H. K. KING.

SHEET FEEDING MACHINE.

APPLICATION FILED MAR. 31, 1909.

1,041,807.

Patented Oct. 22, 1912.

16 SHEETS—SHEET 1.

Fig. 1.

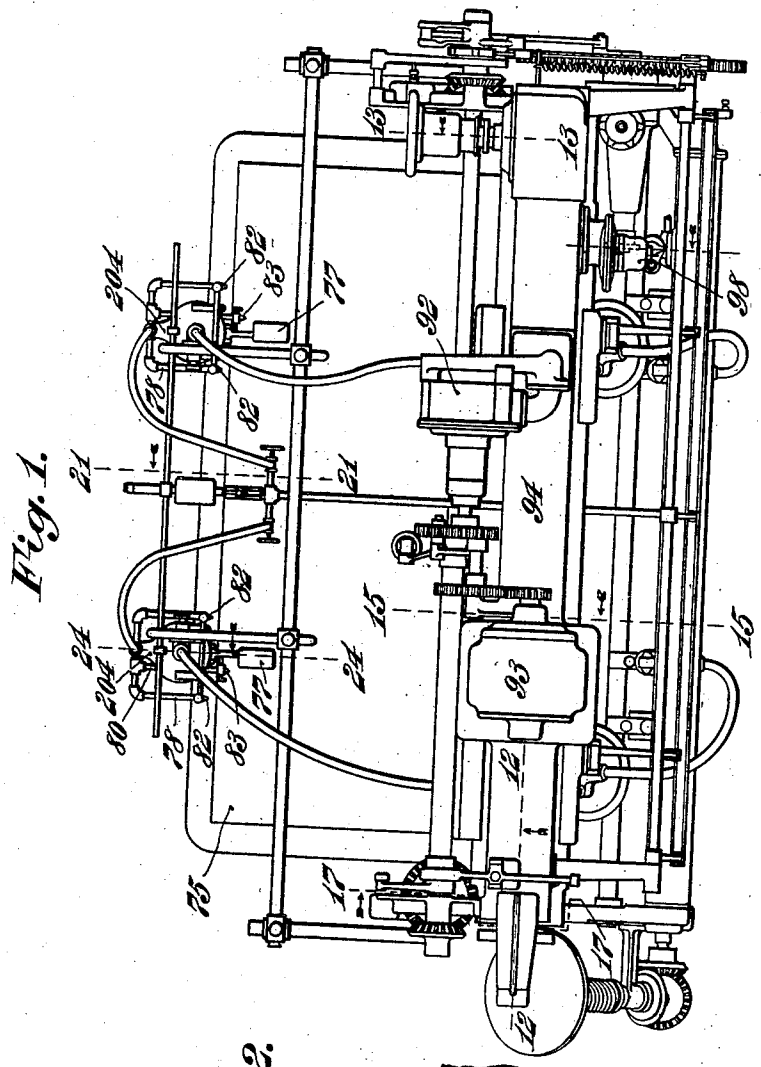
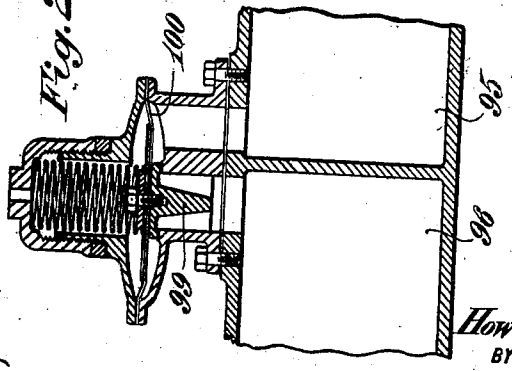


Fig. 2.



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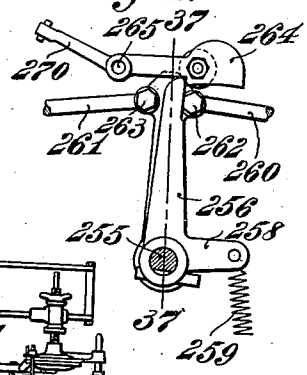
16 SHEETS—SHEET 2.

Fig. 4.



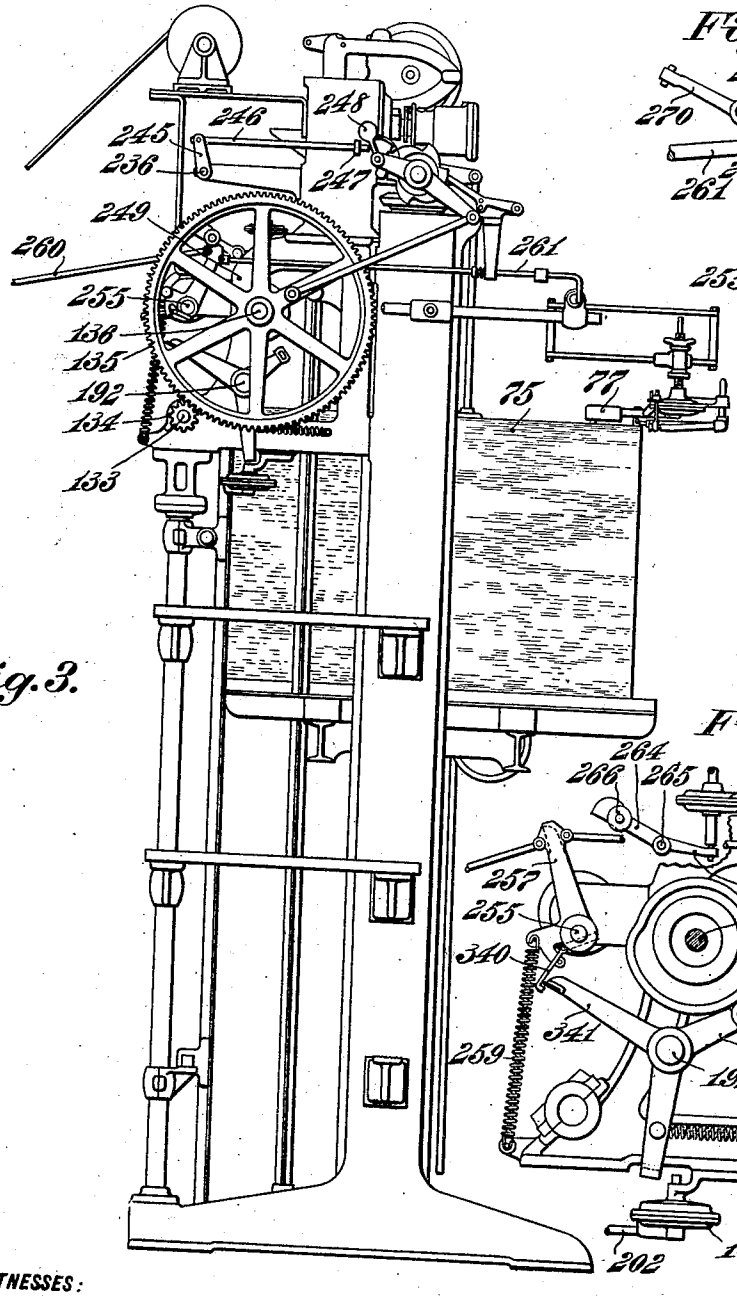


Fig. 3.

Fig. 5.

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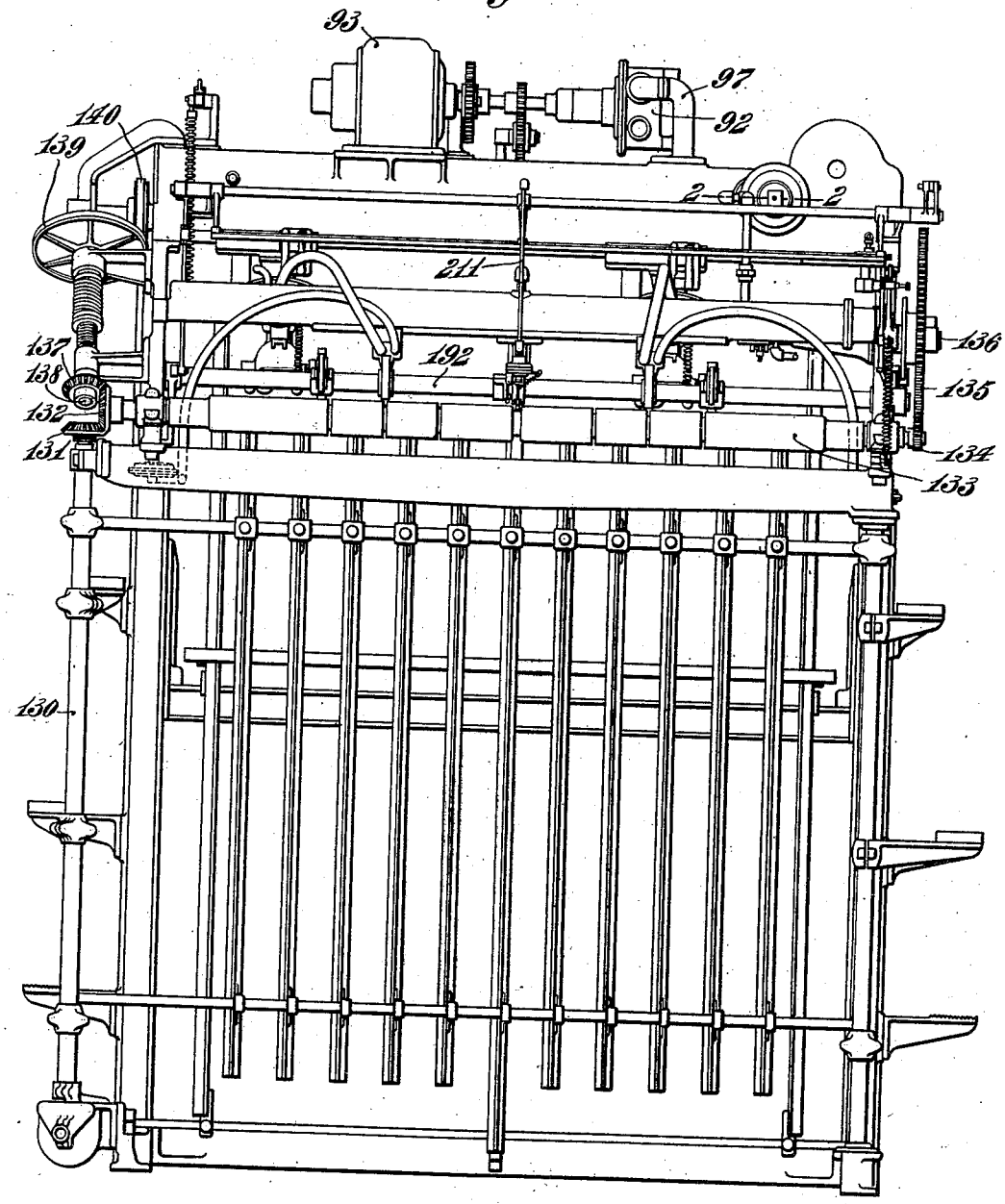
16 SHEETS—SHEET 3.

