C. M. KNEPPLER.

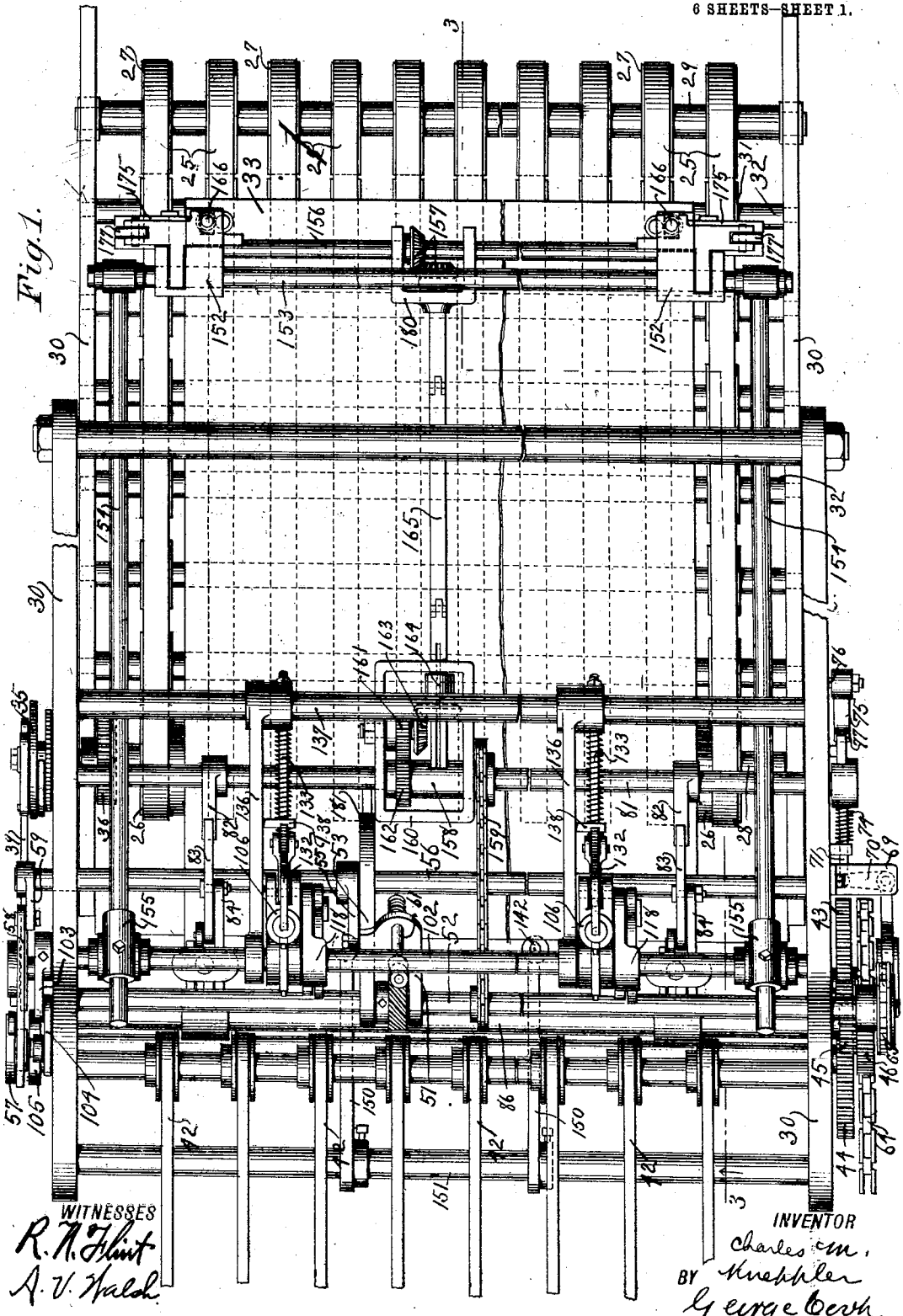
SHEET FEEDING MECHANISM FOR PRINTING PRESSES.

APPLICATION FILED NOV. 29, 1911.

1,044,665. **Patented Nov. 19, 1912.**

6 SHEETS—SHEET 1.

Fig. 1.



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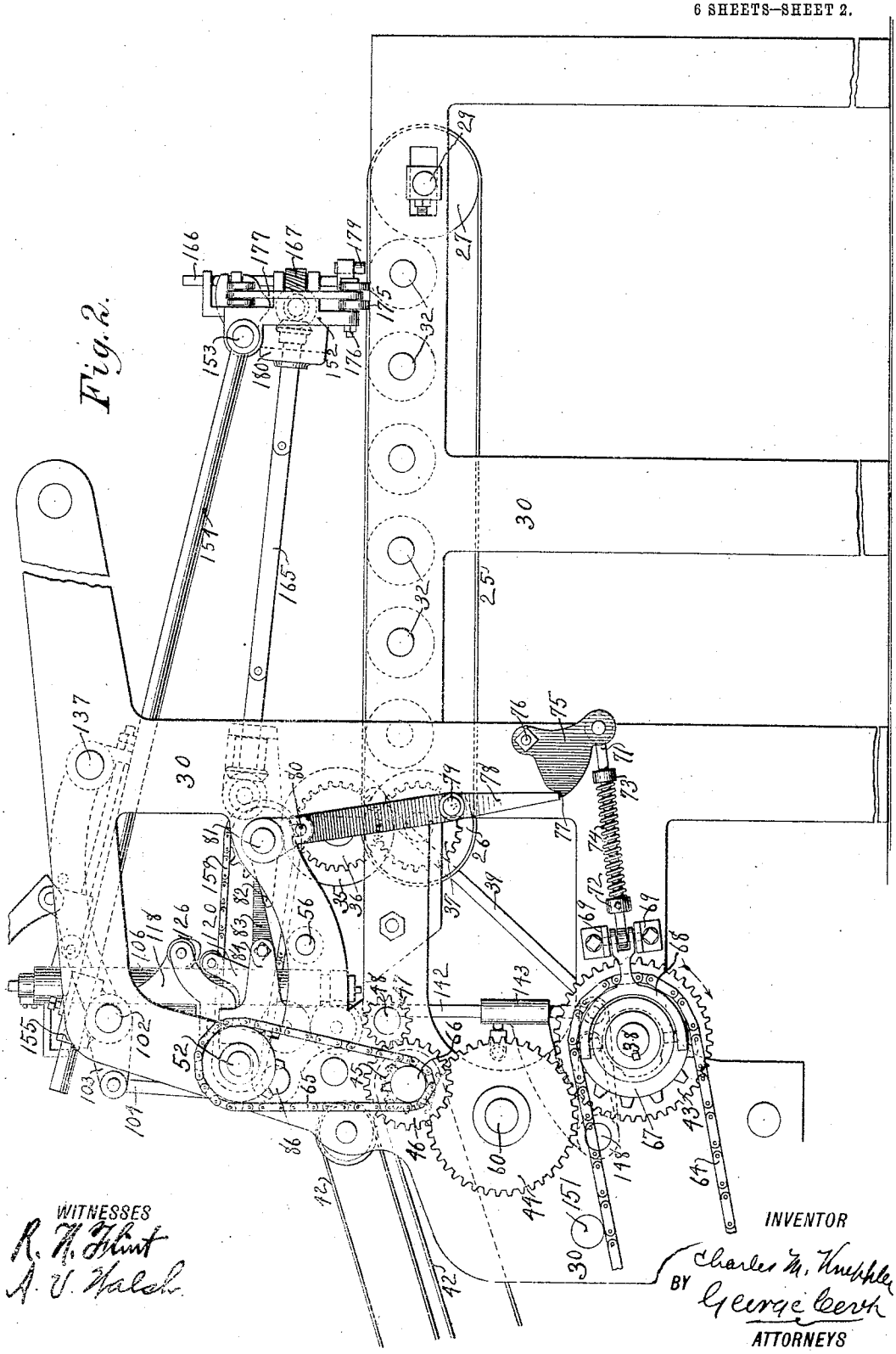
6 SHEETS—SHEET 2.

Fig. 2.



