct and some means must be provided for correcting imperfections. One of the
 25 devices which I employ for this purpose is illustrated in Fig. 7. The feed pawl Q' is connected by a bell crank lever Q^3 with a bent rod Q^4 connected at its outer end to a
 30 vertical rod Q^5 pivoted at Q^6 to the frame N . The rod Q^5 is engaged by a lever Q^7 pivoted at p' to the nut P' and having an arm Q^8 extending under the bottom plate L^2 of the
 35 paper magazine beneath the bolt P . Should the pile of paper be raised too rapidly so that the sucker on its descent produces abnormal
 40 pressure, the false bottom L^3 will yield and will cause the lever Q^7 to be so operated as to cause the withdrawal of the feed pawl Q' and thus stop the feed temporarily. This
 45 stopping of the feed will continue for one or more additional operations of the sucker, but if not, the pressure on the lever Q^7 will be withdrawn and the feed pawl will again
 50 engage the ratchet wheel Q and continue to feed in the usual way.
 55 I have also provided mechanism whereby when the pile of paper is nearly exhausted, the machine may be stopped. Fig. 7 illustrates some of the devices for this purpose. A forked rod R is pivoted to the frame N ,
 60 the tines r of the fork straddling the screw P^2 in such position that when the nut P' has been raised to its full extent it will cause the rod R to be operated to raise the end r' of a
 65 latch R' , the outer end of which engages an arm s connected with a lever S carrying a belt shifter S' . The lever S has a handle s' and a weight s^2 . When the latch R' is withdrawn from engagement with the arm s ,
 70 the weight s^2 will cause the lever to be operated to shift the belt from the fast pulley D to the loose pulley E and thus stop the operation of the machine. Therefore, as
 75 soon as the pile of paper in the magazine is nearly exhausted, the machine will be stopped automatically and all operations will cease.

Should the sucker fail to raise a sheet of paper I have provided means whereby the
 80 type bed may be lowered so that when the sucker descends in the printing operation it

will not come in contact with the type. The shaft m' , before referred to, which carries the rollers m supporting the rails M' , is normally held in its elevated position by the
 85 spring pressure devices T connected to an arm j extending from one of the pivot pins m^3 and the arm j is connected to a rod t carrying on its upper end an arm t' hinged
 90 at t^2 to the upper portion of the rod. The rod t is slotted at t^3 and through this slot extends a guiding stud t^4 . The upper end of the arm t' is formed with a recessed head t^5 .
 95 It is obvious that if the rod t is depressed, the rollers m will be lowered, the rails M' correspondingly lowered and therefore the type bed will be thrown out of operative
 100 position. This is done automatically at the proper time in the following way:—A cross head T^2 is mounted to reciprocate in guides T^3 and is connected by a rod T^4 with an
 105 eccentric T^5 on the counter-shaft F . The cross head T^2 reciprocates continuously during the operation of the machine, but normally has no effect upon the rod t . The arm t' of the rod is normally held in the position shown in Figs. 1 and 7 by a rod t^7 which
 110 is pivoted at t^8 to a bracket T^8 extending from the main frame A . The rod is prolonged and carries a weight T^9 . The weighted end of the rod is arranged close to the shank R^3 of the rack bar F^2 and extends
 115 above the laterally projecting arm K^{10} carried by the upper end of the piston rod K' . Normally the arm K^{10} does not engage the rod t^7 , that is to say, when the sucker engages a sheet of paper such resistance to the upward
 120 movement of the piston is produced that the spring K^3 is stretched to a greater extent than otherwise and the piston rod is not raised to so great an extent as to engage the rod t^7 . In such case the arm K^{10} will
 125 rise to a point, such as indicated by dotted lines at x in Fig. 17, but when the sucker does not engage a sheet of paper the resistance to the action of the piston is not so great, therefore the piston rod will rise to a
 130 greater extent, the arm K^{10} rising to the position shown at x' in Fig. 17, and lifting the rod t^7 so that it withdraws from the arm t' and allows it to swing over into the path of the cross head T^2 . This cross head is
 135 formed with a projection t^{10} adapted to engage the recessed head t^5 of the arm t' . Therefore when the arm t' is swung over to the dotted position, shown in Fig. 17, and the cross head descends, the rod t will be
 140 forced downwards, thus lowering the rails M' and the type bed. If on the next operation the sucker engages a sheet of paper, the arm K^{10} will not rise to the position x' and therefore the rod t^7 will hold the arm t' out of the path of the cross head T^2 and the
 145 printing operation will take place in the usual way, but the type bed will be automatically in this way withdrawn from op-

erative position whenever the sucker omits to carry a sheet of paper thereto.