Fig. 6.



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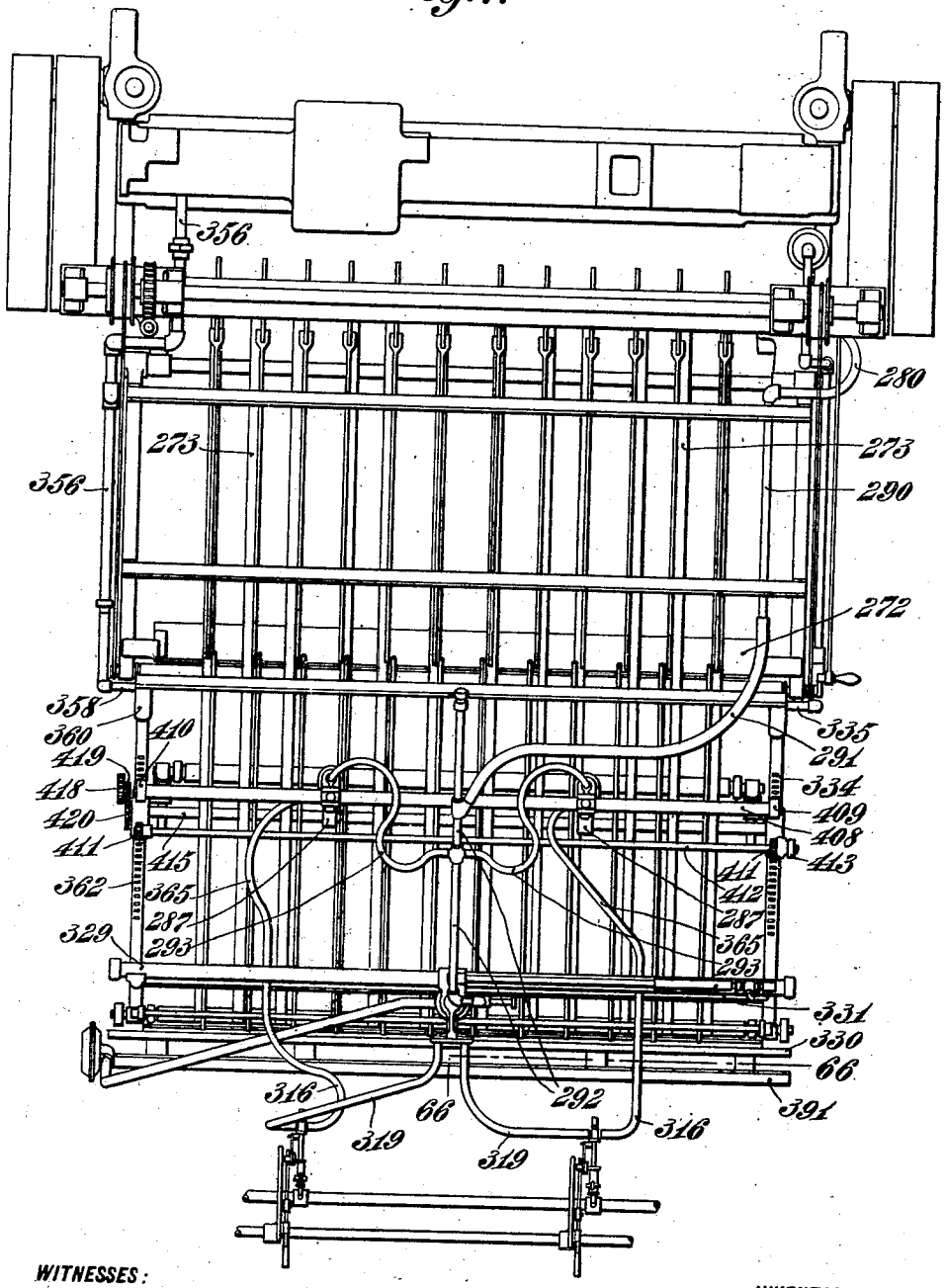
16 SHEETS—SHEET 4.

Fig. 7.



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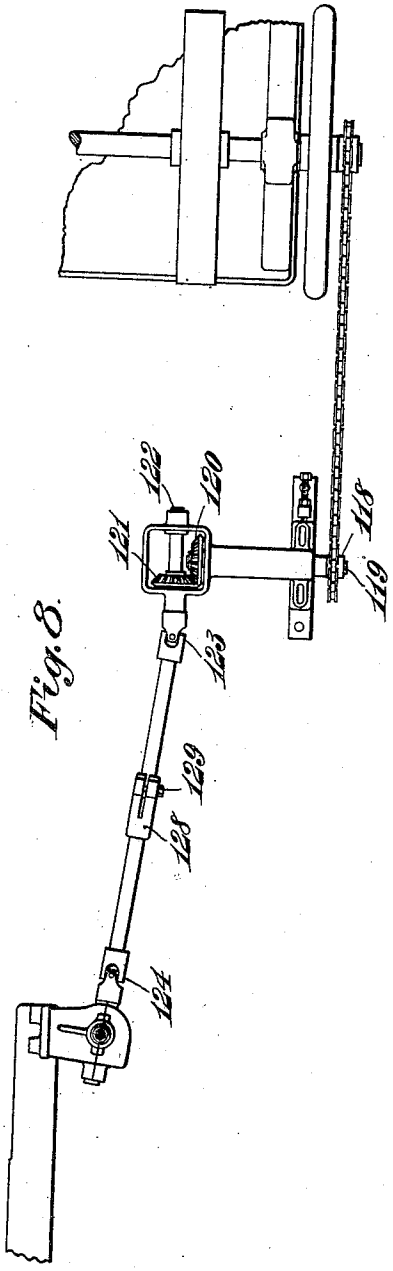

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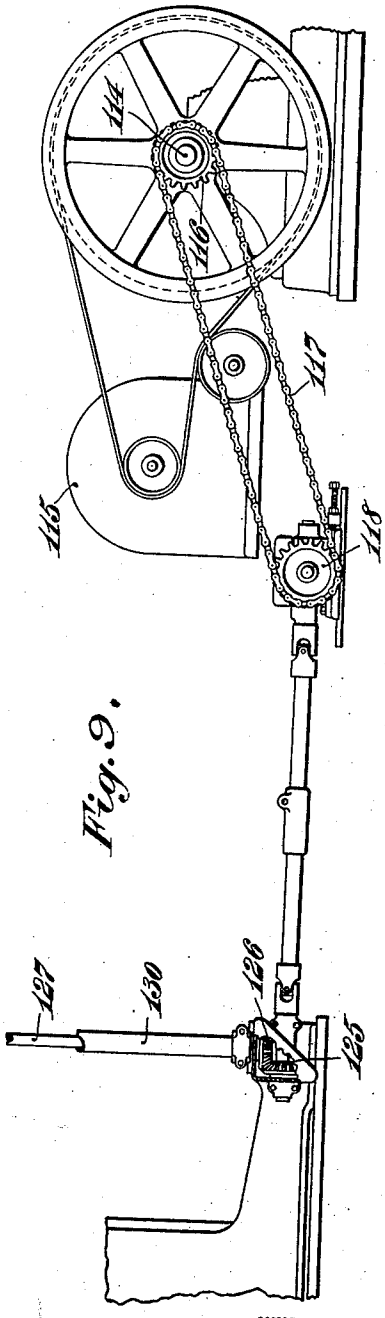

Fig. 9.

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16 SHEETS—SHEET 6.