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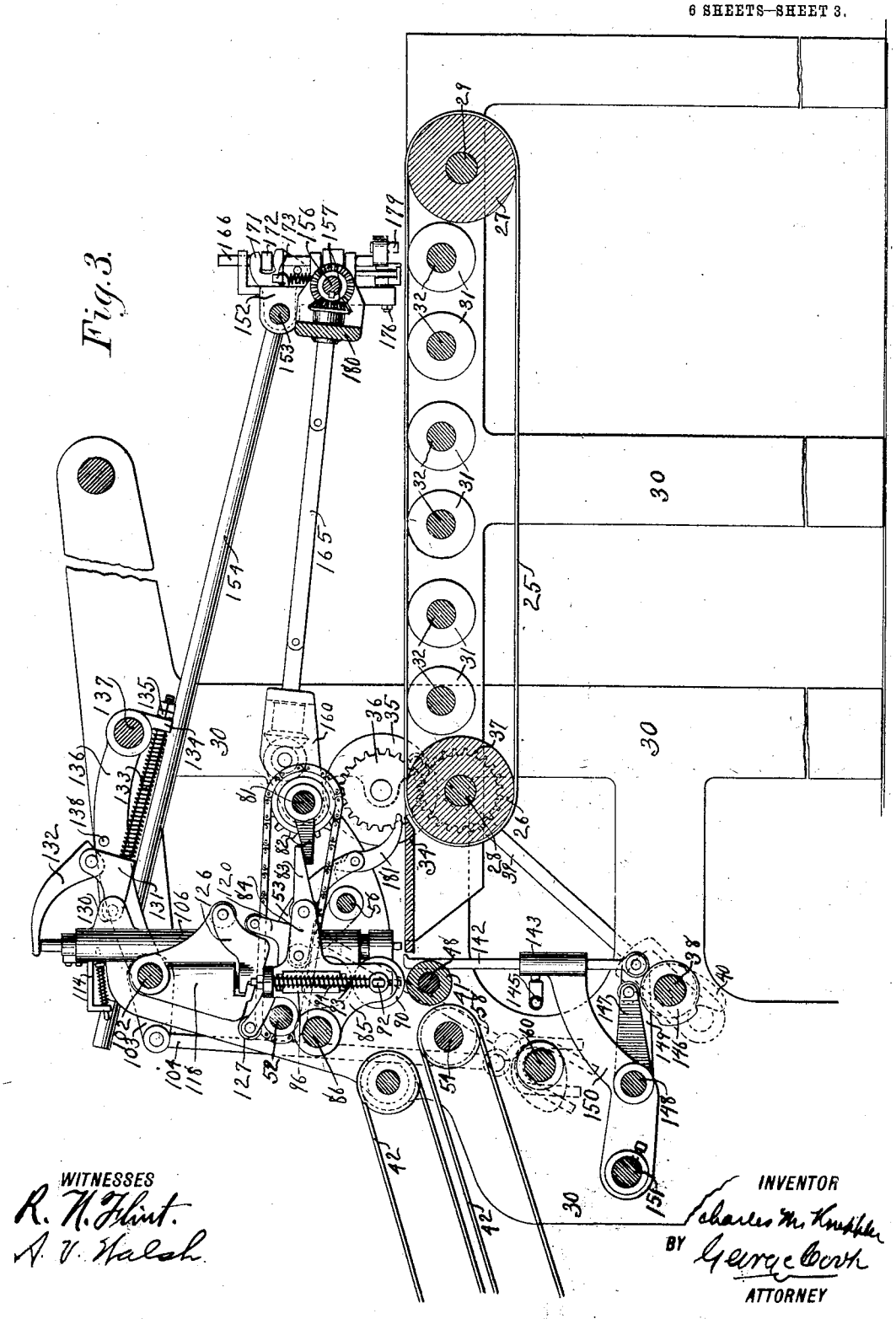
6 SHEETS—SHEET 3.

Fig. 3.



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6 SHEETS—SHEET 4.

Fig. 4

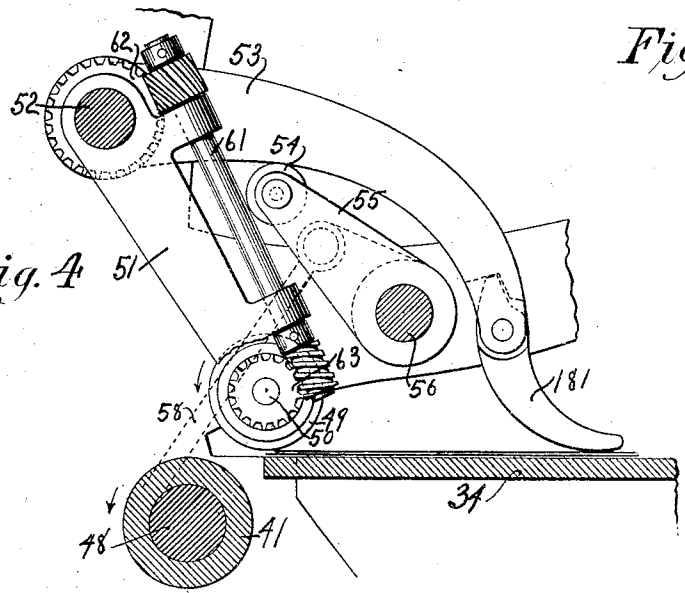


Fig. 5.

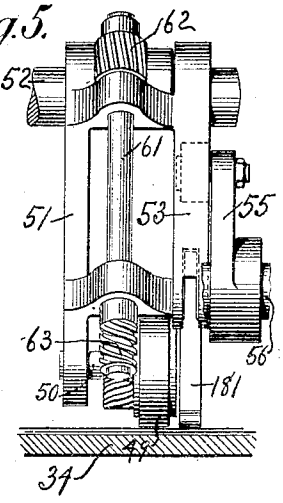


Fig. 6.

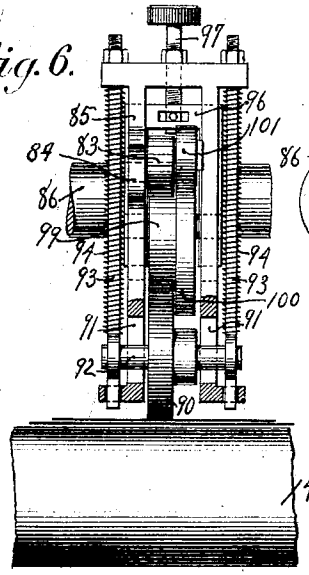


Fig. 7.

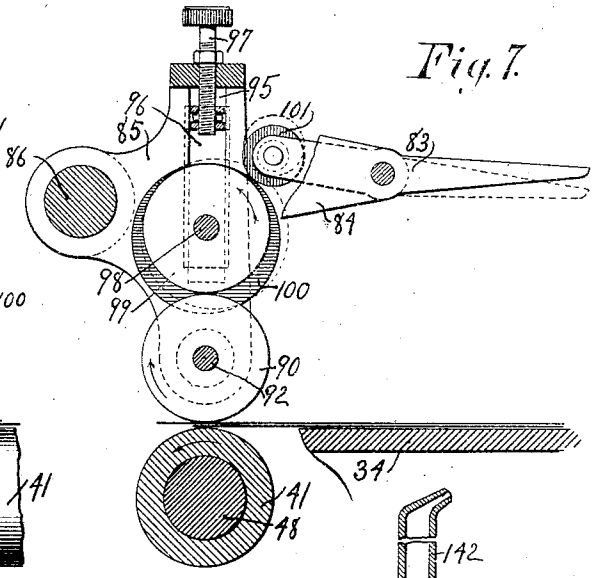


Fig. 8.

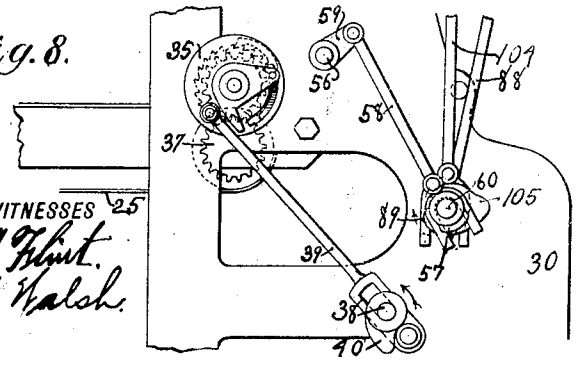
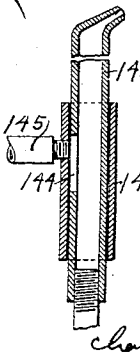


Fig. 9.



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6 SHEETS—SHEET 5.

Fig. 12.