I have also provided means whereby should the sucker repeatedly fail to elevate a sheet from the magazine, all the mechanism will be stopped by the shifting of the driving belt. This mechanism is most clearly indicated in Fig. 17. As there shown, the bracket T^8 carries a toothed segment U pivotally connected with the bracket at u and carrying a detent pawl u' adapted to engage teeth u^2 , u^3 , u^4 on the edge of the bracket. The arm t' carries a spring pressed pawl w^5 which engages the toothed segment U when the arm t' is swung over to the dotted position shown in Fig. 17 in the range of movement of the cross head T^2 . When the arm t' is first thrown over to this position, the pawl w^5 will engage the bottom tooth u^6 of the segment and when the cross head T^2 first descends the segment will be moved one step downwards causing the pawl u' to engage the tooth u^3 . When the cross head next descends, if the arm t' is still beneath it, the pawl w^5 being then in engagement with the tooth u^7 will cause the segment to be depressed another step and should the arm t' still remain in the path of the cross head on the next downward movement thereof, the segment will be caused to descend another step. The outer end of the segment, it will be observed, is connected by a rod U^2 to the latch R , before referred to. The manner of connecting the rod U^2 with the latch, as clearly shown, is by causing the bent upper end u^{10} of the rod to enter a slot r^{10} in the downwardly projecting arm r^{11} of the latch. Normally the segment U is held in an elevated position by means of a spring U^3 and the bent end u^{10} of the rod U^2 occupies a position at the upper end of the slot r^{10} . When the segment has been depressed one step, the bent end u^{10} of the rod will be depressed one step in the manner indicated by dotted lines in Fig. 17. When the segment is depressed another step, the rod will also be depressed correspondingly, but on the third depression of the segment, the latch R will be operated to withdraw from the belt shifting lever which will thereupon operate, that is to say, the mechanism is so arranged that should the sucker fail for three consecutive times to raise a sheet of paper, the machine will be stopped by shifting the driving belt. I have so arranged the mechanism, however, that should the sucker fail for less than three consecutive times to raise a sheet, the parts will be returned to their normal position. It will be observed that the crosshead carries a bent rod V which has a hooked lower end v that is adapted to engage a pin v' projecting laterally from the detaining pawl u' . When the arm t' is first swung over into the path of the cross head T^2 , the end t^{15} of its head t^5 will en-

gage the rod V and raise it to the position shown by dotted lines in Fig. 17, so that, as the cross head rises, the hook v will not encounter or engage with the pin v' , but as soon as the arm t' passes back to its normal position, indicated by full lines in Fig. 17, the rod V will drop and therefore on the next upward movement of the cross head T^2 the hook v will engage the pin v' and thus raise the detaining pawl, permitting the parts to assume their normal position. The rod t is provided with a bell hammer t^{16} cooperating with a gong t^{17} . This is for the purpose of notifying the attendant when the machine is not operating in its normal way. Three strokes of the bell will indicate that the machine has been stopped. The rod T^4 which operates the cross head T^2 also operates the inking roller W which is carried by arms W' pivoted at w to the main frame and connected by a link w' with an arm w^2 connected to a shaft w^3 carrying an arm w^4 bifurcated at its outer end and engaged by a pin w^5 on the rod T^4 . The ink disk 106 is connected with a plate 107 which is pivoted to the bracket 108. The disk 106 has an annular series of teeth 105 on it with which engages a pawl 104 pivotally connected with a bell crank lever 101. The pawl is connected to move with an arm 102 in turn connected by a spring 103 with the bell crank lever 101. This lever is connected by a rod 100 with the lever w^4 . In this way the inking disk is rotated to properly supply ink to the roller W .