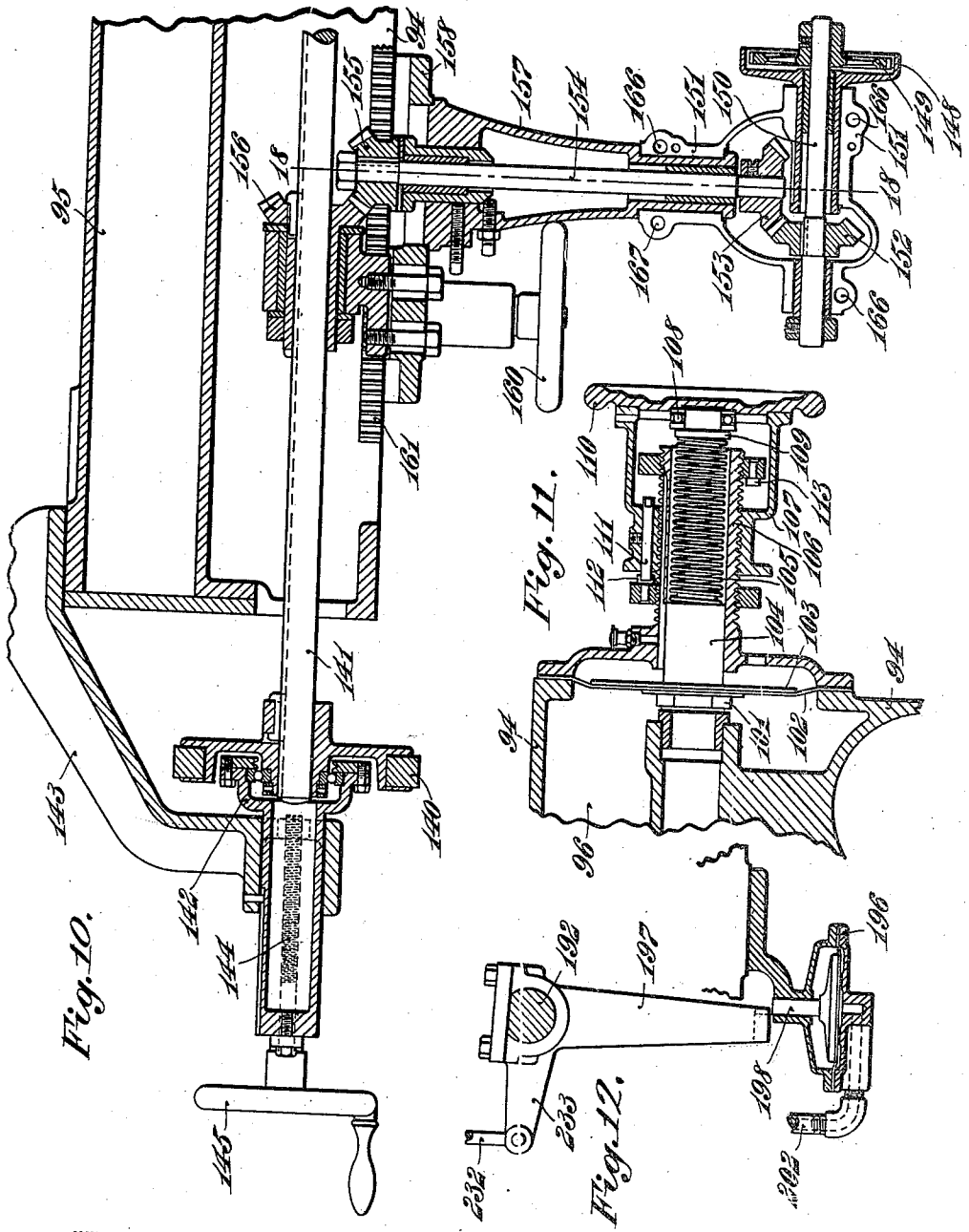

Fig. 10.

Fig. 11.

Fig. 12.

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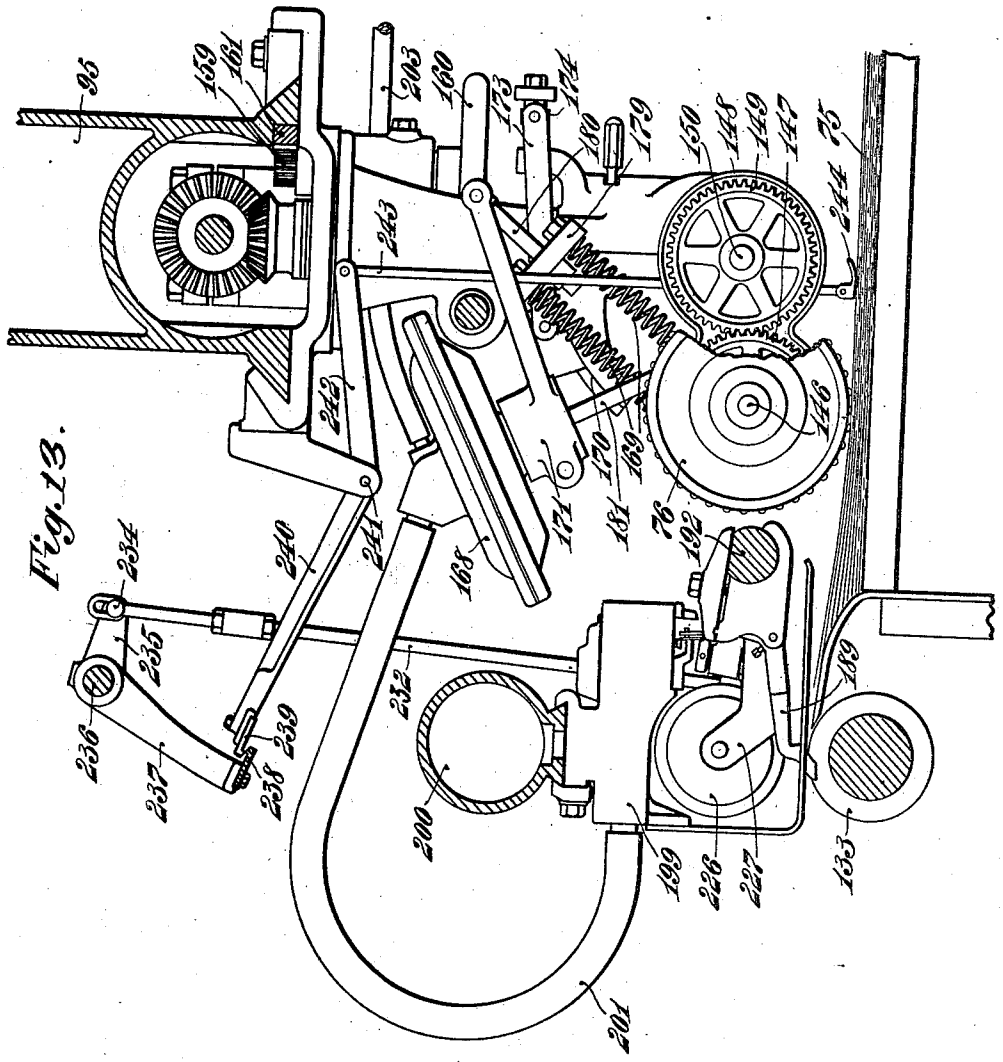
16 SHEETS—SHEET 7.

Fig. 13.



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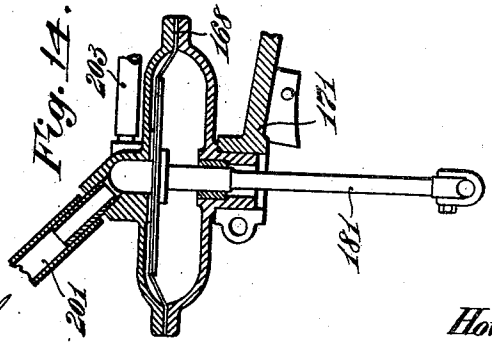

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16 SHEETS—SHEET 8.

Fig. 15.

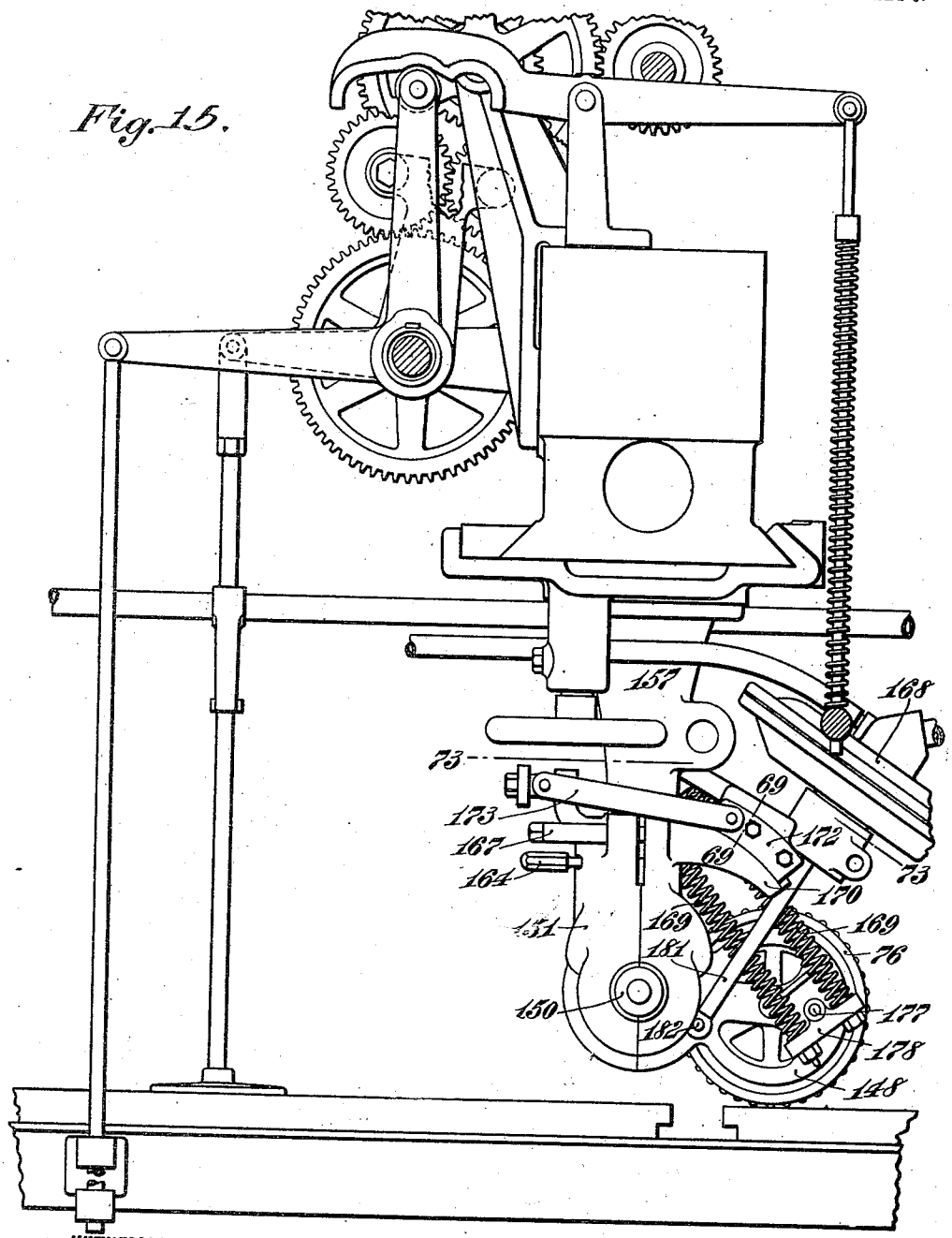

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Fig. 58.