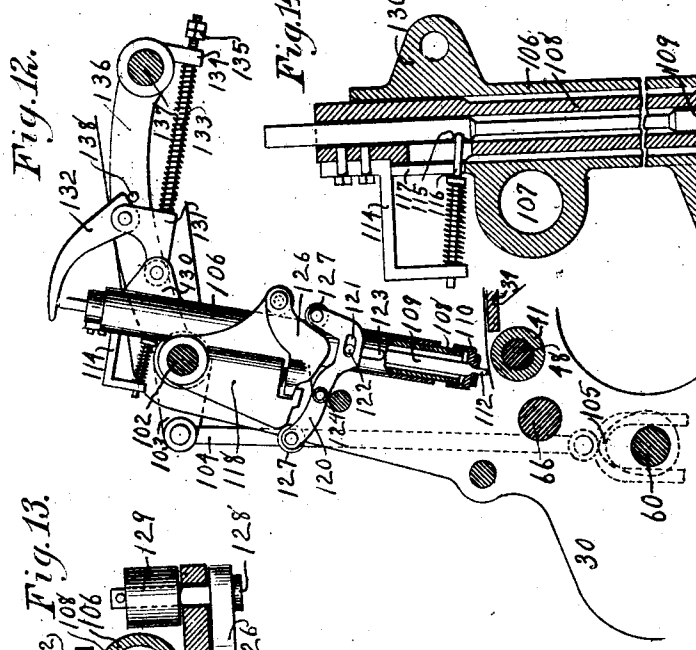


Fig. 14.

Fig. 13.

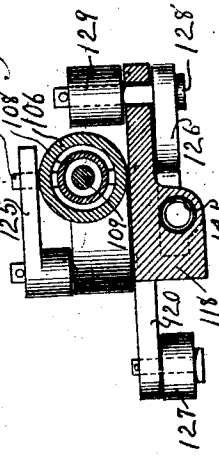


Fig. 15.

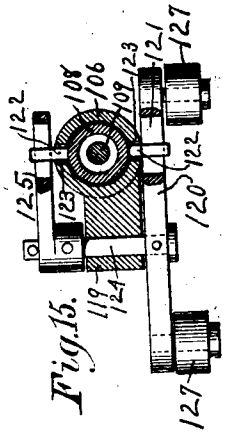


Fig. 11.

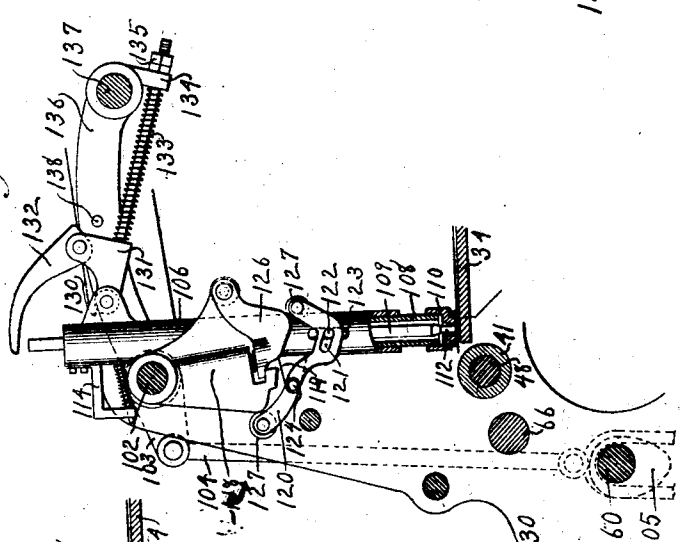
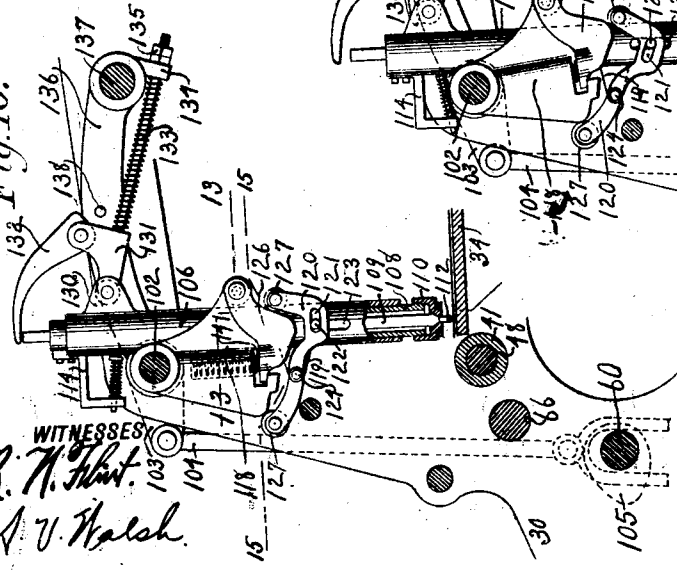


Fig. 10.



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6 SHEETS—SHEET 6.

Fig. 16.

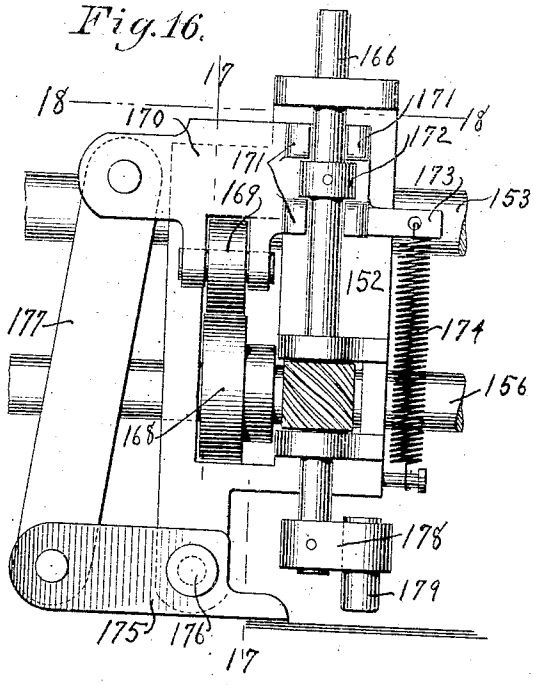


Fig. 17.

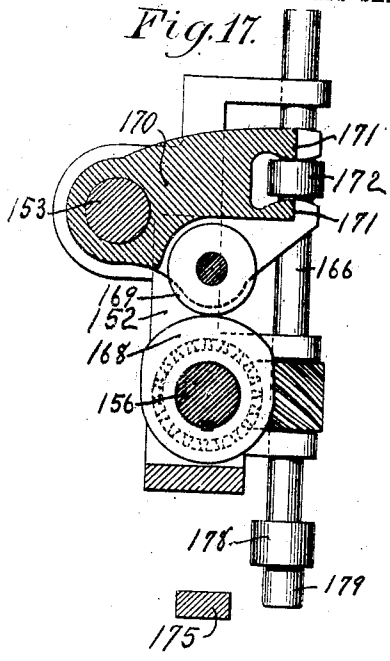


Fig. 18.

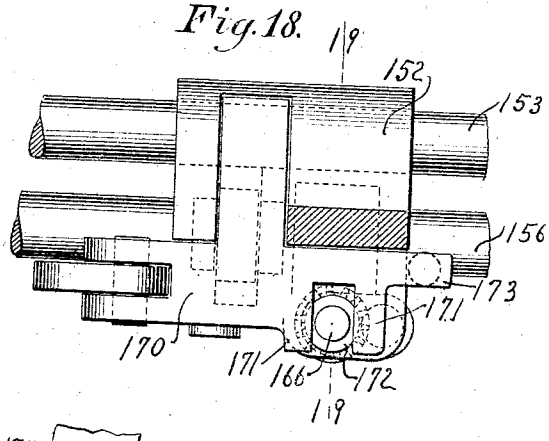
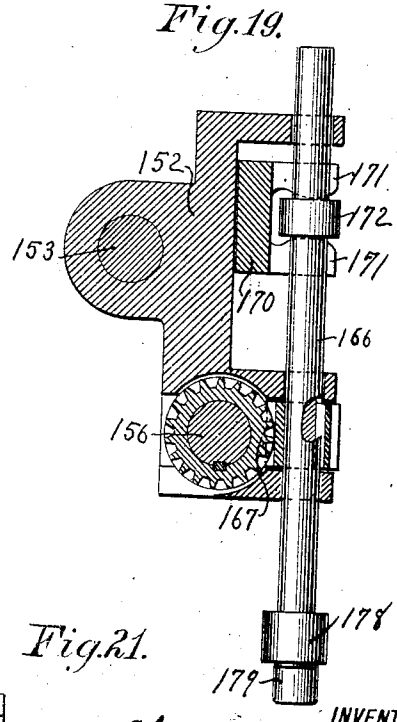


Fig. 19.



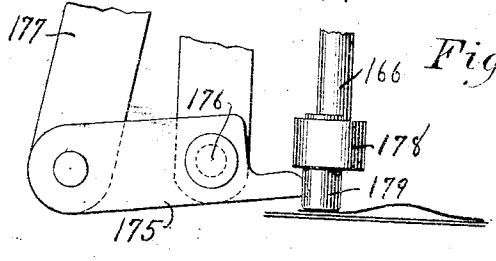


Fig. 20.

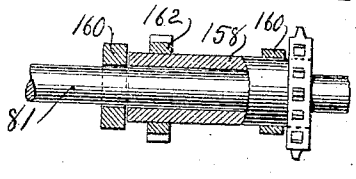


Fig. 21.