The deliverer for the printed sheet is preferably of the form shown in perspective in Fig. 18, comprising sides x^2 supporting wire netting x^3 and having downwardly projecting arms x^4 pivotally connected at x^5 to the frame N . Springs x^6 secured to the frame N and to the arms x^4 tend to withdraw the deliverer from position above the type bed O . One of the arms x^4 is connected by a link x^7 with a plate x^8 which is slotted, as shown, and through this slot extends a pin x^9 attached to the frame N . The plate x^8 is formed with a tooth x^{10} at one end and with a recess x^{11} at the opposite end. A spring hook X^2 is secured to the cross head I' of the sucker and adapted to engage the tooth x^{10} of the plate x^8 when the sucker moves downward and the type bed is below it. When in this latter condition the plate x^8 is disposed, as indicated in Fig. 5, and as at this time the sucker is above the type bed, the hook will on the upward movement of the sucker engage the plate x^8 , shift it to the position shown in Fig. 4 against the tension of the spring x^6 and move the deliverer to the position shown in Fig. 4 where it will receive the printed sheet when dropped by the sucker. It will be understood that as soon as the sheet has been printed and raised from the type bed, the suction is withdrawn and the operation is reversed, the sheet being

forced by pneumatic pressure away from the sucker. The deliverer is held in its elevated position by the pressure of the hook X^2 upon the plate x^8 . As soon, however, as the type bed is shifted, the pressure of the hook X^2 is withdrawn and the springs x^6 will cause the deliverer to be moved to the position shown in Fig. 5 and deposit the printed sheet in a suitable receptacle. Should the springs x^6 fail for any reason to operate, I have provided for the positive actuation of the deliverer by connecting to the arms x^4 a downwardly projecting rod x^{15} arranged in the path of a pin X^{16} attached to the support M, the arrangement being such that at the proper time the pin x^{16} will engage the rod x^{15} to cause it to actuate the deliverer in the manner above explained.

In order that the machine may properly operate upon folded sheets of paper, I have provided the devices particularly illustrated in Figs. 10 and 11. It is obvious that the sucker would not properly hold a folded sheet by mere suction as the under part of the folded sheet would drop by gravity to the position indicated, for instance, in Fig. 11. I have therefore provided devices for holding the bottom portion of the folded sheet up against the upper portion thereof and I automatically operate these holding devices to engage the folded sheet immediately after it is raised from the magazine and to disengage therefrom after the sheet has been printed. The holding device comprises a rod Z having arms z connected at their outer ends by a rubber band z' , or other suitable connection. The rod is pivotally mounted in suitable bearings z^2 and has a cranked portion z^3 connected by a vertical rod z^4 with the arm z^5 of a toothed segment z^6 attached to the cross head I' of the sucker. The segment z^6 engages a row of teeth z^7 of the horizontally arranged bar Z' adapted to slide in guides z^8 and carrying rollers z^9 , z^{10} between which is arranged a cam Z^2 having three projections z^{11} and three corresponding depressions z^{12} . When the roller z^{10} engages a projection thereof. The cam is connected to rotate with a ratchet wheel Z^3 which is engaged by a detent pawl Z^4 and is adapted to engage a dog Z^5 , the shank of which extends through a suitable frame Z^6 and it is normally pressed towards the ratchet wheel Z^3 by a spring Z^7 . The shank of the dog Z^5 is provided with a handle Z^8 by which it may be moved into and out of operative position, it being understood that when single sheets are operated upon, the dog Z^5 is held out of operative position, but when folded sheets are being used, the dog is allowed to move into the path of the ratchet wheel Z^3 . When the sucker descends into the magazine, the holder Z is in the position shown in Fig. 11,

but as the sucker rises out of the magazine, the ratchet wheel Z^3 is engaged by the dog Z^5 and is turned the distance of one tooth, causing the bar Z' to be moved to the left as viewed in Fig. 10, thus causing the holder Z to move over to a position below the sucker and hold the folded sheet against it. The holder will remain in this position until the sucker has again descended, caused the sheet to be printed, and again moved upwards, on which upward movement the ratchet wheel will be again moved but in such manner as to cause the bar Z' to be shifted to the right and thus cause the holder Z to be withdrawn. It will be understood that the mechanism is such that the sheet of paper, envelop, card, or the like, is held in position for printing by suction, but that as soon as the sheet has been printed, the suction is withdrawn and the operation is reversed, the sheet being forced by pneumatic pressure away from the sucker.

