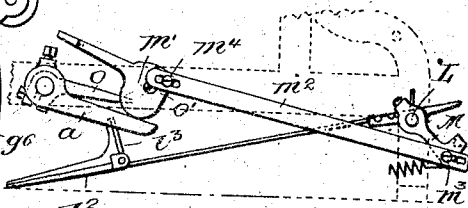
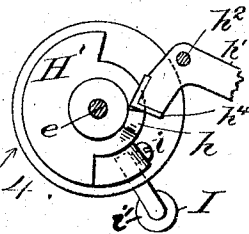
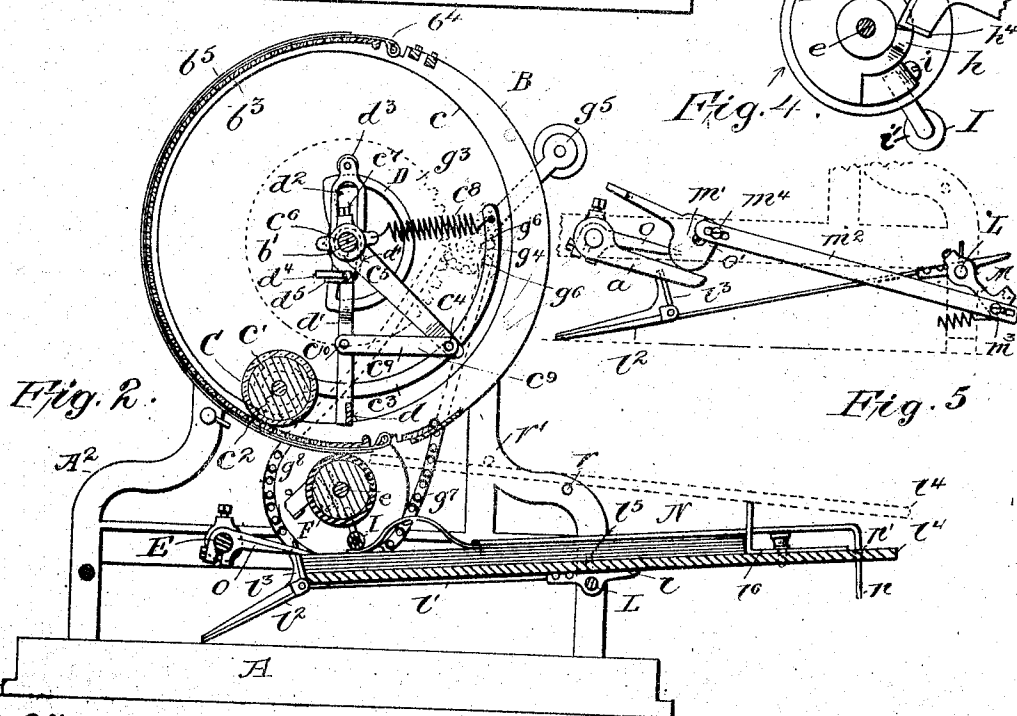
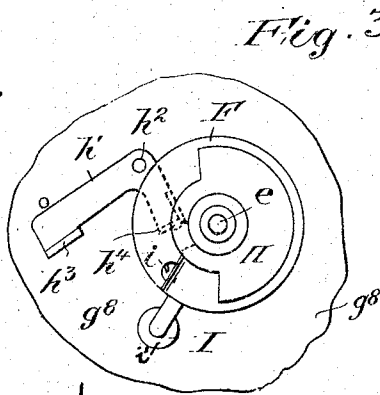
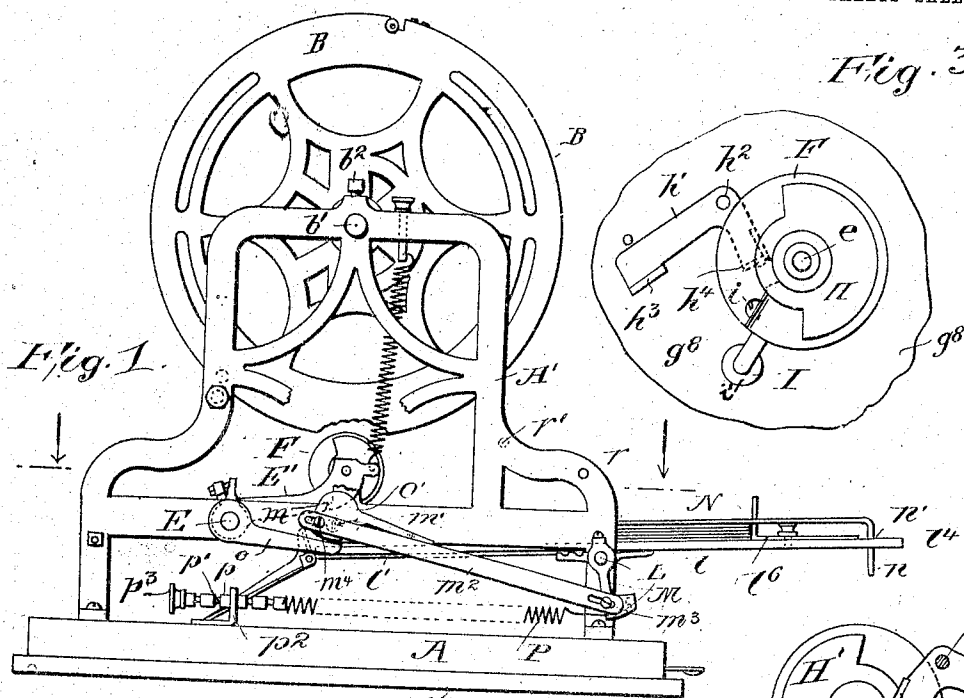