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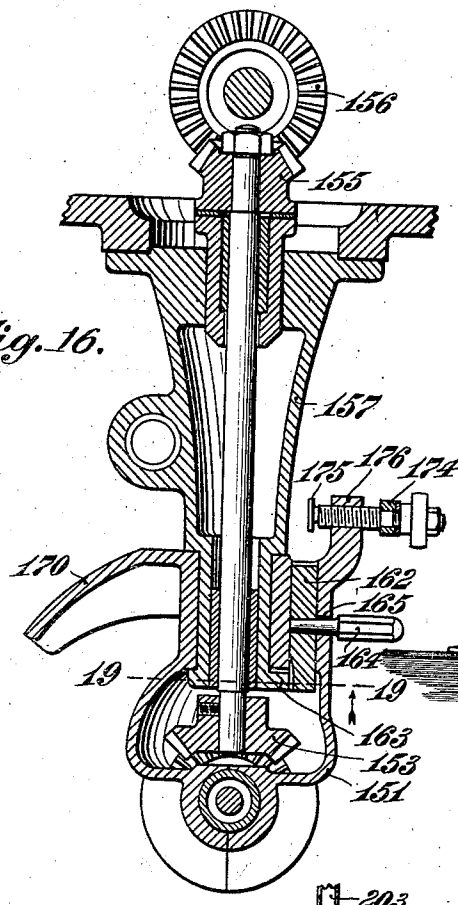
16 SHEETS—SHEET 9.

Fig. 16.



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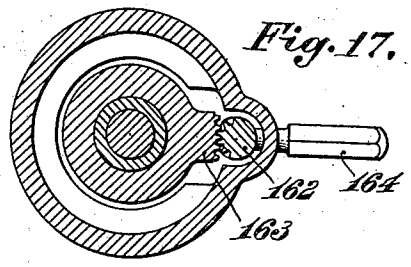

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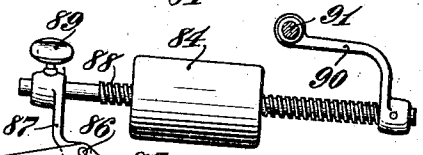
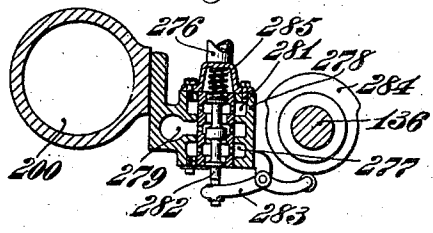


Fig. 19.

Fig. 21.



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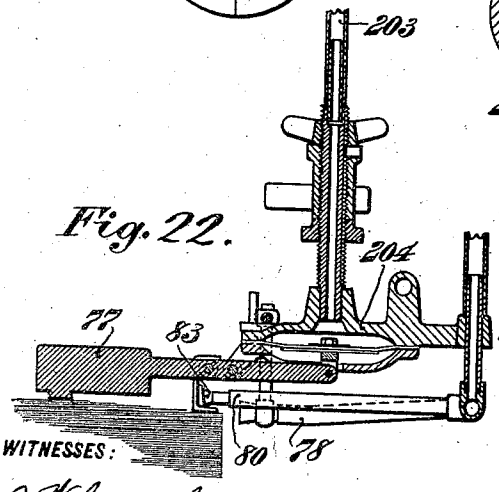

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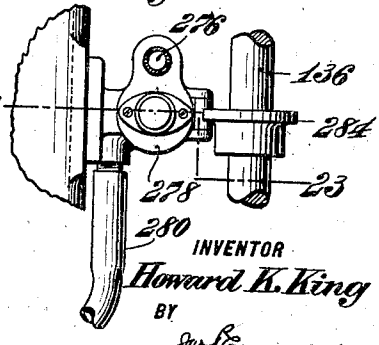

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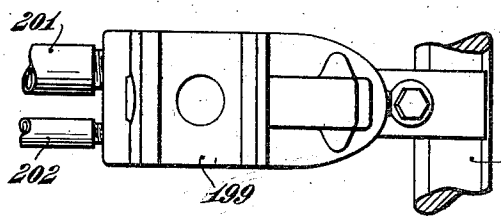
Fig. 23.



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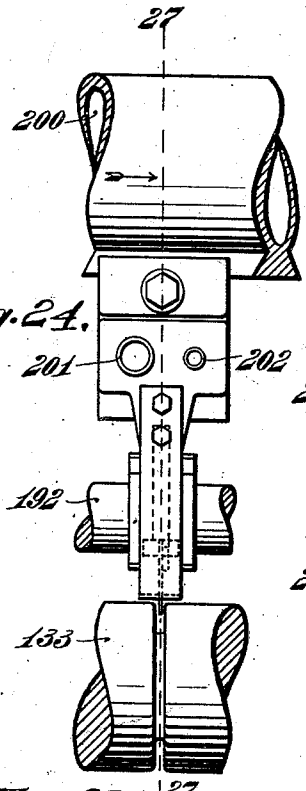

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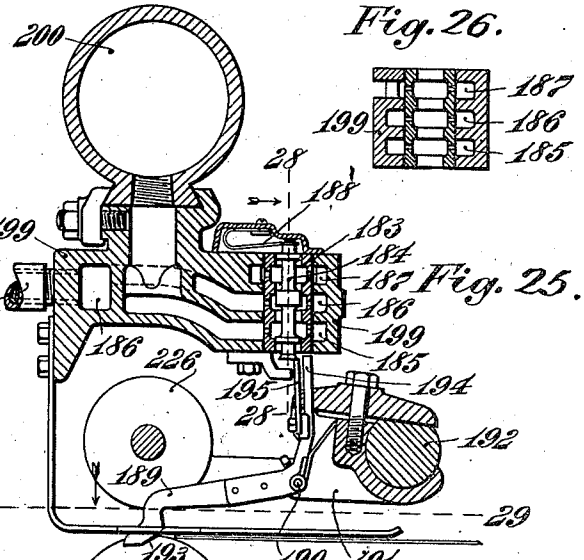
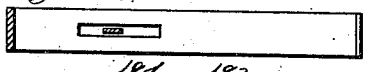


Fig. 25.

Fig. 27.



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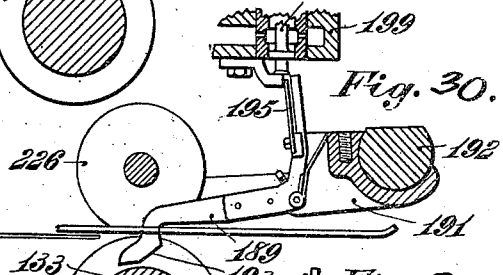

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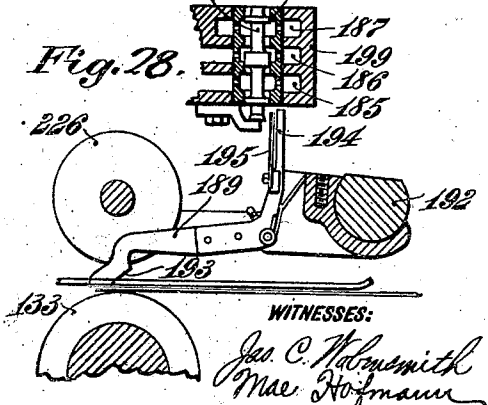
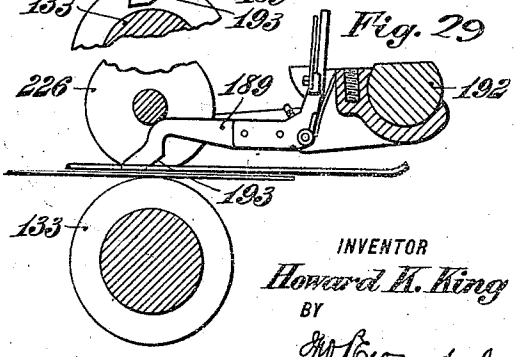


Fig. 29



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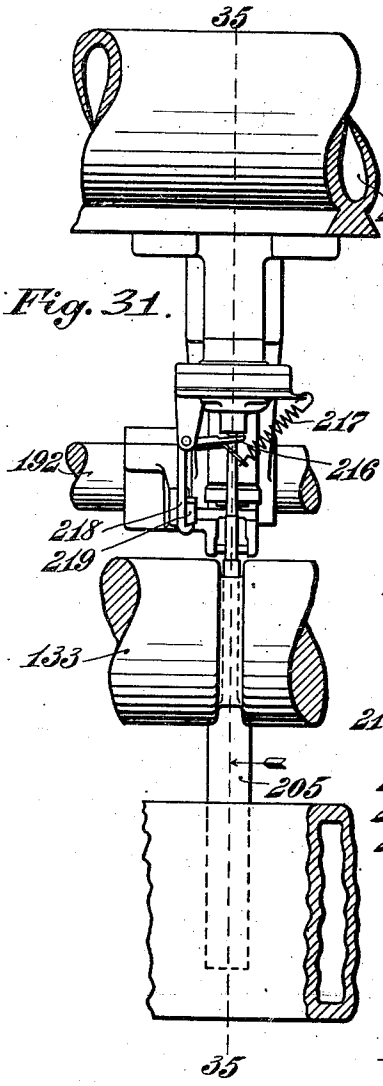
16 SHEETS—SHEET 11.

Fig. 31.