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UNITED STATES PATENT OFFICE.

CHARLES M. KNEPPLER, OF NEW YORK, N. Y.

SHEET-FEEDING MECHANISM FOR PRINTING-PRESSES.

1,044,665. Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed November 29, 1911. Serial No. 663,067.

To all whom it may concern:

Be it known that I, CHARLES M. KNEPPLER, a citizen of the United States, and a resident of New York, borough of Brooklyn, in the county of Kings and State of New York, have made and invented certain new and useful Improvements in Sheet-Feeding Mechanism for Printing-Presses, of which the following is a specification.

My invention relates to sheet feeding mechanism for printing presses of the type designed to print upon separate and distinct sheets of paper, as distinguished from presses designed to print upon a continuous web; and the objects thereof are to provide sheet feeding means dependent upon the pressure of the atmosphere for grasping the separate sheets in succession, separating them from other sheets of a pile of sheets, and moving them in position to be engaged by feed rollers whereby they are advanced toward the press; to provide means dependent upon a current of air for facilitating the separation of the sheets in succession from the sheets beneath them; to provide means for separating the rear end of each top sheet in succession of the sheets upon which it rests in order that the top sheet may be more readily moved toward the feeding rolls and the press by the sheet feeding means first above referred to; to provide means for arresting the operation of the entire sheet feeding mechanism in case two or more sheets are simultaneously advanced toward the press; to provide means for straightening the sheets before they are advanced to the feeding rolls, in case one side of the sheet should be in advance of the other; and to provide such other improvements in and relating to sheet feeding mechanism of the type above referred to as are hereinafter described and illustrated in the drawings accompanying this application, and claimed in the concluding claims.

While in describing my invention I refer to the sheet feeding mechanism as used in connection with a printing press, thereby implying that the sheets are printed upon, my invention is equally applicable for the purpose of feeding separate sheets to a machine which operates upon them otherwise than by impressing printed matter upon their surface, as, for example, to machines which form boxes, envelops, blanks of various forms and for various uses, or other articles of manufacture from the sheets; and the sheets operated upon may be either paper as that term is commonly understood, or a material other than paper.

In the accompanying drawings wherein the preferred embodiment of my sheet feeding mechanism above referred to is shown; Figure 1 is a view showing my improved sheet feeding mechanism in plan; Fig. 2 is a view showing the same in side elevation; Fig. 3 is a view showing a section taken upon a vertical plane indicated by the line 3—3, Fig. 1; Fig. 4 is a fragmentary view showing a side elevation of means for straightening the sheets before they are grasped and advanced to the feeding rolls; Fig. 5 is a view showing the same as seen from a position to the right of Fig. 4; Fig. 6 is a fragmentary view showing a portion of the means for arresting the operation of the entire sheet feeding mechanism in case two or more sheets are advanced at the same time; Fig. 7 is a similar view showing a section of the same mechanism upon a vertical plane transverse to the feeding rolls; Fig. 8 is a fragmentary view showing certain operating mechanism whereby several of the separate parts of my device are operated; Fig. 9 is a view showing a detail of certain pneumatic means for separating the sheet being fed from a pile of sheets upon which it rests; Fig. 10 is a fragmentary view showing pneumatic means for grasping the separate sheets and advancing them to the feed rolls; Fig. 11 is a similar view illustrating the same mechanism with the parts in a second position; Fig. 12 is a similar view illustrating the same mechanism with the parts in a third position, the sheet having been carried into a position between the feed rolls; Fig. 13 is a view showing a section upon a transverse plane indicated by the line 13—13, Fig. 10; Fig. 14 is a view showing a section upon a central vertical plane of a portion of the pneumatic feeding means shown in Figs. 10 to 13; Fig. 15 is a view showing a section upon a transverse plane indicated by the line 15—15, Fig. 10; Fig. 16 is a view showing certain mechanism for separating the rear end of each sheet from the pile of sheets upon which it rests, this view showing the mechanism in question as seen from a position to the right of Figs 1, 2 and 3; Fig. 17 is a view showing the same mechanism partly in section and partly in side elevation; this view being taken upon the plane

indicated by the line 17—17, Fig. 16, looking toward the right; Fig. 18 is a view showing the same mechanism partly in section and partly in elevation, this view being taken upon a plane indicated by the line 18—18, Fig. 16, looking down; Fig. 19 is a view showing a section taken upon a plane indicated by the line 19—19, Fig. 18; Fig. 20 is a view showing a portion of the mechanism shown in Fig. 16 with the parts in another position; and, Fig. 21 is a view showing a detail of the driving connection for operating the mechanism shown in Figs. 16 to 20.

Referring to the drawings, the reference character 25 designates a plurality of tapes or belts, the same passing around pulleys 26—27 supported on shafts 28—29, which in turn are supported in suitable bearings in the frame 30 of the press, these belts or tapes being supported along their length by a series of rolls 31 upon transverse shafts 32, the ends of which are also supported in the frame of the press. These belts serve as supports for a pile of sheets of paper as shown in Fig. 1, where 33 indicates the pile of sheets. The forward end of the pile of sheets rests upon the table 34 which extends across the feeding mechanism.

The pile of sheets of paper is advanced toward the left, Figs. 1, 2 and 3, so as to keep the forward end thereof in position such that the top sheet may be grasped, as hereinafter explained, and advanced toward the press. The means for operating the belts 25 and thereby moving the pile of sheets upon them forward, so as to keep the front ends of the sheets in position to be grasped and moved toward the press, is shown at 35, Figs. 1, 2, 3 and 8, from which motion is transmitted to the transverse shaft 28 through gears 36—37. The mechanism 35 is operated from the main driving shaft 38 through a connecting rod 39 and cam 40.

The mechanism above briefly referred to for rotating the shaft 38 and advancing the tapes or belts 25, and the pile of sheets upon them, forms no part of the invention disclosed and claimed in this present application, as such mechanism, together with other mechanism for feeding sheets of paper to a press is fully described and claimed in my application for patent for sheet feeding mechanism for printing presses, filed October 12th, 1910, Serial No. 586,768.

The reference numeral 41 designates a transversely extending feed roll by means of which individual sheets separated from the pile of sheets upon the tapes 25 and table 34, and advanced by means of pneumatic feeding device which forms a part of my invention, are advanced separately toward the press. The sheets are advanced to the printing mechanism of the press by any suitable mechanism, such, for instance, as the mechanism disclosed and claimed in Letters Patent for feeding mechanism for printing presses, granted to me on March 29th, 1910, No. 953,273; but which advancing mechanism is shown in a conventional manner in the drawing as comprising a series of bands 42. The feed roll 41 is operated continuously from the main driving shaft 38 by means of any suitable gearing, as, for example, the gears 43, 44, 45, 46 and 47, this latter gear being secured to the shaft 48 to which the feed roll 41 is secured, and the roll 41 may be either continuous or made up of a plurality of separate rolls secured to the shaft 48.

The device whereby the individual sheets are straightened before being fed toward the press, in case one side of the sheet is in advance of the other, is shown separately in Figs. 4 and 5, and is shown in the position which it occupies relative to the other elements of my complete sheet feeding mechanism in Figs. 1, 2 and 3. This sheet straightening means will include two such devices as are shown in Figs. 4 and 5, one upon each side of a feeding mechanism, so as to engage each side of the sheet, although only one of the devices in question appears in Fig. 1. Each of the mechanisms above referred to comprises a roller 49 supported upon a shaft 50 at the lower end of a swinging frame 51, which frame is operated from a rotating shaft 52 suitably journaled in the frame 30 of the sheet feeding mechanism, the frame 51 being capable of oscillatory motion about the shaft 52 as a center. The frame 51 is provided with an arm 53, the under side of which arm is engaged by a roller 54 at the free end of an arm 55 secured to an oscillating shaft 56, which shaft is oscillated by means of a cam 57 acting through a reciprocating rod 58 the upper end of which is secured to an arm 59, which arm is secured to the shaft 56. The cam 57 is carried by a transverse shaft 60 which shaft also supports the gear 44 hereinbefore referred to, the shaft 60 being thus driven from the main driving shaft 38. The cam 57 therefore imparts oscillating movement to the shaft 56, and the roller 54 at the free end of the arm 55 secured to such shaft acts upon the under side of the arm 53, thus swinging the frame 51 about the shaft 52 and imparting an up and down movement to the roller 49. A presser-foot 181 is pivotally connected to the free end of the arm 53 and moves with the frame 51.