In Figs. 19 and 20, I have shown a modification in which the magazine L and the type bed O are held in a fixed position, while the cross head I' carrying the sucker J, in addition to being reciprocated, is oscillated. In this modification the cross head I' is mounted to reciprocate in suitable guides I^{10} which swing about a shaft I^{11} . The cross head is connected by suitable lever mechanism, in the manner indicated, and by an eccentric I^{12} with an operating shaft I^{13} which may be located and operated in the same manner as the counter-shaft F, before referred to. The support L^{10} for the magazine and the type bed is adjustable by means of an adjusting screw L^{11} so that the magazine and the type bed may be held in proper relation with the sucker as it reciprocates and oscillates. In other respects the construction and operation of the mechanism is the same as that before described and similar parts are correspondingly lettered.

In Figs. 21 and 22, I have shown an organization in which the sucker is made to reciprocate in stationary guides while the type bed, when in printing position, is arranged above the top of the paper magazine. In the mechanism shown, the sucker is arranged to reciprocate in guides O^3 and the paper magazine L is provided with arms or wings L^{20} adapted to move vertically in guide recesses L^{21} in the guides O^3 . The arms or wings L^{20} are connected in the manner shown to eccentrics L^{22} on a shaft L^{23} carrying a toothed segment L^{24} engaged by a reciprocating rack bar L^{25} operated, in the manner indicated, from an eccentric L^{26} . By this mechanism the paper box is made to move up and down. The frame N of the type bed is pivotally connected, as indicated at L^{20} to the guide frames O^3 and it is formed with curved slots L^{21} through which extend

rollers ⁷²² carried by pins ⁷²³ projecting from the sides of the magazine L. The arrangement is such, as clearly indicated, that as the magazine is raised and lowered the type bed 5 will be moved into position below the sucker and then out of operative relation therewith, the mechanism being so timed that the sucker will descend and raise a sheet of paper from the magazine while the type bed is in the position indicated by dotted lines in Fig. 22, and will then descend with the sheet of paper upon the type when the type bed is in the position indicated by full lines in Fig. 22.

15 In Fig. 23 I have illustrated a further modification in which the sucker is arranged to reciprocate vertically in fixed guides and the magazine and type bed are made to oscillate about a horizontal axis. As shown, 20 the magazine and frame N of the type bed are pivotally connected with a rod N¹⁰ and the frame N is connected by a rod S⁹ with a bell crank lever S⁸ in turn connected by a rod S⁷ with an eccentric S⁸ which operates to move 25 the magazine and type bed back and forth from the position shown by full lines to that shown by dotted lines and vice versa. This figure of the drawing also shows the deliverer for the printed sheet, but as the operation is 30 similar to that hereinbefore described, no further description of this mechanism is necessary in this connection.

I have described what I call a pneumatic withdrawing device or sucker. It will be understood that fluid pressure of other kinds 35 may be employed. The mechanism shown is arranged to stop the operation of the machine should the sucker fail for three consecutive times to raise a sheet of paper from 40 the magazine, but of course it may be arranged to thus operate when the sucker has failed twice or a greater number of times to perform this operation. It will be understood that the machine is adapted to operate 45 on single sheets of paper, folded sheets, cards, envelopes, etc.

I claim as my invention:—

1. In a printing machine, the combination of a magazine for sheets of paper, a 50 type bed, a combined pneumatic withdrawing device and platen, means for reciprocating it into and out of the magazine, means for bringing the type bed and withdrawing device into printing relation with each other, 55 and means for causing the combined withdrawing device and platen to press a sheet of paper upon the type.