E. A. COX.  
 DUPLICATING APPARATUS.  
 APPLICATION FILED DEC. 23, 1904

3 SHEETS—SHEET 1.



Witnesses  
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No. 815,905.

PATENTED MAR. 20, 1906.

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3 SHEETS—SHEET 2.

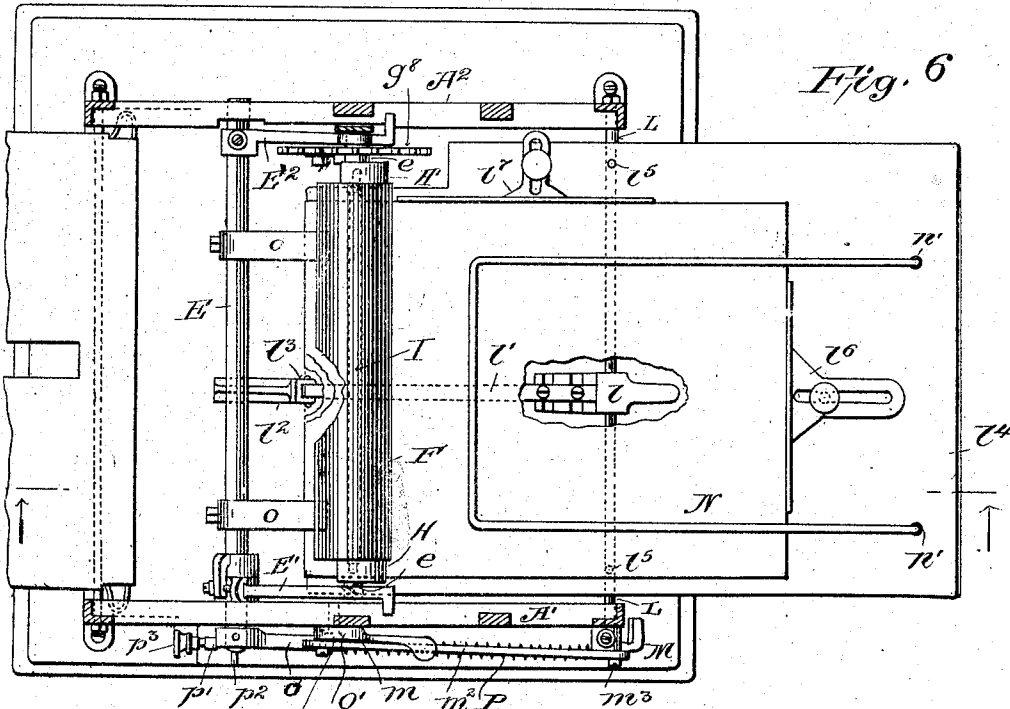


Fig. 6

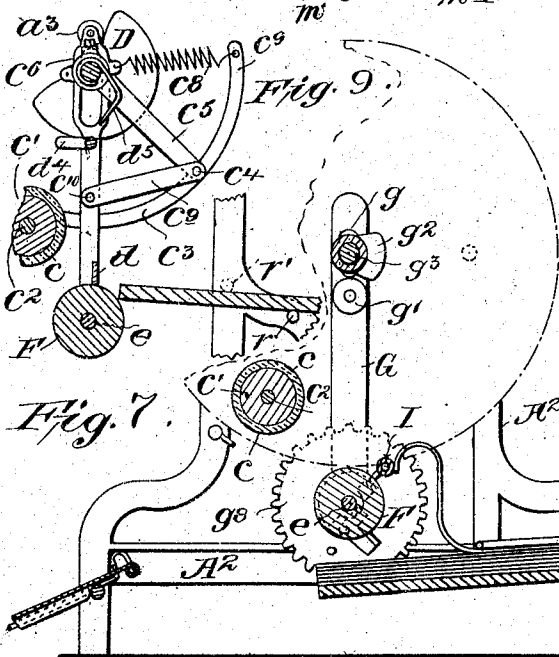


Fig. 7