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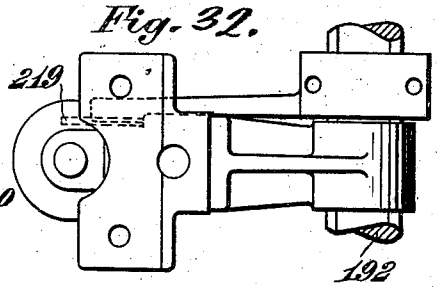

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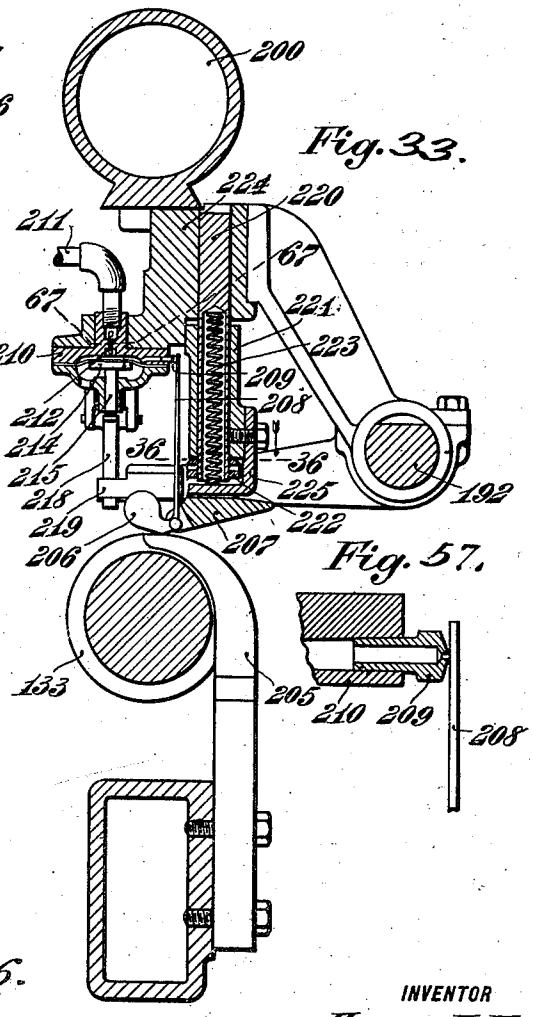
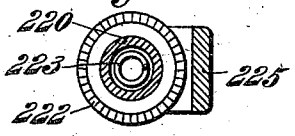


Fig. 57.

Fig. 34.



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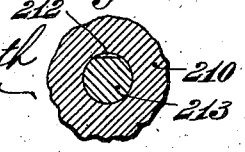

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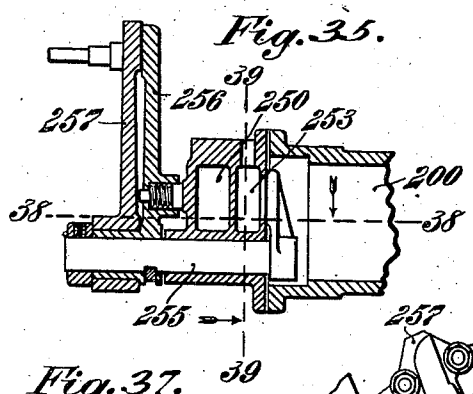
16 SHEETS—SHEET 12.

Fig. 35.



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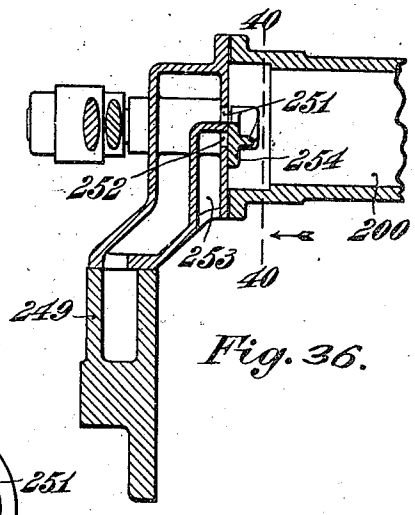

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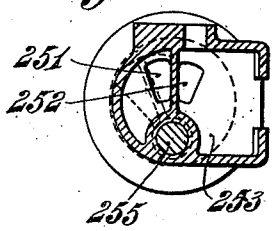


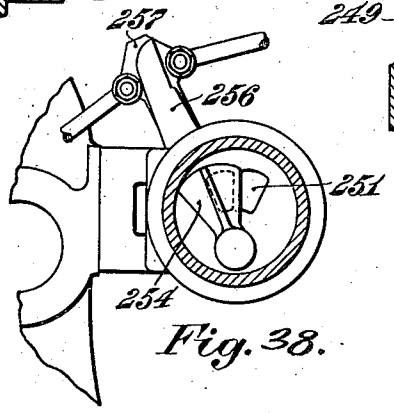
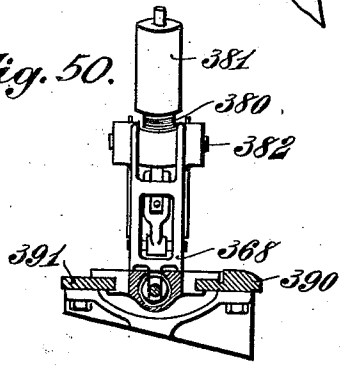


Fig. 38.

Fig. 50.



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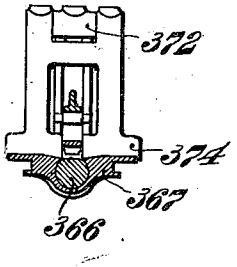

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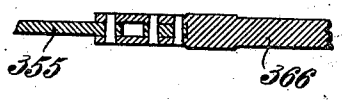

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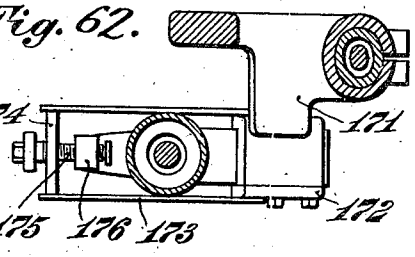

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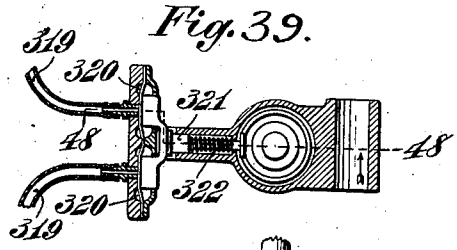
16 SHEETS—SHEET 13.

Fig. 39.



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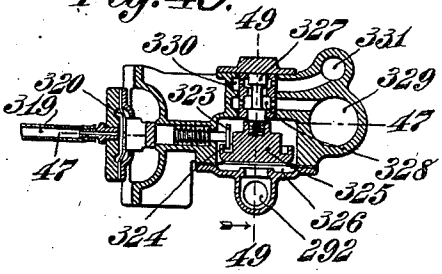

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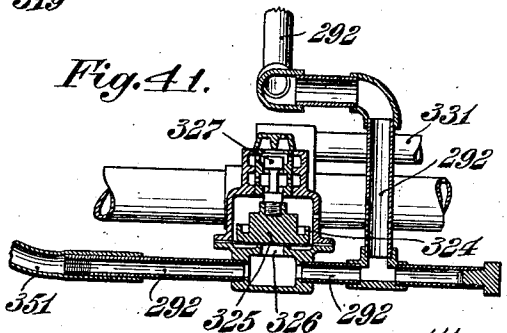

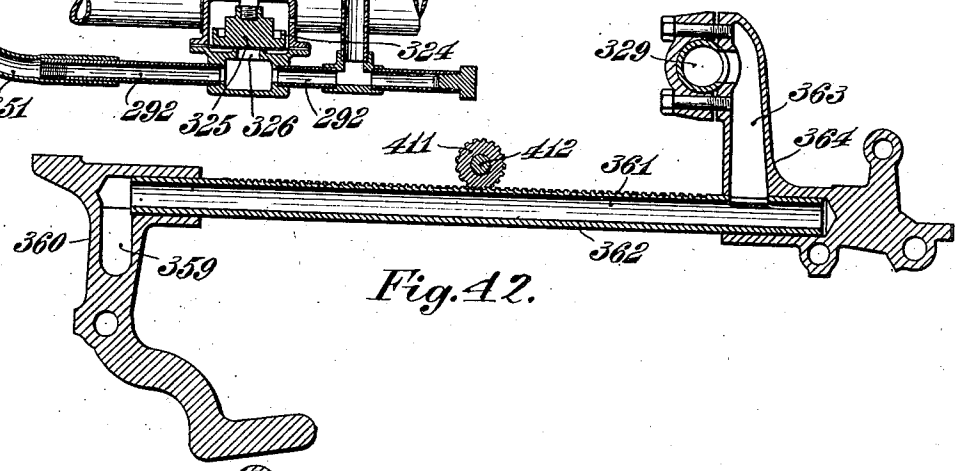

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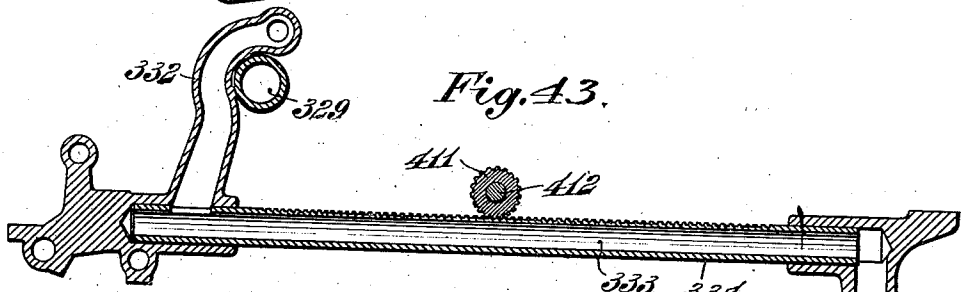
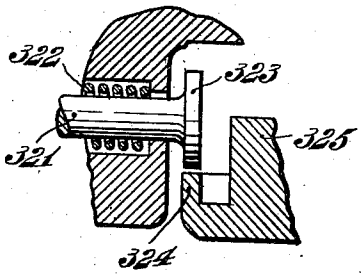


Fig. 43.

Fig. 64.



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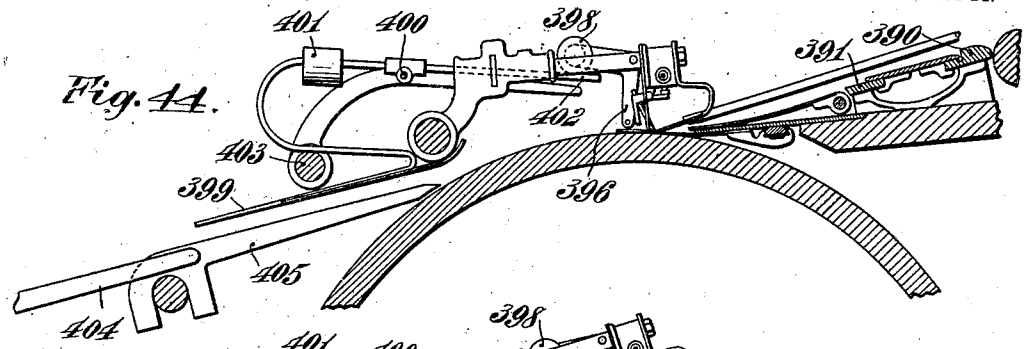
16 SHEETS—SHEET 14.