2. In a printing machine, the combination of a magazine for paper to be printed, 60 a combined pneumatic withdrawing device and platen, means for step by step raising the pile of paper in the magazine, means for causing the combined pneumatic withdrawing device and platen to withdraw

paper sheet by sheet from the magazine, and 65 means for causing said platen and withdrawing device to press the sheets upon the type.

3. In a printing machine, the combination of a pneumatic withdrawing device, a 70 magazine for paper to be printed, means for step by step raising the pile of paper, means for reciprocating the pneumatic withdrawing device into and out of the magazine, and means for causing the withdrawing device 75 to press the sheet of paper held thereby upon the type bed.

4. In a printing machine, the combination of a magazine for sheets of paper, a type bed, a pneumatic withdrawing device, means 80 for reciprocating it into and out of the magazine, means for then bringing the withdrawing device and type bed into printing relation with each other and means for causing the withdrawing device to descend with a 85 sheet of paper upon the type.

5. In a printing machine, the combination with a bed of type of a magazine for paper to be printed, a pneumatic withdrawing device reciprocating over the magazine, 90 means for step by step raising the pile of paper, means for causing the pneumatic withdrawing device to withdraw paper sheet by sheet from the magazine, and means for causing the withdrawing device 95 to press the sheets upon the type.

6. In a printing machine, the combination of a magazine for sheets of paper, a type bed, a pneumatic withdrawing device reciprocating over the magazine and operated to withdraw sheets of paper one by one 100 therefrom, means for shifting the magazine and type bed into and out of the range of movement of the withdrawing device, means for causing the withdrawing device to press 105 the sheet of paper held thereby upon the type, and means for feeding the pile of paper step by step upwardly at the end of each reciprocation of the magazine and type bed. 110

7. A paper magazine adjustable to accommodate sheets of different areas and provided with devices for arresting or retarding the withdrawal of the sheets from the magazine consisting of yielding mounted 115 strips of soft material, vertically arranged pins and spring hooks, substantially as described.

8. A pneumatic withdrawing device or sucker having a flat rigid under surface provided with holes, housings or casings inside the sucker around said holes, perforated 120 metallic rings arranged within the casings, rings of soft material carried by said metallic rings, and springs for pressing said rings 125 downwards.

9. In a printing machine, the combination of a magazine for paper to be printed, a

type bed, a pneumatic sucker cooperating therewith, a support for the type bed and magazine, and means for automatically moving the type bed out of the range of movement of the sucker should it fail to lift a sheet from the magazine.

10. In a printing machine the combination of a magazine for paper to be printed, a type bed, a support for the magazine and type bed, a reciprocating sucker cooperating therewith, a support for the magazine and type bed, means for reciprocating the support beneath the sucker, and means for automatically lowering the support to withdraw the type bed out of the range of movement of the sucker should the latter at any time fail to withdraw a sheet of paper from the magazine.

11. The combination of a magazine for sheets of paper, a type bed, a pneumatic sucker cooperating therewith, means for reciprocating the sucker, a support on which the magazine and type bed are mounted, rails beneath said support, means for reciprocating the support to bring the magazine and type bed alternately into the range of movement of the sucker, and means for automatically lowering the rails to withdraw the type bed from operative relation with the sucker.

12. The combination of a magazine for paper, a type bed, a pneumatic sucker cooperating therewith, a pump connected with the sucker, means yieldingly connected with the pump piston for operating it, and devices controlled by the movement of the piston to move the type bed out of operative relation with the sucker should the latter fail to withdraw a sheet of paper from the magazine.

13. The combination of a magazine for paper, a type bed, a pneumatic sucker cooperating therewith, a pump for supplying the sucker having a yielding piston rod, a support for the magazine and type bed, devices for raising and lowering said support, and means brought into operation by the movement of the pump piston to lower the type bed should the sucker at any time fail to remove a sheet of paper from the magazine.

14. In a printing machine the combination of a magazine for paper, a type bed, means for raising sheets of paper one at a time from the magazine and pressing them against the type bed, and means for stopping the machine when the supply of paper is nearly exhausted but before the last sheet has been raised.