The roller 49 is driven in the direction shown by the arrow in Fig. 4, that is in a direction opposite to the direction of rotation of the feed roll 41, from which it follows that the periphery thereof will engage the forward edge of the sheets of paper and push the sheets backward, and, it being remembered, that there is one such mecha-

nism as is shown in Figs. 4 and 5 at each side of the sheet, it will be obvious that if one side of the sheet is in advance of the other, that side will be pushed back, and the sheet thus straightened, and the front edge thereof brought into position parallel with the feed roll 41 before the sheet is moved toward the roller and advanced to the press. This action takes place when the roll 49 is in its lowermost position during which time the presser-foot 181 rests upon the pile of sheets, the purpose of the presser-foot being to prevent displacement of the top sheet while the roller 49 is acting upon the sheets.

The mechanism whereby motion is transmitted from the shaft 52 to the roller 49 comprises a shaft 61 supported in bearings carried by the frame 51, which shaft is driven by worm-gearing shown at 62—63; and the shaft 52 is driven by means of a sprocket chain 65 passing around suitable sprockets, one of which is carried by a transverse shaft 66, this latter shaft being driven from the main driving shaft 38 through the gears 43, 44, 45, hereinbefore referred to.

The reference character 64 designates a sprocket chain by means of which the entire sheet feeding mechanism is driven. The sprocket chain 64 passes around a sprocket wheel 67 from which the main driving shaft 38 hereinbefore referred to is driven, there being a suitable clutch of any kind interposed between the sprocket wheel 67 and shaft 38 whereby said shaft may be disconnected from the sprocket wheel and the entire sheet feeding mechanism stopped in case two or more sheets start for the press at the same time. The clutch in question is operated by means of the yoke 68 supported by means of brackets 69 secured to the frame of the machine, which yoke has a projecting arm 70 at the free end of which is connected a rod 71. This rod has a collar 72, and 73 is a guide secured to the frame of the feeding mechanism through which the rod 71 passes. A spring 74 surrounds the rod 71, which spring is under compression and the ends of which rest respectively against the collar 72 and guide 73.

From the above it will be understood that the tendency of the spring 74 is to force the rod 71 toward the left, thereby swinging the free end of the yoke 68 away from the frame of the machine, whereby the clutch will be disconnected and the entire sheet feeding operation interrupted.

The spring 74 is normally under compression as specified, and movement of the rod 71 in the manner above mentioned is restrained by mechanism as follows: The free end of the rod 71 is pivotally connected with a swinging sector 75 supported from the frame at 76 and having a shoulder 77, which shoulder is engaged by the lower end of a lever 78 pivotally secured to the frame at 79. The upper end of this lever is bifurcated and is engaged by a pin 80 carried at the lower end of an arm secured to an oscillating shaft 81. The shaft 81 is provided with one or more arms 82, and 83 is a lever pivotally supported from an arm 84 and the right hand end of which engages the arm 82 as shown in Figs. 1, 2, 3 and 7. The arm 84 projects from a frame member 85 carried by a transverse oscillating shaft 86, the ends of which have bearings in the frame 30 of the machine. The shaft 86 is provided with an arm at one end and 88, (see Fig. 8) is a link the upper end of which is connected with said arm, and the shaft 86 is oscillated to swing the frame member 85 by means of a cam 89 upon the shaft 60 which cam imparts vertical movement to the link 88.

The frame member 85 carries a roller 90 located above the feed roller 41, said roller being vertically movable in slots 91 provided at the lower end of the frame 85. The roller 90 is carried by a shaft 92 the ends of which extend through the slots 91; and the ends of said shaft are supported by spring-pressed rods 93, the upper and lower ends of which move through guides upon the frame member 85, as best shown in Fig. 6. Springs 94 surround the rods 93 and serve to press the roller 90 downward, such downward movement being limited by nuts at the upper ends of the rods as shown in Figs. 3 and 6.

The frame member 85 is provided with slots 95 at its upper portion within which slots a sliding yoke 96 moves and which yoke may be adjusted by a screw 97. The lower ends of the yoke 96 support a shaft 98 upon which is secured a roller 99 and a cam 100, the roller and cam being secured together so as to form in effect a single member; and the roller 99 is located above the roller 90, but is normally out of contact therewith. The rolls 90 and 99 are normally out of contact with one another so that the roll 90 may rotate without imparting motion to the roller 99 and cam 100. This is what occurs when a single sheet only passes between the feed roller 41 and the roller 90. If, however, two or more sheets pass between these rollers at the same time, the roller 90 will be moved upward, this movement being permitted by the springs 94, whereupon said roller engages the roller 99 and rotates together with the cam 100.

The right hand end of the lever 83 carries a roller 101 which is in contact with the cam 100 as shown in Fig. 7, and, it being remembered that the other end of the lever 83 contacts with an arm on the shaft 81, so long as the cam 100 is not rotated the lever 83 remains in the position shown in full lines in Fig. 7, and the lever 78 remains in a position such that its lower end engages the notch 77

of the sector 75, thus preventing the spring 74 from operating the yoke 68 and disconnecting the clutch between the sprocket wheel 67 and main shaft 38. If, however, the roller 90 is forced upward by two or more sheets between it and the roll 41, as above explained, the said roller will engage and operate the roller 99 and cam 100, which cam will operate upon the roller 101 and tip the lever 83 into the position shown in dotted lines in Fig. 7, which action will oscillate the shaft 81 and swing the lower end of the lever 78 free from the notch 77 thus permitting the spring 74 to actuate the clutch and disconnect the driving shaft in the manner hereinbefore referred to.

The yoke 96 and adjusting screw 97 are provided in order that the roller 99 and cam 100 may be adjusted relative to the roller 90 in order to compensate for sheets of varying thickness, and to insure that the clutch will be thrown whenever more than one sheet is advanced toward the press at the same time.

The construction and operation of the means whereby separate and individual sheets are grasped and moved into a position such that they will be seized and forwarded to the press by the feed roll 41 is as follows: The reference numeral 102 designates an oscillating transverse shaft supported in suitable bearings in the frame 30 and having an arm 103 to one end of which is connected a reciprocating rod 104 having a roller at its lower end in engagement with a cam 105 upon the shaft 60. The shaft 102 serves to impart oscillating or swinging motion to one or more pneumatic feeding devices, such as are shown in Figs. 10 to 15; Fig. 1 of the drawing showing my improved sheet feeding mechanism as provided with two of such devices.

Referring to Figs. 10 to 15, 106 is a reciprocating supporting member, the upper end of which is shown as provided with a bearing 107 through which the shaft 102 extends, and whereby said supporting member is carried by said shaft. This supporting member is provided with a longitudinal passage within which fits a reciprocating hollow barrel 108, and within this barrel and movable relatively thereto is a rod 109. The lower end of the barrel 108 is closed by a cap 110 provided with a central passage and a valve seat 111, and the lower end of the rod 109 is shaped to form a valve adapted to coöperate with the seat 111 and thereby control said passage, said rod being prolonged to provide a stem 112 which extends through the passage aforesaid. The lower end of the cap 110 is provided with a rubber washer 113. The upper end of the barrel 108 is provided with a bracket 114, and the upper end of the rod 109 is provided with a depression at 115; and a spring pressed rod 116 is provided, one end of which engages the depression 115 and the other end of which extends through an opening in the bracket 114, which rod swings into positions above and below its normal central position as the rod 109 is moved up and down; the purpose of said spring-pressed rod being to hold the valve rod 109 in either an upper or lower position according to the position into which it is moved as hereinafter explained. The bracket 114 and rod 116 move in a slot 117 provided in the swinging supporting member 106. The reciprocating barrel 108 is moved within the bearing provided for it in the swinging support 106 by means of a swinging cam member 118, secured to the shaft 102, the lower portion of which cam member is shaped to form a cam surface. The swinging support 106 is provided with an arm 119 which carries a pivotally supported lever 120 provided with rollers 127 at each end designed to be operatively engaged by a cam surface at the lower end of the swinging cam member 118. This lever is provided with a slot 121 and the barrel 108 is provided with pins 122 which project through slots 123 in the swinging support 106 and through the slots 121 in the lever 120, so that as said lever is swung upon its pivot 124 the barrel 108 will be moved up and down. I preferably provide the pivot 124 with an arm 125 located opposite the swinging lever 120 so as to prevent binding as the barrel 108 is moved, this arm being provided with a slot similar to the slot 121, as best shown in Fig. 15.

From the above description, it will be understood that as the cam member 118 is oscillated by means of the shaft 102 the reciprocating barrel 108 will be moved downward, the barrel being shown in its upper position in Fig. 10 and in its lower position in Fig. 11.

The cam member 118 is preferably provided with a pivoted yielding portion 126 in order to avoid injury to the parts if the lower end of the cap 110 should contact with an unyielding surface before the cam has completed its swinging motion, this yielding portion of the cam surface being held in position by a spring 141 contained in a barrel formed in the cam member. The pivot 128 whereby the yielding portion 126 of the cam surface is secured to the member 118 is prolonged and carries a stop 129, designed to engage the swinging support 106, it being understood that the cam member 118 may move slightly relative to the support 106, as indicated in Figs. 10 and 11.