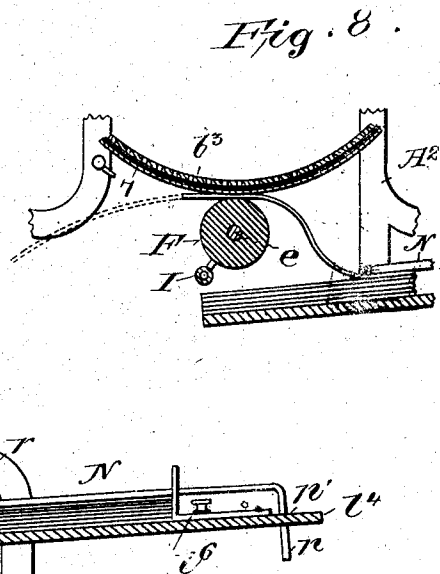


Fig. 8

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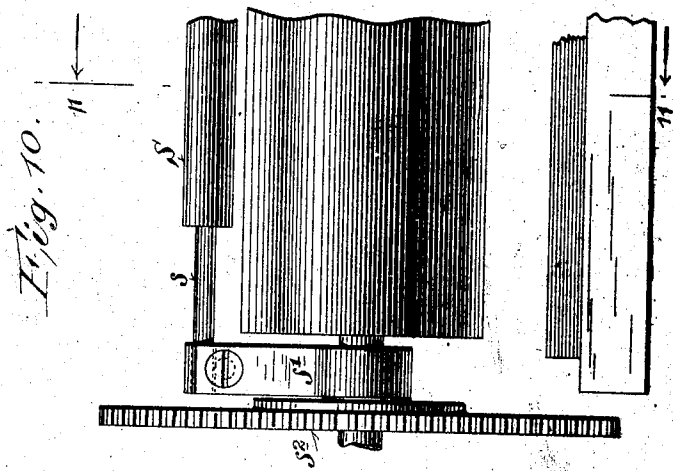
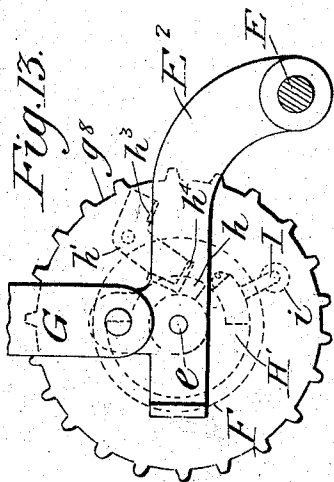
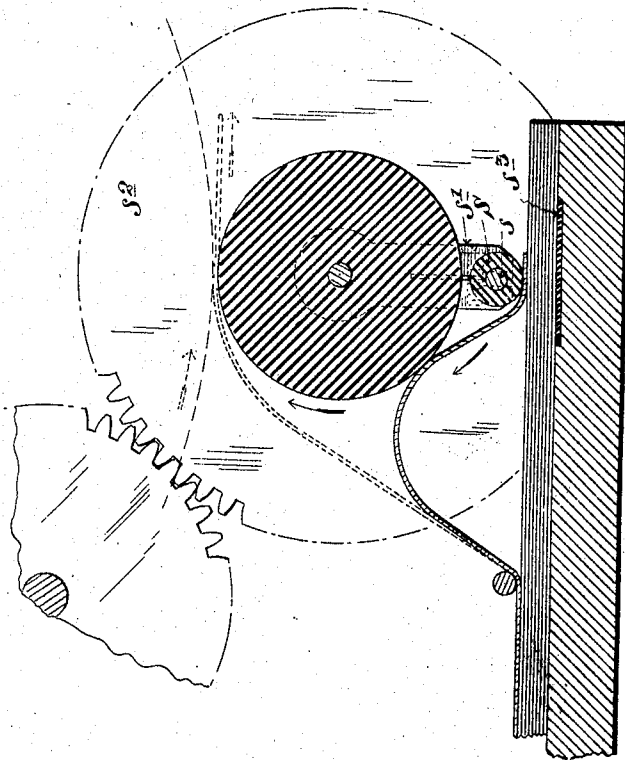
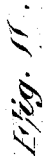
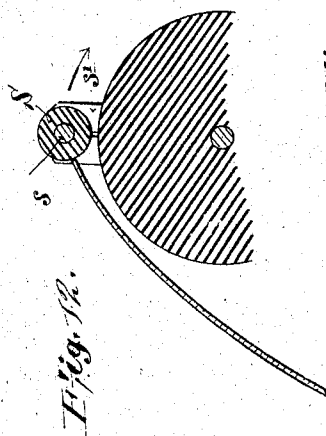
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3 SHEETS--SHEET 3.