Fig. 44.



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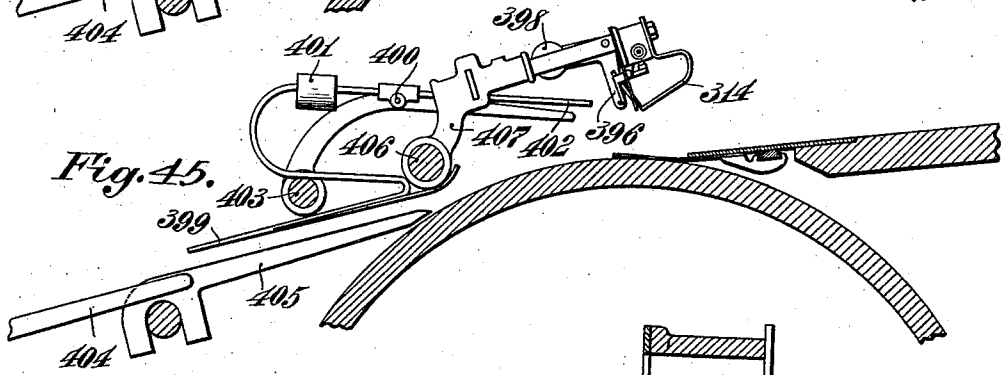


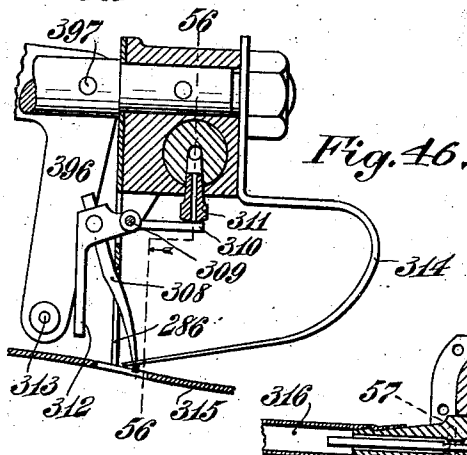
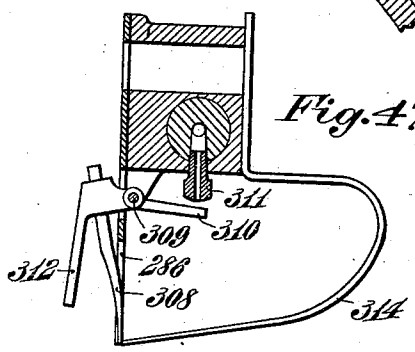


Fig. 46.

Fig. 47.



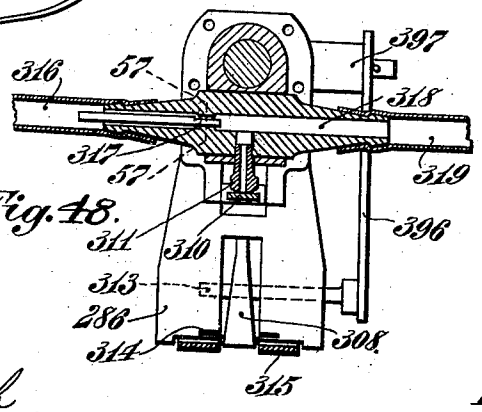


Fig. 48.

Fig. 49.

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SHEET FEEDING MACHINE.

APPLICATION FILED MAR. 31, 1909.

1,041,807.

Patented Oct. 22, 1912.

16 SHEETS—SHEET 15.

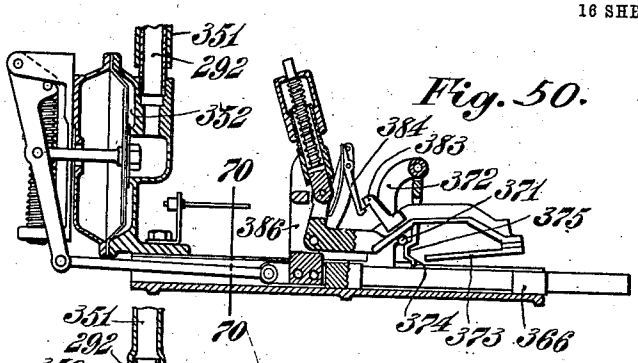

Fig. 50.

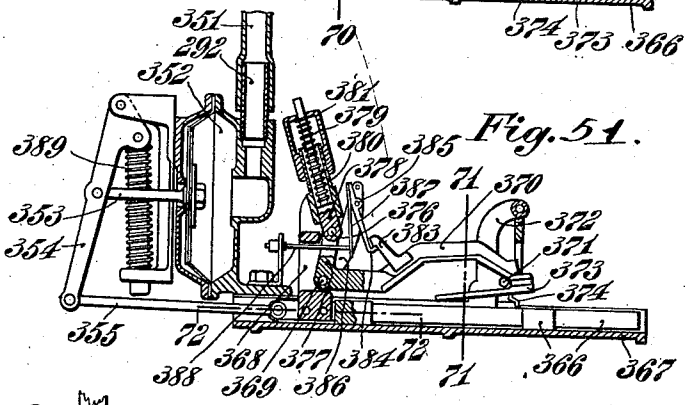

Fig. 51.

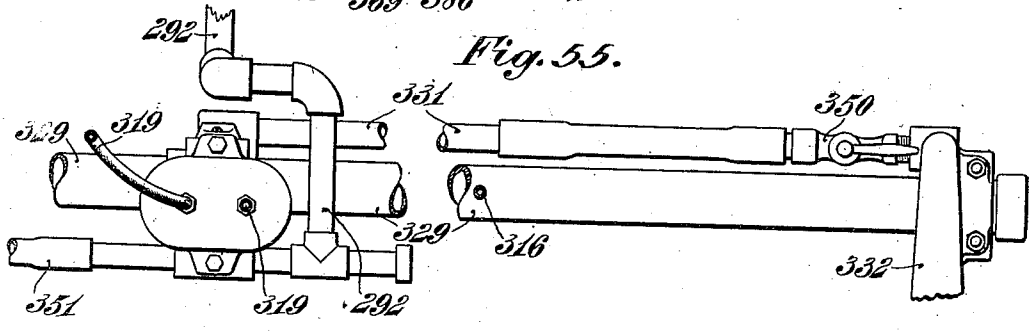

Fig. 55.

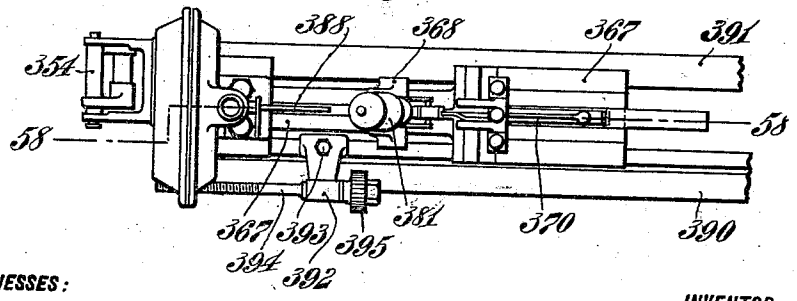

Fig. 63.

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1,041,807.

Patented Oct. 22, 1912.

16 SHEETS—SHEET 16.

Fig. 52.

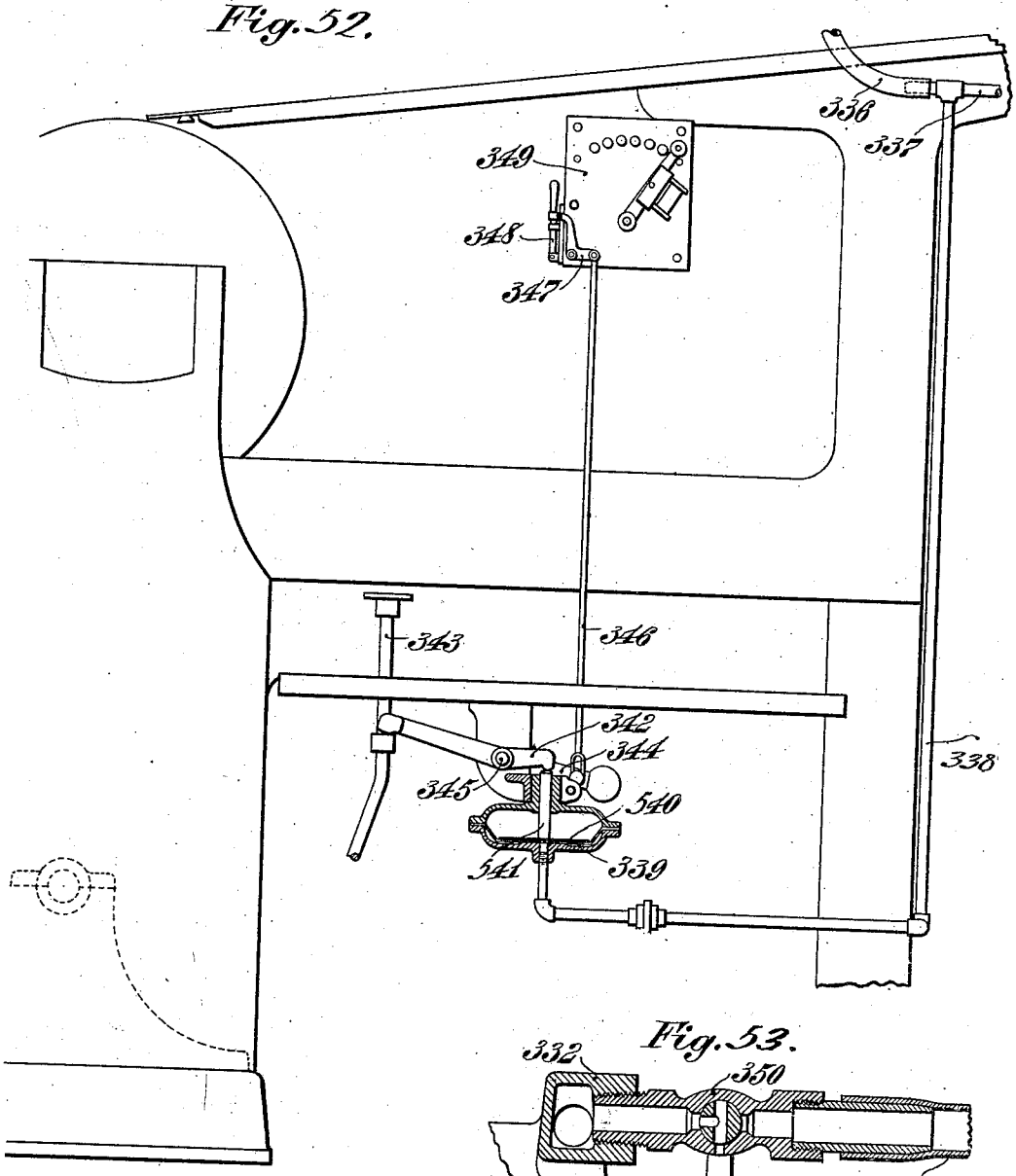
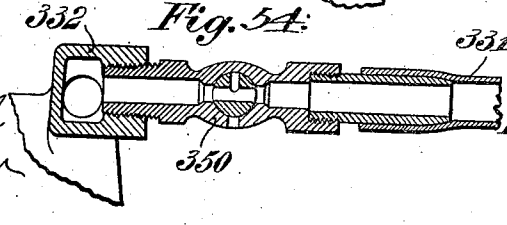


Fig. 53.