Means are provided for moving the valve rod 109 in a downward direction as follows: The upper end of the swinging support 106 is provided with an arm 130 to which is pivotally connected a trip carrying member

131, which in turn carries a pivotally supported trip member 132, the free end of which may engage the upper end of the valve rod 109, as shown. The trip carrying member 131 is held in its left hand position and the supporting member 106 in an upright position by means of a spring 133 acting against an abutment 134 and surrounding a rod which forms a part of the trip carrying member, movement of the rod toward the left, and, consequently, movement of the upper end of the swinging support in the same direction being limited by nuts 135. The abutment 134 is shown as formed on a link member 136 extending between the shaft 102 and a transverse bar 137, which link carries a stop or pin 138; the location of the pin being such that a portion of the trip member 132 engages a pin, as shown in Fig. 12, when the swinging support 106 is swung about the shaft 102, thus forcing the free end of the trip member downward.

The lower end of the barrel 108 is enlarged and provided with a port 139 which is in constant communication with a nipple 140 carried by the swinging support 106, this nipple being connected with any suitable suction device for maintaining a partial vacuum within the lower end of the barrel 108, the upper portion of the valve rods fitting within the barrel tight enough to prevent a flow of air along its length, and the valve 111 at the lower end of the valve rod serving to prevent a flow of air through the opening in the lower end of the cap 110 when it is in engagement with its seat as shown in Figs. 10 and 14.

Such being the construction of the pneumatic sheet feeding device which forms a part of my invention, the operation thereof is as follows: Starting with the parts in the position shown in Fig. 10, the cam member 118 is first swung toward the right during which movement the cam surface at the lower end thereof engages the rolls 127 and swings the lever 120 upon its pivot which lever acts through the pins 122 to move the barrel 108 downward within the swinging support 106, said support being held in an upright position by means of the nuts 135. As the barrel 108 is moved downward the stem 112 contacts with the sheet of paper upon the table 34, whereupon the valve rod 109 is moved upward within the barrel, and the cap 110 is pressed against the paper. A vacuum being maintained in the lower end of the barrel 108 it follows that when the valve 111 is off its seat, the sheet of paper will be held against the lower end of the cap 110, and rubber washer 113, by the external pressure of the atmosphere, the valve rod 109 fitting sufficiently tight in the barrel 108 to prevent a flow of air along the same. The upward movement of the valve rod 109 has carried the right hand end of the spring-pressed rod 116 upward, and the spring surrounding said rod, and acting in an upward direction will serve to hold the valve rod in its upward position until the same is moved down, as hereinafter explained. Fig. 11 shows the position of the parts at the end of the movement of the cam member 118 toward the right. The said member is next moved toward the left, and, as the cam at the lower end thereof moves back over the rolls 127, the lever 120 acts to raise the barrel 108 and lift the forward end of the sheet held against the cap 110 free from the table 34, or from the sheets beneath the particular sheet to be fed to the press, the rod 109 being held in an upward position by the spring-pressed rod 116. During the first portion of the movement of the cam member 118 to the left, the swinging support 106 remains in a vertical position. The stop 129, however, presently engages the swinging support after which the same is swung about the shaft 102 as a center and carried finally into the position shown in Fig. 12. Before reaching this final position, however, the rear portion of the trip 132 engages the pin 138, as shown in Fig. 12, whereupon the free end of said trip member is forced against the upper end of the valve rod 109, whereupon said rod is forced downward and the valve at the lower end thereof brought into engagement with the valve seat in the cap 110 to prevent the flow of air through the opening in said cap when the sheet is released therefrom. During this downward movement of the valve rod, the stem 112 at the lower end thereof engages the sheet of paper being operated upon, thus insuring that the same will be freed from the lower end of the cap. At the end of the downward movement of the valve rod the sheet of paper is freed from the pneumatic feeding device, and its forward end is in position above the feed roller 41, so that it may be grasped between said roller and the roller 90, and forwarded toward the press. Finally the swinging cam member 118 is moved toward the right thus permitting the spring 133 to move the swinging support 106 from the position shown in Fig. 12 into the initial position shown in Fig. 10.

The movements hereinbefore explained of the sheet straightening mechanism shown in Figs. 4 and 5, the two sheet detecting mechanism shown in Figs. 6 and 7, and the pneumatic feeding mechanism shown in Figs. 10 to 15 are timed as follows: The rolls 49 are first lowered to bring them into a position in front of the forward edge of the sheet or pile of sheets, which rollers then engage the forward edge of the sheets to straighten the sheet which is to be fed to the press, after which the rollers are moved upward and away from the sheet as here-

inbefore explained. The rolls 90 are moved away from the feed roll 41 at about the same time that the roll 49 is moved upward. The pneumatic sheet feeding mechanism shown in Figs. 10 to 15 is next operated to grasp a sheet and carry its forward edge into a position above the feed roll 41. Finally the rolls 90 are lowered into contact with the upper surface of the sheet to press the same against the feed roll 41, whereupon said roll advances the sheet toward the press.

The reference character 142 designates a reciprocating pipe the upper end of which is provided with a nozzle adapted to discharge a stream of compressed air along the under surface of a sheet of paper toward the rear end thereof after it has been lifted by the pneumatic feeding device disclosed in Figs. 10 to 15, to thereby more effectively separate the sheet from the pile of sheets beneath it and enable it to be moved forward to the feed rolls 41 with a minimum danger of becoming detached from the pneumatic feeding mechanism. The upper end of this pipe, and the nozzle referred to, are shown in Fig. 9, which figure also illustrates a sleeve 143 through which the pipe moves, and by which it is guided. The pipe in question is provided with a part 144 adapted to register with the discharge end of the compressed air discharge conduit 145 through which air is supplied. The port is preferably so arranged that when the pipe 142 is in its lowermost position air from the conduit 145 will be cut off from the interior of the pipe, although the port may communicate with the pipe 145 at all times if desired. The pipe 142 is moved upward to bring its discharge nozzle in line with the under side of the sheet after the same has been lifted as explained by means of a cam 146 upon the main driving shaft 38, said cam acting upon the free end of an arm 147 secured to an ascillating shaft 148 to which shaft is secured a second arm 149, the free end of which is connected with the lower end of the pipe 142. As many of these pipes 142 and nozzles will be provided as may be found necessary to loosen the sheet from the pile of sheets beneath it, two or more of such pipes being usually arranged across the sheet feeding mechanism. The sleeve 143 is supported by means of an arm 150 supported by the shaft 148 together with a second transverse shaft 151, the shaft 148 fitting loosely in the arm, and the shaft 151 preventing the same from turning about the shaft 148 as a center.

Figs. 16 to 20 inclusive show the mechanism which I provide for separating or loosening the rear end of the sheet to be advanced to the feed roller from the pile of sheets beneath it, and for holding the rear ends of the sheets not being advanced to the feed roll securely in place, so that they may not be displaced as the top sheet of the pile is forwarded toward the press. This mechanism is arranged in duplicate, one upon each side of the rear end of the pile of sheets, as will be understood from Fig. 1. The mechanism in question comprises an upright frame 152 supported by a transverse rod 153, which rod is held in a definite position by means of adjustable radius bars or rods 154; the rear ends of which rods are connected with said frame and the front ends of which pass through sleeves 155 supported upon the shaft 102. The bars 154 are adjustable through the sleeves, so that the rod 153 can be adjusted for different lengths of sheets and the frames 152 held in proper position at the rear end of the pile of sheets. The sleeves 155 are loose upon the shaft 102 so that the frames 152 and mechanism which they carry may be raised so as to rest upon the top of the pile of sheets irrespective of the thickness of the pile, and the said frames descend as the sheets are fed from the pile, the mechanism in question always resting directly upon the upper surface of the sheets. The frames 152 support a transverse driving shaft 156 which shaft is driven through bevel gearing shown at 157 from a rotary sleeve 158 loosely supported upon the oscillating shaft 81, said sleeve being driven from the shaft 52 by means of a sprocket chain 159 and suitable sprocket wheels. The oscillating shaft 81 also supports a frame 160 which frame serves as a support from a stub shaft upon which is located a pinion 161 driven from a similar pinion 162 upon the sleeve 158. Operatively connected with the pinion 161 is a bevel gear 163 which meshes with a second bevel gear 164 in sliding operative engagement with the forward end of a driving shaft 165 through which motion is transmitted to the bevel gears 157, and, consequently to the driving shaft 156. The rear end of the shaft 165 is supported in a frame 180 carried by the shaft 156. The forward end of the shaft 165 is supported in the frame 160 above referred to and said shaft is preferably made in sections, and is preferably made adjustable through the bevel gear 164 by means of a key way and key or equivalent sliding engagement between the shaft and gear, in order that the frames 152 may be adjusted into position to rest upon the rear end of a pile of sheets of different lengths. The frames 152 are provided with bearings in which a rotary and reciprocating shaft 166 is supported, said shaft being driven from the driving shaft 156 by means of worm gearing shown at 167, the shaft being capable of vertical movement with reference to the gearing, but being always in driving engagement therewith as shown. Reciprocat-