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# UNITED STATES PATENT OFFICE.

EDWIN AUSTIN COX, OF LONDON, ENGLAND, ASSIGNOR TO A. B. DICK COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## DUPLICATING APPARATUS.

No. 815,905.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed December 23, 1904. Serial No. 238,094.

### *To all whom it may concern:*

Be it known that I, EDWIN AUSTIN COX, a subject of the King of Great Britain, residing at London, England, have invented a certain new and useful Improvement in Duplicating Apparatus, of which the following is a specification.

This invention relates to duplicating apparatus, and particularly to that type of such apparatus in which is employed a rotating drum having a perforated stencil-carrier extending over a portion of its periphery and upon which the inking-pad and stencil-sheet are secured.

The object of the invention is to increase the efficiency of machines of this type in several respects hereinafter noted. One of these respects concerns the means for feeding the impression - paper to the stencil - carrying drum to receive the print from said stencil. Under the present invention means are employed whereby such paper may be fed by hand, as is usual in machines of this type, or automatically and as the result of the operation of the stencil-carrying drum itself. For the latter purpose there is employed, preferably in conjunction with the pressure-roller which commonly underlies the drum, an automatic paper-feeding device which may be thrown to operative or inoperative position and which when in operative position coacts with the forward edge of the top sheet of a paper pile to feed the same between the stencil-carrying drum and the pressure-roller in order that the surface thereof may receive the impression from the stencil carried by said drum.

Other features and advantages of the apparatus will appear from the following description.

In the drawings illustrating a preferred form of the invention, Figure 1 is a side elevation of the duplicating apparatus, certain superfluous structural elements thereof being omitted. Fig. 2 is a central vertical section taken on the line indicated by the arrows in Fig. 6. Fig. 3 is an enlarged detail view looking upward from the lower end of the roller F as seen in Fig. 6, the arm E' being removed. Fig. 4 is an enlarged detail view taken just inside the sprocket-wheel G' looking downward as seen in Fig. 6. Fig. 5 is a detail view illustrating particularly the con-

struction of the mechanism for operating the feed-board. Fig. 6 is a horizontal section taken on the line indicated by the arrows in Fig. 1. Fig. 7 shows in cross-section a portion of the apparatus shown in Fig. 2, but illustrating what may be termed the "second" stage in the feeding of the sheet from the pile. Fig. 8 is an enlarged detail view illustrating what may be termed the "third" stage in the feeding of such sheet. Fig. 9 is a detail view illustrating the drum-contained paper-stop in stopping position. Fig. 10 is an enlarged detail illustrating a modification in the construction of the sheet-feeder. Fig. 11 is a transverse section of the mechanism shown in Fig. 10 on the line indicated by the arrows in said figure. Fig. 12 is an enlarged detail of the pressure-roller, sheet-feeder, and sheet illustrated in Figs. 10 and 11; and Fig. 13 is a fragmentary side elevation showing the mechanism for elevating and depressing the pressure-roller.