Fig. 54.



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SHEET-FEEDING MACHINE.

1,041,807. Specification of Letters Patent. Patented Oct. 22, 1912.

Application filed March 31, 1909. Serial No. 486,934.

To all whom it may concern:

Be it known that I, HOWARD K. KING, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented a new and useful Sheet-Feeding Machine, of which the following is a specification.

My invention relates to sheet feeding machines, and is especially adapted for feeding sheets to a printing press.

My invention belongs to the class of sheet feeding machines in which combing wheels are used and includes means for operating the combing wheels by air pressure, and means for securing a range of varying pressure for said combing wheel actuation.

My invention comprises improved sheet detectors and trips controlling pneumatically operated means for the control of the combing wheel actuation.

My invention also comprises improved tail clamps pneumatically operated, and blowers connected therewith.

My invention also comprises means for securing a relative increase or decrease of volume of air blowing between the sheets corresponding to an increase or decrease of pneumatic pressure on the combing wheels to meet the requirements as to the nature of the sheets operated upon.

My invention also comprises improved means for adjusting the pressure on the drag weight for reducing the variation of feed due to the difference in resistance between "hard" and "soft" spots in the sheets.

The present invention also comprises an improved pneumatic valve, and trigger controlling the same, operated in connection with the drop roller shaft for the pneumatic control of the combing wheel, latching device for the drop roller and the tail clamps.

My invention also comprises a sheet detector adjacent the drop and feed roller controlling a pneumatic device for controlling a latch which in turn controls the drop roller shaft actuation.

My invention also includes pneumatically operated detectors for indicating the correct position of the sheet against the feeding guides before the same is delivered to the press, also improvements in side registering mechanism, and other details in improvements in construction and operation.

Referring to the drawings:—Figure 1 is a plan view of my device. Fig. 2 is a section on line 2—2 of Fig. 6 on an enlarged scale. Fig. 3 is a side elevation of my device. Fig. 4 is a detail of the latch of the start and stop lever and associated mechanism, on an enlarged scale. Fig. 5 is a detail of the start and stop lever and associated mechanism, the lever in the position to prevent feeder from feeding. Fig. 6 is a front elevation of the feeder removed from the printing press. Fig. 7 is a plan of the apron showing a part of the feeder. Fig. 8 is a plan view of the driving connection to the press. Fig. 9 is a side elevation of same. Fig. 10 is a section on line 12—12 of Fig. 1 on an enlarged scale. Fig. 11 is a section on line 13—13 of Fig. 1 on an enlarged scale. Fig. 12 is a detail of the latching device for the drop roller, the one on the right hand side of the feeder. Fig. 13 is a section on line 15—15 of Fig. 1 on an enlarged scale showing one of the combing wheel heads. Fig. 14 is a section through one of the combing wheel diaphragms. Fig. 15 is a section of the upper part of the feeder on line 17—17 of Fig. 1 on an enlarged scale. Fig. 16 is a section on line 18—18 of Fig. 10 on an enlarged scale. Fig. 17 is a section on line 19—19 of Fig. 16 on an enlarged scale. Fig. 18 is a plan of the tension shoe and weight. Fig. 19 is a side elevation of same, being a section on line 21—21 of Fig. 1. Fig. 20 is a plan of the valve and cam operating side guide, tail grippers, trips, etc. Fig. 21 is a section on line 23—23 of Fig. 20 on an enlarged scale. Fig. 22 is a section on line 24—24 of Fig. 1 on an enlarged scale. Fig. 23 is a plan of one of the air valves controlling the combing wheels. Fig. 24 is a front elevation of the same. Fig. 25 is a section on line 27—27 of Fig. 24. Fig. 26 is a section on line 28—28 of Fig. 25. Fig. 27 is a section on line 29—29 of Fig. 25. Fig. 28 is a similar view to that shown in Fig. 25, of the valve with the valve piston and trip in a different position. Fig. 29 is a similar view with the trip in a still different position. Fig. 30 is a similar view showing the trip in a still different position. Fig. 31 is a front elevation of the feeder sheet detector and associated mechanism. Fig. 32 is a plan of part of the structure shown in Fig. 31. Fig. 33 is a section on line 35—35 of Fig. 31. Fig. 34 is a section

on line 36—36 of Fig. 33. Fig. 35 is a section through the start and stop valve and associated mechanism, the section line being on the line 37—37 of Fig. 4. Fig. 36 is a section on line 38—38 of Fig. 35. Fig. 37 is a section on line 39—39 of Fig. 35. Fig. 38 is a section on line 40—40 of Fig. 36. Fig. 39 is a horizontal section on line 47—47 of Fig. 40. Fig. 40 is a vertical section on line 48—48 of Fig. 39. Fig. 41 is a vertical cross-section on line 49—49 of Fig. 40. Fig. 42 is a longitudinal vertical section of the right hand frame, the lower part of the apron looking from the outside. Fig. 43 is a longitudinal vertical section of the left hand frame. Fig. 44 is a vertical section through the press cylinder showing a side elevation of the press feeding guides with the sheet detector attached. Fig. 45 is a similar view with the parts in different positions. Fig. 46 is an enlarged side elevation in part section of one of the feed guides and detectors. Fig. 47 is a similar view with a detector finger in a different position. Fig. 48 is a vertical cross-section on line 56—56 of Fig. 46. Fig. 49 is a cross-section on line 57—57 of Fig. 48. Fig. 50 is a section of the side guide on line 58—58 of Fig. 63. Fig. 51 is a similar view with the parts in different positions. Fig. 52 is a side elevation of the press trips and stop mechanism, the operating diaphragm being in section. Fig. 53 is a section of the air cock. Fig. 54 is a similar view with the valve in a different position. Fig. 55 (Sheet 15) is a section on line 66—66 on Fig. 7, on an enlarged scale. Fig. 56 is a section on line 67—67 of Fig. 33, on an enlarged scale. Fig. 57 is an enlarged section of the nozzle 209 shown in Fig. 33. Fig. 58 is a section on line 69—69 of Fig. 15. Fig. 59 is a section on line 70—70 of Fig. 50. Fig. 60 is a section on line 71—71 of Fig. 51. Fig. 61 is a section on line 72—72 of Fig. 51. Fig. 62 is a section on line 73—73 of Fig. 15. Fig. 63 is a plan view of the structure shown in Fig. 50. Fig. 64 is an enlarged partial cross-section on line 48, of Fig. 39.

Similar numerals refer to similar parts throughout the several views.

Referring to Figs. 1 and 3, the pile of sheets to be fed is indicated by 75. These are combed forward in the usual way by the combing wheel 76 such as is clearly shown in Fig. 13. A detailed description of the adjustment, operation and control of the combing wheel will be given later on.

Tail clamping weight.—To the rear of the pile of sheets are secured two tail clamping weights 77 shown clearly in detail in Fig. 22. These weights serve as gravity clamps and are pneumatically operated against gravity to cause their release from the pile. The pneumatic element of the clamp is called the clamping head. A description of the detail of construction and operation and control of the tail clamps will be given later on.

Blow pipes.—Operating in connection with these gravity clamps are blowing pipes 78, 79 and 80, blowing into the back of the pile of sheets, there being three nozzles 81, 82 and 83 on each head two of them blowing into the top of the pile, part of the air usually blowing just over the pile, the object being to blow under the sheets that are already combed forward. However the heights of these nozzles are adjustable and can be set as desired. The third nozzle 83 is provided with a foot which rests on the pile just forward to the back edge. It is held in position by the rubber tube 89 through which the air passes. This tube forms a flexible connection permitting the nozzle to accommodate itself to the varying height of the pile, at the same time holding it in a fixed position relative to the back edge of the pile. The air from this nozzle only strikes between the sheets that are combed beyond the edge of it, the object being to have the top sheets thoroughly winded to insure perfect separation of all the sheets.

Drag-weight.—The drag-weight 84 is connected with the shoe 85 which is adapted to engage the pile of sheets at substantially the middle of the rear edge thereof. This pressure shoe is pivoted at 86, see Fig. 19, to the arm 87 which is adjustably secured to the threaded rod 88 by the thumb-screw 89. This rod 88 is secured at its other end to the arm or bracket 90, pivotally supported on the shaft 91. The weight 84 has a threaded engagement with rod 88, so that by turning, the weight can be moved forward and back along the shaft to secure the desired adjustment of pressure exerted by the shoe 85. In fact it can be moved sufficiently toward the bracket 90 to relieve all pressure from said shoe 85. The shoe 85 itself, in view of the position of pivot 86, is arranged to bear the hardest at the extreme back of the pile and gradually less on the sheets that are combed into more advanced position. A drag-tension is of the utmost importance in combing wheel feeders. If a given pile of sheets would comb uniformly throughout, there would not be any need for such a device, but the pile does not run uniform, frequently far from it, there being "hard" and "soft" spots. A "hard" spot may take more than double the combing force required for a "soft" spot. It is understood that more pressure must be applied to combing wheels when working with the drag-weight.