ing movement is communicated to the shaft 166 from a cam 168 upon the driving shaft 156, said cam acting upon a roller 169 carried by an oscillating member 170, one end of which member is supported upon the transverse rod 153 while its free end is bifurcated to provide a series of lugs 171 which engage a collar 172 upon the shaft 166. The oscillating member 170 is provided with an arm 173 to which one end of a spring 174 is attached, the purpose of which is to keep the roller 169 in contact with the cam 168. The reference character 175 designates a holding member adapted to engage the pile of sheets and prevent them from displacement while the upper sheet of the pile is being forwarded to the press. This member is shown as in the form of a lever pivotally supported from the frame 152 at 176, and 177 is a link the lower end of which is pivotally connected with the lever 175, while its upper end is connected with the oscillating member 70; from which it follows that as the member 170 is raised by means of the cam 168, the right hand end, referring to Fig. 16, of the holding member 175, will be tipped downward and the free end thereof brought into contact with the pile of sheets of paper. The lower end of the rotary reciprocating shaft 166 is provided with an arm 178 which carries an eccentrically located finger 179, preferably of rubber. It being remembered that the shaft 166 is continuously rotated, the operation of this portion of my sheet feeding mechanism is as follows: The parts being in the positions shown in Figs. 16 and 17, the driving shaft 156 will move the cam 168 from beneath the roller 169 thus permitting the shaft 166 to descend until the finger 179 engages the upper sheet of the pile, whereupon as the shaft rotates the portion of the top sheet engaged by the finger is pushed aside as indicated in Fig. 20, thus loosening the rear edge thereof from the pile of sheets beneath it. The downward movement of the oscillating member 170 after the finger is in contact with the sheets acts to move the free end of the lever away from the pile of sheets as shown, thus leaving them free to be acted upon by the finger 179. As the shaft 156 continues to rotate the cam 168 again engages the roller 169 and lifts the finger 179 from the top sheet, this same movement carrying the link 177 upward and swinging the lever 175 upon its pivot to bring its free end again into engagement with the pile of sheets of paper, from which the upper sheet has been freed, thus preventing displacement of the remaining sheets of the pile during the forward movement of the upper sheet.

The mechanism above referred to is timed relative to the pneumatic feed mechanism for forwarding the top sheet to the feed roll in such a manner that the rear edge of the sheet is operated upon to loosen it as aforesaid at about the same time that the forward end is lifted by means of the pneumatic feed mechanism above referred to, and also at about the same time that the pipe 142 is raised into position to discharge a stream of air beneath the top sheet, from which it follows that the top sheet is effectively loosened or separated from the pile of sheets beneath it throughout its entire length; and, as the same is moved forward toward the press, it moves a layer of air between the sheets; while at the same time the rear ends of the pile of sheets remaining upon the belts 25 are securely held in position and the remaining sheets prevented from being displaced during the feeding operation.

Having thus described and explained my invention, I claim and desire to secure by Letters Patent:—

1. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said roll; a second roll adapted to engage the forward edge of the sheets for straightening them before they are operated upon by said feed roll; and means adapted to operate upon each successive top sheet of the pile after it has been straightened as aforesaid for moving the successive top sheets from the pile and into position to be acted upon by said feed roll.

2. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a second roll adapted to engage the forward edge of the sheets; means for rotating said second roll in a direction opposite to the direction of rotation of said feed roll; and means adapted to operate upon each successive top sheet of the pile after it has been straightened as aforesaid for moving the successive top sheets from the pile and into position to be acted upon by said feed roll.

3. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a second roll adapted to engage the forward edge of the sheets; means for moving said second roll toward and from said sheets; means for rotating said second roll in a direction opposite to the direction of rotation of said feed roll; and means for moving separate sheets from the pile and into position to be acted upon by said feed roll.

4. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press;

means for moving a pile of sheets toward said feed roll; a rotating shaft; means for operating said shaft; a frame carried by said shaft; a second roll carried by said frame and movable toward and from the sheets operated upon; means for rotating said second roll from said rotating shaft and in a direction opposite to the direction of rotation of said feed roll; means for moving said second roll toward and from said feed roll; and means for moving separate sheets from the pile and into position to be acted upon by said feed roll.

5. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a rotating shaft; a frame carried by said shaft and movable about the same as a center; a second roll carried by said frame; spiral gearing interposed between said rotating shaft and said roll and adapted to rotate said roll in a direction opposite to the direction of rotation of said feed roll; an oscillating shaft; means for oscillating said shaft; an arm carried by said shaft and in operative engagement with said frame and by means of which said second roll may be moved toward and from said feed roll; and means for moving separate sheets from the pile and into position to be acted upon by said feed roll.

6. In sheet feeding mechanism for printing presses, a fed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a second roll adapted to engage the forward edge of the sheets before they are operated upon by said feed roll; means for rotating said second roll in a direction opposite to the direction of rotation of said feed roll; a presser-foot adapted to engage the sheets at the time they are being operated upon by said second roll; means for simultaneously moving said second roll and said presser-foot toward and from the pile of sheets; and means for moving separate sheets from the pile and into position to be acted upon by said feed roll.

7. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said roll; a rotary shaft; means for operating said shaft; a frame carried by said shaft and movable about the same as a center; a second roll carried by said frame; gearing interposed between said rotating shaft and said second roll for rotating the latter in a direction opposite to the direction of rotation of said feed roll; a presser-foot carried by said frame; means for oscillating said frame about said rotary shaft to thereby move said second roll and said presser-foot toward and away from the sheets; and means for moving separate sheets from the pile and into position to be acted upon by said feed roll.

8. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a rotary shaft; an oscillating frame supported by said rotary shaft; a second roll carried by said frame; gearing interposed between said rotary shaft and said second roll and adapted to rotate the latter in a direction opposite to the direction of rotation of said feed roll; an arm carried by said frame; an oscillating shaft; an arm carried by said oscillating shaft and the free end of which is in operative engagement with said arm and whereby said frame may be moved about said rotary shaft; and a presser-foot pivotally connected with the free end of said arm and adapted to rest upon the pile of sheets while said second roll is acting upon the sheets.

9. In sheet feeding mechanism for printing presses, a feed roll adapted to forward separate sheets of paper toward a press; means for moving a pile of sheets toward said feed roll; a rotary shaft; an oscillating frame supported by said rotary shaft; a second roll carried by said frame; a shaft carried by said frame; spiral gearing whereby said second roll is driven from said rotary shaft through the shaft upon said frame and in a direction opposite to the direction of rotation of said feed roll; an arm carried by said frame; an oscillating shaft; an arm carried by said oscillating shaft and the free end of which is in operative engagement with said arm and whereby said frame may be moved about said rotary shaft; and a presser-foot pivotally connected with the free end of said arm and adapted to rest upon the pile of sheets while said second roll is acting upon the sheets.

10. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a rotary disk between which and said feed roll the sheets pass, said disk being movable toward and away from said roll; means for intermittently moving said disk toward and from said feed roll; and means engaged by said disk when it moves away from said roll for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

11. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby

said roll may be connected with and disconnected from said driving mechanism, a rotary disk between which and said feed roll the sheets pass, said disk being movable toward and away from said roll; means for intermittently moving said disk toward and from said feed roll; a second rotary disk normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; and means operated by said second disk for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

12. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a rotary disk between which and said feed roll the sheets pass, said disk being movable toward and away from said roll; means for intermittently moving said disk toward and from said feed roll; a second rotary disk normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; a cam operated by said second disk; a lever operated by said cam; and means controlled by said lever for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

13. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a supporting frame; a rotary disk carried by said supporting frame and driven from said feed roll and between which roll and disk the sheets pass; means for intermittently moving said frame in a way to move the disk carried thereby toward and from said roll; a second rotary disk normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll and whereupon said disk will be driven by said first disk; and means operated by said second disk for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

14. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a supporting frame; a rotary disk carried by said supporting frame and driven from said feed roll and between which roll and disk the sheets pass, said disk being movable in said frame toward and away from said roll; a second rotary disk carried by said supporting frame and normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; an oscillating shaft whereupon said supporting frame is carried; means for operating said shaft to thereby move said rotary disks away from said feed roll; and means operated by said second disk for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

15. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a supporting frame; a rotary disk carried by said supporting frame and driven from said feed roll and between which roll and disk the sheets pass, said disk being movable in said frame toward and away from said roll; a second rotary disk carried by said supporting frame and normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; an oscillating shaft whereupon said supporting frame is carried; means for operating said shaft to thereby move said rotary disks away from said feed roll; a cam operated by said second disk; a lever operated by said cam; and means controlled by said lever for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

16. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a supporting frame; a rotary disk carried by said supporting frame and driven from said feed roll and between which roll and disk the sheets pass, said disk being movable in said frame toward and away from said roll; a second rotary disk carried by said supporting frame and normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; an oscillating shaft whereupon said supporting frame is carried; means for operating said shaft to thereby move said rotary disks away from said feed roll; a cam operated by said second disk; a lever carried by said frame and operated by said cam; an oscillating shaft; an arm secured thereto and with which the free end of the lever aforesaid may contact; a second lever operated

by said oscillating shaft; and means controlled by said second lever for operating said clutch to thereby disconnect said feed roll from said driving mechanism.