Referring to the drawings, in which similar letters denote corresponding parts, A designates the base of the machine carrying the frame, which comprises mainly the side members A' A<sup>2</sup>. The drum B is loosely mounted upon the shaft b', secured to the side members of the frame by set-screw b<sup>2</sup> or other suitable means. The heads of the drum are here shown as connected by the perforated stencil-carrier b<sup>3</sup>, over which extends the ink-pad b<sup>4</sup>, the stencil-sheet b<sup>5</sup> being secured outside of said pad by any suitable means.

The inner face of each of the drum-heads is provided with a cam-track c, with which coact sheaves c', carried by the shaft c<sup>2</sup> of the ink-distributing roller C. Said shaft c<sup>2</sup> is journaled in segmental arms c<sup>3</sup>, pivoted at b<sup>4</sup> to radial arms c<sup>5</sup>, formed integral with or secured to collars c<sup>6</sup>, which in turn are secured to the shaft b' by set-screws c' or other suitable means. Coil-springs c<sup>8</sup> connect the distant ends of said segmental arms c<sup>3</sup> with said collars, exerting a tendency to draw said distant ends inwardly toward the center of the drum, and consequently to force said ink-distributing roller C outwardly into contact with the stencil-carrier b<sup>3</sup> and its sheaves c' into contact with said cam-track c.

D D designate paper-stop cams formed upon the inner faces of the heads of the drum

B.  $d$  designates the paper-stop. This is carried by vertical arms  $d'$ , having slots  $d^2$ , through which the shaft  $b'$  extends, and at their upper ends sheaves  $d^3$ , coacting with said cams D. A cross-rod  $d^4$ , directly underlying the shaft  $b'$ , connects the paper-stopping supporting arms  $d'$ .  $d^5$  designates a catch carried by said shaft  $b'$  and movable to operative and inoperative positions relatively to said cross-rod  $d^4$ . When in operative position, this catch elevates said cross-rod, and thereby correspondingly elevates the supporting-arms  $d'$  of the paper-stop. In this position the sheaves carried by said arms do not coact with the paper-stop cams D, and said stop is therefore in inoperative position. To bring said paper-stop to operative position, the cross-rod  $d^4$  may be released from the catch, (see Fig. 9,) whereupon said sheaves  $d^3$  will coact with said stop-cams D in order to alternately raise and lower the paper-stop  $d$ . The coaction of said cams D and sheaves  $d^3$  results in the elevation of the paper-stop  $d$  when that portion of the drum which is covered by the stencil is passing in contact with the pressure-roller which underlies the drum. (See Fig. 2.) As the covered portion of the drum passes the impression-roller the curved portions of the cams D cease to coact with the sheaves  $d^3$ , whereupon the stop-carrying arms  $d'$  are free to descend so as to move the stop  $d$  to paper-stopping position. In this position, Fig. 9, it directly overlies the pressure-roller in order that the sheets may be fed against the same and there brought to a rest until the covered portion of the periphery of the drum comes in contact with the sheet and carries it through the machine under pressure from said pressure-roller. In order to guide the stop-carrying arms  $d'$  in this vertical movement, I prefer to employ guide-arms  $c^9$ , extending between the pivotal points  $c^4$  and the points  $c^{10}$ , where said arms are pivotally attached to said stop-supporting arms  $d'$ .

It will be understood that the paper-stopping device above described is intended to be released (by means of the catch  $d^5$ ) only when the impression-sheets are to be fed by hand. Under this condition the feed-board shown in the drawings and presently to be described is rearranged in order that the sheets passed over the same may be moved substantially on the same plane as the point of contact between the drum and pressure-roller, so as to abut against the paper-stop  $d$  when the same is in its lowermost position.