15. In a printing machine, the combination of a magazine for paper, a type bed, means for raising sheets of paper one at a time from the machine and pressing them against the type bed, means for stopping the machine when the supply of paper is nearly

exhausted, and means for stopping the machine should the devices for withdrawing paper from the magazine fail to do so repeatedly.

16. In a printing machine, the combination of a magazine for sheets of paper, a type bed, a pneumatic sucker cooperating therewith, a pump connected with the sucker having a yielding piston rod, means for reciprocating the piston rod, means for raising and lowering the type bed relatively to the sucker and devices carried by the piston rod for causing the type bed to be lowered should the sucker fail to withdraw a sheet of paper from the magazine.

17. The combination of a magazine for sheets of paper, a type bed, a pneumatic sucker cooperating therewith, a pump connected with the sucker, a yielding piston rod, means for raising and lowering the type bed relatively to the sucker, and devices actuated by the piston rod to cause the machine to stop should the sucker repeatedly fail to withdraw a sheet of paper from the magazine.

18. The combination of a magazine for sheets of paper, a type bed, a pneumatic sucker, a pump connected therewith and having a yielding piston rod, means for raising and lowering the type bed and devices carried by the piston rod for causing the type bed to be moved out of operative relation with the sucker should the latter at any time fail to withdraw a sheet of paper from the magazine, and means for causing the machine to stop should the sucker repeatedly fail to withdraw paper from the magazine.

19. The combination of a magazine for sheets of paper, a type bed, a vertically moving rod connected therewith for raising and lowering it, a swinging arm on this rod, a cross head adapted to connect with this arm and move the rod downwards, a rod for normally holding said arm out of the range of movement of the cross head, a toothed segment, a pawl on said arm adapted to engage said segment, a belt shifter, connections between the segment and the belt shifter, and devices for withdrawing said rod from said arm to cause the segment to be moved to shift the belt.

20. The combination of a magazine for paper, a type bed, a pneumatic sucker for raising sheets of paper one by one from the magazine and pressing them upon the type bed, a paper deliverer, and means operated by the movement of the sucker for moving the deliverer into and out of position above the type bed.

21. The combination of a magazine for sheets of paper, a type bed, a pneumatic sucker, means for reciprocating it above the magazine and the type bed, means for shifting the positions of the magazine and type

bed, a paper deliverer adapted to receive printed sheets from the sucker, and means operated by the sucker for actuating the paper deliverer.

5 22. The combination of a type bed, a reciprocating sucker, a spring hook carried thereby and reciprocating therewith, a paper deliverer, and a toothed plate connected therewith and engaged by the hook for the
10 purpose specified.

23. The combination with the sucker, of a holder for folded sheets, comprising a bent wire frame, a vertically moving rod connected therewith, and means for causing this
15 rod to move vertically to swing the frame as the sucker moves up and down.

24. The combination with the sucker, of a holder for folded sheets, a rod connected therewith, a segment jointed to the rod, a
20 reciprocating toothed bar, and means for reciprocating this bar as the sucker is moved.

25. The combination with the sucker, of a holder for folded sheets, a reciprocating bar, a cam connected therewith, connections be-
25 tween the reciprocating bar and the holder, and means for actuating said cam.

26. The combination of the sucker, a holder for folded sheets connected therewith, a reciprocating rod connected with the holder, a segment to which the rod is jointed, a
30 reciprocating toothed bar engaging the segment, a cam for operating the bar, a toothed wheel for turning the cam and a spring bolt engaging the toothed wheel.

27. In a printing machine, the combina-
35 tion of a magazine for sheets of paper, a pneumatic sucker reciprocating over said magazine, a type bed upon which the sucker is adapted to press the paper held thereby, a holder for folded sheets of paper connected
40 with the sucker, and means operated by the reciprocation of the sucker to cause the holder to engage a folded sheet after it has been raised from the magazine, pressed upon
45 the type and raised therefrom.

In testimony whereof, I have hersunto subscribed my name.

JOSEPH E. ANGEL.

Witnesses:

B. F. ROBERTSON,
THOS. P. NEWMAN.