17. In sheet feeding mechanism for printing presses, a feed roll adapted to advance sheets of paper toward the press; driving mechanism for said roll; a clutch whereby said roll may be connected with and disconnected from said driving mechanism; a supporting frame; a rotary disk carried by said supporting frame and driven from said feed roll and between which roll and disk the sheets pass, said disk being movable in said frame toward and away from said roll; a second rotary disk carried by said supporting frame and normally out of contact with said first disk but with which said first disk may contact when it moves away from said feed roll, and whereupon said second disk will be driven by said first disk; an oscillating shaft whereupon said supporting frame is carried; means for operating said shaft to thereby move said rotary disks away from said feed roll; a cam operated by said disk; a lever carried by said frame and operated by said cam; an oscillating shaft; an arm secured thereto and with which the free end of the lever aforesaid may contact; a second lever operated by said oscillating shaft; an oscillating sector with which the free end of said second lever engages and which sector is operatively connected with said clutch; and a spring for operating said sector and said clutch when the free end of said second lever is moved out of engagement with said sector.

18. In sheet feeding mechanism for printing presses, an oscillating supporting member having a passage extending longitudinally thereof; a hollow barrel located within said passage and movable relatively to said supporting member to thereby bring the lower end of said barrel into contact with a sheet of paper; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating rod located within said barrel and the ends whereof extend beyond said barrel; a valve located adjacent the lower end of said rod and adapted to cooperate with said valve seat; and means adapted to engage the upper end of said rod to force said valve into contact with its seat.

19. In sheet feeding mechanism for printing presses, an oscillating supporting member provided with a passage extending longitudinally thereof; a hollow barrel located within said passage and movable relative to said supporting member to thereby bring the lower end of said barrel into contact with a sheet of paper; a port adjacent the lower end of said barrel; a conduit extending through the wall of said supporting member and with which said port is in communication; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating rod having a valve at its lower end adapted to coöperate with said valve seat, the lower end of which rod extends through said passage and the upper end of which extends beyond the upper end of said barrel; a trip member adapted to engage the upper end of said rod; and means for operating said trip member to thereby move said rod and bring said valve into contact with its seat when the sheet is to be released from said barrel.

20. In sheet feeding mechanism for printing presses, an oscillating supporting member; an oscillating shaft whereby said supporting member is supported; a hollow barrel carried by said member and movable relatively thereto to thereby bring the lower end of said barrel into contact with a sheet of paper; a cam member secured to said oscillating shaft; an oscillating lever secured by said supporting member and operated by said cam; means whereby motion imparted to said lever is communicated to said barrel; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating valve coöperating with said seat; and means for operating said valve to move it from its seat as the lower end of said barrel is moved into contact with a sheet of paper, and to move it onto its seat when the sheet is to be released from said barrel.

21. In sheet feeding mechanism for printing presses, an oscillating supporting member having a passage extending longitudinally thereof; a hollow barrel located within said passage and movable relatively to said supporting member to thereby bring the lower end of said barrel into contact with a sheet of paper; an oscillating shaft whereupon said supporting member is supported; a cam secured to said shaft; an oscillating lever carried by said supporting member and operated by said cam; means whereby motion imparted to said lever is transmitted to said barrel; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating rod located within said barrel and the lower end of which extends through said passage, and the upper end of which

extends beyond the upper end of said barrel; a valve adjacent the lower end of said rod and adapted to coöperate with said valve seat; a trip member adapted to engage the upper end of said reciprocating rod; and means for operating said trip member to thereby move said valve onto its seat when the sheet is to be released from said barrel.

22. In sheet feeding mechanism for printing presses, an oscillating supporting member having a passage extending longitudinally thereof; a hollow barrel located within said passage and movable relatively to said supporting member to thereby bring the lower end of said barrel into contact with a sheet of paper; an oscillating shaft whereupon said supporting member is supported; a cam carried by said oscillating shaft; means whereby said barrel is operated by said cam; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating valve coöperating with said seat; and means for operating said valve to move it from its seat as the lower end of said barrel is moved into contact with a sheet of paper, and to move it on to its seat when the sheet is to be released from said barrel.

23. In sheet feeding mechanism for printing presses, an oscillating supporting member; a hollow barrel carried by said member and movable relatively thereto to thereby bring the lower end of said barrel into contact with a sheet of paper; an oscillating shaft whereupon said supporting member is supported; a cam secured to said shaft; means whereby said cam operates said barrel; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating rod located within said barrel, the lower end of which extends through said passage, and the upper end of which extends beyond the upper end of said barrel; a valve adjacent the lower end of said rod and adapted to coöperate with said seat; a spring-pressed trip carrying member pivotally connected with the upper end of said supporting member; a trip member pivotally supported by said trip carrying member; and a stop with which said trip member engages to thereby force its free end against the upper end of said rod when the sheet is to be released from said barrel.

24. In sheet feeding mechanism for printing presses, an oscillating supporting member having a longitudinally extending passage; a hollow barrel located within said passage and movable relatively to said supporting member to thereby bring the lower end of said barrel into contact with a sheet of paper; means for exhausting the air from the interior of said barrel; a passage at the lower end of said barrel whereby communication is established between the external atmosphere and the interior thereof; a valve seat surrounding said passage; a reciprocating rod located within said barrel, the lower end of which extends through said passage and the upper end of which extends beyond the upper end of said barrel; a valve adjacent the lower end of said rod and adapted to coöperate with said seat; a spring-pressed trip carrying member pivotally connected with the upper end of said supporting member; a trip member pivotally supported by said trip carrying member; and a stop with which said trip member engages to thereby force its free end against the upper end of said rod when the sheet is to be released from said barrel.

25. In sheet feeding mechanism for feeding separate sheets in succession from the top of a pile of sheets of paper; a frame supported upon the rear end of the pile of sheets; a vertically movable and rotary shaft supported in bearings upon said frame and having an eccentrically arranged finger at its lower end; a rotary driving shaft supported in bearings upon said frame; gearing whereby said first-mentioned shaft is operated from said driving shaft; means whereby said vertically movable shaft is reciprocated from said driving shaft; and a radius rod whereby said frame is held in position adjacent the rear end of the pile.

26. In sheet feeding mechanism for feeding separate sheets in succession from the top of a pile of sheets of paper; a frame supported upon the rear end of the pile of sheets; a vertically movable and rotary shaft supported in bearings upon said frame and having an eccentrically arranged finger at its lower end; a rotary driving shaft supported in bearings upon said frame; gearing whereby said first-mentioned shaft is operated from said driving shaft; a cam upon said driving shaft, and means whereby said cam imparts vertical movement to said vertically movable shaft; and a radius rod whereby said frame is held in position adjacent the rear end of the pile.

27. In sheet feeding mechanism for feeding separate sheets in succession from the top of a pile of sheets of paper; a frame; a lever pivotally connected with said frame and one end of which is adapted to rest upon the top of the pile of sheets; a vertically movable and rotary shaft supported in bearings upon said frame and having an arm at its lower end; a finger adjacent the end of said arm and adapted to engage the top sheet of the pile; a rotary driving shaft

supported in bearings upon said frame; gearing whereby said first-mentioned shaft is operated from said driving shaft; a cam upon said driving shaft; an oscillating member associated with said frame and operated by said cam, and the free end of which is in operative engagement with said first-mentioned shaft to move it up and down; a link connecting said oscillating member with the other end of said lever; and a radius rod whereby said frame is held in position adjacent the rear end of the pile.

Signed at New York, borough of Manhattan, in the county of New York and State of New York, this 27th day of November, A. D. 1911.

CHARLES M. KNEPPLER.

Witnesses:
R. N. FLINT,
A. V. WALSH.