E designates a rock-shaft journaled at either end in the side members  $A'$   $A^2$  of the frame of the machine. Secured to this rock-shaft are arms  $E'$   $E^2$ , in the forward ends whereof is journaled the shaft  $e$  of the pressure-roller F. To the arm  $E^2$  is pivoted a vertically-reciprocating bar G, slotted at  $g$  to receive the shaft  $b'$  and provided with a

sheave  $g'$ , coacting with a cam  $g^2$ , formed upon the outer face of a pinion  $g^3$ , moving with the drum. Said pinion  $g^3$  is operated by a pinion  $g^4$ , actuated by the crank and handle  $g^5$ . The shaft of said pinion  $g^4$  is supported by the side member  $A^2$  of the frame and carries in addition to said pinion a sprocket-wheel  $g^6$ , which through the endless chain  $g^7$  transmits motion to a sprocket-wheel  $g^8$ , secured to the shaft  $e$  of the pressure-roller F. The coaction of the cam  $g^2$  and sheave  $g'$  causes the depression of the pressure-roller F against the tension of the vertically-arranged coil-spring (shown in Fig. 1) after the covered portion of the drum has passed said pressure-roller and keeps it depressed until the covered portion of the drum again comes into juxtaposition to said pressure-roller. Also said coaction of the cam  $g^2$  and sheave  $g'$  causes the movement of said rock-shaft for the purpose hereinafter explained.

II II' designate collars loosely mounted upon the shaft  $e$  of the pressure-roller F and on either side of said pressure-roller. To these collars is detachably secured the paper-feeder I, here shown in the form of a bail, the ends whereof are turned at a right angle to the main body, such ends being detachably secured to the collars II II' by means of the screws  $i$ . The body portion of said bail is preferably provided with a rubber covering  $i^7$ . The collar II' is provided with a projection  $h$ , extending outwardly and almost to the inner face of the sprocket-wheel  $g^8$ , and coacting therewith is a clutch, whereby said collars may be caused to rotate on the shaft  $e$  with said sprocket-wheel  $g^8$ . In the present embodiment of the invention this clutch takes the form of a bell-crank lever  $h'$ , pivoted at  $h^2$  to the inner face of said sprocket-wheel  $g^8$ , one end of said lever being provided with the operating finger-piece  $h^3$ , the other end  $h^4$  being movable by said finger-piece into the path of the projection  $h$  upon the collar II'. The construction here presented is illustrated in detail in Figs. 3 and 4. When the impression-sheets are to be fed by hand, (the cross-rod of the paper-stopping arms being then released from the catch  $d^5$ ), the clutch  $h'$  is moved to inoperative position, so that the sheet-feeder will not move with the shaft  $e$  of the pressure-roller, but will assume a stationary position below and back of said roller. This is done by grasping the finger-piece  $h^3$  and turning clutch member  $h'$  on its pivot until its end  $h^4$  is carried to such a position that as gear  $g^8$  is rotated the end  $h^4$  of the clutch member does not engage the projection  $h$  on the collar II', to which one end of bail I is connected. Movement of clutch member  $h'$  in the opposite direction carries its end  $h^4$  to such a position that as gear  $g^8$  is rotated the end  $h^4$  engages projection  $h$ , and thus causes collar II', bail I, and col-

lar H to rotate with gear  $g^8$ . When the parts are in this position, the bail I may drop by gravity through approximately a half-revolution after moving above the pressure-roller past the position in which the bail is vertically disposed, the collars H H' turning loosely on shaft  $e$ .

L designates a rock-shaft, which, like the shaft E, is mounted at each end in the side members A' A<sup>2</sup> of the frame. Intermediate of its ends (see Figs. 5 and 6) it is provided with the flat feed-board support  $l$ , to which is secured one end of the arm  $l'$ , the other end of said arm being pivoted to a paper-guide  $l^2$  in the form of a bell-crank lever, the extension  $l^3$  thereof operating, as shown in Fig. 2, to determine the degree to which the sheet pile may be moved inwardly in placing the same in operative position. The feed-board  $l^4$  when the machine is designed for automatic feeding rests upon the support  $l$ . It is also provided with perforations through which extend pins  $l^5$ , carried by the rock-shaft L. Said feed-board is preferably provided with the adjustable end guide  $l^6$  and adjustable side guide  $l'$  for determining the position of the paper.

M designates a crank-arm secured to one end of the rock-shaft L outside the side member A' of the frame.  $m$  designates a cam-lever pivoted at  $m'$  to the side member A' of the frame, and  $m^2$  designates a connecting-arm having slot-and-pin connections  $m^3$   $m^4$  with the crank-arm M and cam-lever  $m$ . The cam-lever  $m$  is designed for manual manipulation to throw the feed-board to operative and inoperative positions. The normal position of the parts is illustrated in Fig. 5, in which the cam-lever  $m$  is shown as having been moved rearwardly. This brings the feed-board to a very considerable downward incline, throwing the paper-guiding extension  $l^3$  to approximately a right angle relatively to such board. The sheet pile may now be placed upon the board, its forward edge resting against such extension  $l^3$ , and the cam-lever  $m$  moved forwardly. This rocks the shaft L, moving the feed-board to the position in which it is shown in Figs. 1, 2, 7, and 8, the forward end of the sheet pile then directly underlying the pressure-roller F. If now the clutch  $h$  be moved to engaging position, so as to cause the collars H H' to move with the pressure-roller shaft  $e$ , the sheet-feeder I, carried by said collars H H', will be rotated around said pressure-roller F. Its operation and the result thereof are clearly shown in Figs. 2, 7, and 8, illustrating different stages in the feeding of a sheet from the top of the pile. Said feeder comes in contact with the uppermost sheet near its forward edge and tends to move said edge backward. The entire sheet is precluded from such backward movement by the end guide  $l^6$ . The continued movement of the feeder I, there-

fore, buckles only the forward portion of the uppermost sheet, as illustrated in Fig. 2.

The quantum of curvature may be determined by the pressure of the hand upon the top of the sheet pile, or in lieu thereof I may employ a detachable pressure device, such as that illustrated in the drawings and comprising the rod N, the angular downturned ends  $n$  whereof engage with perforations  $n'$ , formed in feed-board  $l^4$ . The continued movement of the feeder I brings the forward edge of the uppermost sheet to the position shown in Fig. 7. At this time, as will be seen, the covered portion of the periphery of the drum B has passed on from the point of contact with the pressure-roller F. As the feeder I therefore moves out of contact with the forward edge of the uppermost sheet said edge falls, by reason of the elasticity of the sheet, upon the periphery of the pressure-roller F, which through the operation of the cam  $g^2$ , sheave  $g'$ , and vertically-reciprocating bar G will have been depressed at this stage in the rotation of the drum B. The rotary movement of the feeder I is continued, but without feeding effect, until the same again comes into contact with the sheet pile. As the forward edge of the stencil comes in contact with the pressure-roller F (said roller having been raised to operative position to permit this) the forward edge of the topmost sheet is grasped between the pressure-roller and the stencil-covered periphery of the drum and fed rearward, the printing being impressed upon the surface thereof by the ink forced through the stencil-carrier  $b^3$ , the pad  $b^4$ , and the stencil  $b^5$ . This coaction is illustrated in Fig. 8. (For the sake of clearness the thickness of the sheets of the pile is much exaggerated in the drawings.)

O O designate fingers carried by the rock-shaft E, the ends thereof extending to a position immediately over the forward edge of the sheet pile. Said fingers press upon the forward edge of the pile, depressing such edge as the forward edge of the uppermost sheet is removed therefrom by the feeder I, thereby assisting in the separation of such uppermost sheet from the pile and preventing the lateral edges of the sheet from curling upwardly. Also mounted upon said rock-shaft E and outside the side member A' of the frame is an adjustable arm  $o$ , the free end whereof underlies a cam  $o'$ , formed on the cam-lever  $m$ . When said cam-lever is thrown to the position shown in Fig. 5, the coaction of its cam  $o'$  with the arm  $o$  rocks the rock-shaft E, thereby depressing the arms E' E<sup>2</sup>, and consequently the pressure-roller mounted in those arms.

In order to permit paper of varying thickness to be employed with the automatic feed herein described, a variable spring-tension is employed in connection with the feed-board and this is clearly shown in Fig. 1. It com-

prises in the present instance a coil-spring P, one end whereof is secured to the crank-arm M. Its other end is secured to a rod  $p$ , provided with a series of notches  $p'$ , coacting with a stop  $p^2$ , the end of said rod being provided with a finger-piece  $p^3$ . To increase or diminish the tension with which the rearward end of the feed-board is pressed upwardly, it is only necessary to lift the rod  $p$  from engagement with the stop  $p^2$  and to again engage said rod with said stop by means of a different one of the several notches  $p'$  formed therein.

The position in which the feed-board is shown in the drawings is the position which it occupies when the machine is arranged for automatic feeding. To cut out the automatic feeder and feed the sheets by hand, the cross-rod  $d^4$  of the paper-stop-carrying arms is released from the catch  $d^5$ , so that the paper-stop  $d$  shall occupy stopping position from the time the rear end of the stencil ceases to coact with the pressure-roller until the time when the forward end of the stencil commences to coact with said roller. The feed-board  $b^4$  is removed from the support  $l$  and pins  $l^5$  and placed in the machine so that its lateral edges shall rest upon the supporting-pins  $r$ , the rearward end being prevented from moving upward by a pin  $r'$ . This position of the feed-board is illustrated in dotted lines in Fig. 2.

In Figs. 10, 11, and 12 I have illustrated a somewhat different method of mounting and operating the sheet-feeder, whereby the same is driven with a continuous positive movement around the pressure-roller rather than allowed to fall after passing its highest point on completing the feeding of the sheet. In this modification the feed-roll S is mounted upon a shaft  $s$ , the ends whereof are journaled in the arms  $s'$ , which in turn are mounted upon the shaft of the pressure-roller. There is a connection of any suitable form between one of the arms  $s'$  and a gear  $s^2$ , driven by the movement of the drum of the duplicating apparatus in any suitable manner. For instance, this gear may mesh with a corresponding gear carried by one of the heads of the drum, means being provided for throwing said gears into and out of operative relation, accordingly as the machine is to be used for automatic feeding or for manual feeding. The operation of the feed-roll is clearly illustrated in Fig. 11, wherein said roll is shown as having engaged with, pressed backward, and buckled the top sheet of the pile. The continued movement of the roll S brings the sheet to the position indicated in full lines in Fig. 12 and in dotted lines, Fig. 11, where it is caught between the pressure-roller and the stencil-carrying drum and thence passed out of the machine in the manner above described.

If desired, the feed-board may be provided

at a point directly under the pressure-roller with a facing  $s^3$  of rubber or other elastic material.

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

1. In duplicating apparatus, the combination with a drum and a pressure-roller, of a rotary sheet-feeder in juxtaposition to said roller, operating around the same and supported from the shaft thereof, said sheet-feeder comprising a rod having a covering of elastic material such as rubber, substantially as set forth.

2. In duplicating apparatus, the combination with a drum and a pressure-roller having a shaft, of collars carried by said shaft, and a sheet-feeder carried by said collars and comprising a rod having a covering of elastic material such as rubber, substantially as set forth.

3. In duplicating apparatus, the combination with a drum, of a shaft below said drum and means for transmitting motion thereto, a pressure-roller mounted upon said shaft, a sheet-feeder loosely carried by said shaft and comprising a rod having a covering of elastic material such as rubber, and a clutch between said sheet-feeder and said shaft, substantially as set forth.

4. In duplicating apparatus, the combination with a drum and a roller, of a feed-board, a rock-shaft for supporting the same, means for actuating said shaft, and a pivoted paper-guide coacting with said feed-board, substantially as set forth.

5. In duplicating apparatus, the combination with a drum and pressure-roller, of an adjustable feed-board and a paper-guide coacting therewith, and means for simultaneously throwing said feed-board and said pressure-roller to operative or inoperative position, substantially as set forth.

6. In duplicating apparatus, the combination with a drum and pressure-roller, of mechanism for automatically feeding successive sheets between said drum and roller, and means for throwing said mechanism out of operative relation and for manually feeding sheets between said drum and roller, said means including a feed-board and mechanism for supporting the same in different positions relatively to said drum and pressure-roller, substantially as set forth.

7. In duplicating apparatus, the combination with a drum and roller, of means for automatically feeding sheets between said drum and roller, and mechanism for throwing such automatic feed out of operative condition, a feed-board and means for supporting the same in one position when said automatic feed is in operative condition and in another position to adapt the same for the manual feeding of sheets between said drum and roller, substantially as set forth.

8. In duplicating apparatus, the combination with a drum and roller, of means in juxtaposition to said roller for automatically feeding sheets between the same, and a feed-  
5 board for supporting such sheets, the same having a facing of elastic material such as rubber, directly underlying said roller, substantially as set forth.

10 9. In duplicating apparatus, the combination with a drum and roller, of means in juxtaposition to said roller for automatically feeding sheets between the same, and a feed-

board for supporting such sheets, the same having a facing of elastic material such as rubber arranged directly below said automatic feeding means and underlying said roller, substantially as set forth. 15

This specification signed and witnessed this 28th day of November, 1904.

EDWIN AUSTIN COX.

Witnesses:

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A. NUTTING.