To illustrate the advantage of the use of the drag-weight, suppose that, without a drag-weight, the difference in resistance between hard and soft spots to be in a ratio

of two to one; with the action of the drag-weight added it may be made as three to two, or four to three, or five to four, depending upon the amount of weight used. The two to one variation might mean trouble, without the attention of the operator to change the pressure on the combing wheels, while the three to two variation would be taken care of itself without attention from the operator. Considerable variation in the length of these steps can be tolerated. But when the steps are too long the feeder will miss feeding, because the sheet fails to reach the required position in time. When the steps are too short, two sheets will be brought into the sheet detector, thereby causing the press and feeder to stop.

Air pressure.—The air pressure for operating the various pneumatic devices is provided by the motor driven blower 92, the electric motor being indicated by 93; it being understood that the motor 93 runs independently of the driving of the press and is run practically all the time, that is, it should start in advance of the press and run all the time the press is in operation. The blower 92 delivers to the reservoirs contained in the hollow beam 94. These reservoirs are indicated in Fig. 2, 95 being high pressure and 96 being low pressure. The blower delivers to the high pressure reservoir 95 through the hollow conducting bracket 97. The regulating valve connected between the high pressure and low pressure reservoirs is indicated at 98 and serves to maintain the pressure in the high pressure reservoir 95 substantially constant. The valve proper 99 is operated by the spring pressed diaphragm 100. It is understood that the blower delivers at a volume sufficient to maintain the required high pressure in the high pressure reservoir, and to cause sufficient flow through the valve to maintain in the low pressure reservoir a supply of air pressure sufficient for the several pneumatic devices connected therewith.

Low pressure reservoir.—This low pressure reservoir is provided with a valve 101 similarly controlled by a spring actuated diaphragm 102 which maintains a constant pressure in said reservoir 96, any excess being permitted to escape to atmosphere through said valve. This valve mechanism is clearly shown in detail in Fig. 11, in which the piston 103 is connected with the piston rod 104, which is controlled by the spiral spring 105; the desired tension of which is secured by the threaded adjustment between the sleeve 106 and the surrounding casing 107, there being antifriction bearings 108 between the head of the casing 107 and the cap 109, said casing 107 is provided with the hand wheel 110 for manual operation. The casing 107 is provided with a pin 111 having projecting ends, one end adapted to encounter stop 112 at the limit of the adjustable movement in one direction of said casing 107, the other end adapted to encounter stop 113 at the limit of adjustable movement in the other direction; stops 112 and 113 are secured on collars held rigid on sleeve 106. The purpose of these stops is to prevent the jamming of the said threaded elements.

The high pressure above referred to is used for the pneumatic actuation of the sheet detectors, side guides and the diaphragm to stop the feeder and to stop the press. This high pressure must always be in excess of the highest pressure used in the low pressure reservoir.

The low pressure is used for the pneumatic operation of the combing wheels, the tail clamps, and the blowing nozzles for winding the sheets. This low pressure reservoir is maintained at any required pressure by the adjustment of the tension of the spring 105 on the valve piston 104, see Fig. 11, by simply turning the hand wheel 110 as hereinbefore described. The air pressure operating the combing wheels can be varied in this way. The lightest pressure that has been used in this device is about 9/16 pounds per square inch, and the heaviest about 1⅛ pounds; the resulting pressure on the wheels varying from two to twelve pounds, on each wheel. This is supposed to give sufficient range to suit the different size of sheets and different kinds of paper used on an ordinary printing press.

High pressure reservoir.—The high pressure reservoir or chamber 95, receiving the compressed air direct from the blower, carries a pressure of about 2⅛ pounds per square inch; all sheet detectors and trips are connected to this pressure. The valve controlling this pressure permits the surplus air to flow into the low pressure chamber 96, forming the combing wheel supply reservoir. The valve controlling the combing wheel pressure allows a surplus of air to escape to the atmosphere. It will be understood that the blower at all times furnishes a surplus of air. This blower must be run independently of the press, and must be started in advance of the press and must never stop while the press is in motion. By the mechanism above described, it will be seen that by the simple turning of the hand wheel 110 the pressure exerted by the combing wheels and the amount of air blown between the sheets can be increased or diminished as the operator finds necessary for proper combing.

Drive.—The feeding machine is operatively connected with the printing press in the following manner. 114 is the driving shaft of the printing press, which in Fig. 9 is shown as driven by the motor 115. The driving shaft 114 is provided with the

sprocket 116 which is connected through the chain 117 with the sprocket 118, said sprocket 118, driving shaft 119 which is provided with the bevel gear 120 which cooperates with the bevel 121 which is on shaft 122, which is connected through the universal joints 123 and 124 with the bevel gears 125 and 126. The shaft connected between the joints 123 and 124 is in two parts, one part having a split sleeve 128 secured thereto, the other element being adjustably secured in said split sleeve and fastened or clamped therein by the clamp bolt 129. This permits of ready adjustment not only between the press and the feeding apparatus, but also for securing the desired tension of the chain 117. The shaft 127 is incased in the hollow column 130, see Figs. 6 and 9. This shaft 127 is provided at its upper end with a gear 131 which coöperates with the bevel gear 132 which is secured to the feed roller 133. At the opposite end of the feed roller is secured the pinion 134 which meshes with gear 135 which is on the cam shaft 136. Gear 132 also coöperates with the gear 137 on shaft 138 which carries the friction disk 139 which coöperates with the friction wheel 140, which is feathered on shaft 141. This friction wheel 140 is actually journaled on ball-bearings in the casing 142, which is slidably mounted in the stationary framework or bracket 143 and is moved longitudinally by means of the screw 144 operated by the hand wheel 145, so that by turning the wheel 145, in one direction or the other, the friction wheel 140 may have a range of movement between the center and circumference of the friction disk 139 so that any required speed may be communicated from the friction disk to said friction wheel 140, see Fig. 10.

Combing wheel.—Referring to Figs. 13 and 15, the combing wheel 76 is of the usual type and is journaled on the stud 146. The combing wheel 76 is carried on the gear wheel 147 which is mounted on the stud 146 which is secured to the rocking frame 148. The gear 147 coöperates with the gear 149 secured on shaft 150, which is journaled in the rocking frame 148, which is supported by the stationary casing 151. The bevel gear 152 cooperates with the bevel gear 153 on shaft 154 which is provided at the upper end with bevel gear 155 which coöperates with the bevel gear 156 on shaft 141, see Fig. 10. The casing 151 is journaled on the inverted column 157 which is secured to the plate 158 which is slidably connected with the beam 94 forming part of the stationary framework. The plate 158 also carries the pinion 159 operated by the hand wheel 160, said pinion adapted to coöperate with the rack 161 on beam 94; the purpose of which is to move said plate and the structure supported thereby along the beam to any desired position. The plate structure 158 also carries the bearing for bevel gear 156 which is feathered on shaft 141, so that said bevel gear 156 will maintain the desired relative position with respect to its coöperating gear 155.

The movement of the combing wheel by means of the pinion 159 and rack 161 is for shifting the wheels laterally to the desired position with respect to the pile of sheets. The purpose of journaling casing 151 on the end of column 157 is to permit a slight rotative movement in said casing 151 to change the direction of the comb. The shifting is accomplished by means of the pinion 162 coöperating with the sector gear 163 forming part of the column 157. The handle 164 is connected with the pinion 162 moving in a slot 165 in the casing 151. By means of the handle 164 and pinion 162 cooperating with the sector gear 163 ample power is given for a very slight and even movement of the casing 151 and amply secures all the adjustment in this respect that is necessary. The purpose of this adjustment is to change the direction of comb to overcome a tendency which sometimes develops in the sheets not to comb straight. The casing 151 is made in two parts; the split surface of one-half is shown clearly in Fig. 10. Each shell is provided with four holes for bolts 166 and 167; the bolts in the three holes 166 are adapted to be clamped tightly to bring the opposing faces together; while the bolt in opening 167, the surface approximate this opening being relieved slightly, serves as a clamp bolt to pinch the casing around the journal of the column 157.

It will be understood that the combing wheel supported in the frame 148 has a rocking movement about shaft 150; said movement being normally controlled by the pneumatic head 168 and the springs 169. The normal possible range of rocking movement is about two inches. When, however, there is a distinct difference in the height of the pile of sheets at one side from the height at the other side, it becomes necessary for one combing wheel to work at a lower level than is within the range of its normal possible variation. For this purpose we secure a means for manually lowering said combing wheel to meet this emergency as follows; the casing 151 is provided with the projection 170, see Figs. 13 and 15, having an arc-shaped face. Secured to the face of the projection 170 by dovetail engagement is the bracket 171 having a coöperating arc surface corresponding to the arc of projection 170 so that said bracket is capable of being adjustably secured in different positions on the arc surface of projection 170 by means of a clamp plate 172 forming an element of the dovetail, see Fig. 58. The movement of the bracket on the projection 170 is secured

by the following mechanism. To the bracket 171 are secured the connecting bars 173 at the outer ends of which is the cross head 174. A screw 175 is tapped into the bracket 176 of casing 151, see Figs. 15, 16 and 62. This screw passes through the cross head and is provided with a shoulder on one side and a head on the other side of the cross-head, so that by turning the screw in one direction or the other the cross-head is moved toward and away from the bracket which gives a corresponding movement through the connecting bars 173 and the bracket 171. To bracket 171 is secured the head structure 168, said bracket 171 being clamped about a portion of the head structure 168. It consequently follows that the position and formation of the arc surface of projection 170 is such that by the movement of the bracket 171 thereon in one direction or the other the head structure 168 is elevated or lowered as the case may be to elevate or lower the combing wheel.

Combing wheel rocking actuation.—The combing wheel supporting frame 148 is supported at two points namely the axis 150 and the stud or pivot connection 177 which secures the cross head 178. To cross-head 178 are secured the ends of the two springs 169; the other ends of said springs being secured to cross-head 179 from which extends the rod 180, which is pivotally secured at its outer end to the bracket 171, so that the said spring structure is supported by said bracket 171. These springs it will be understood, are always under tension, and are of such strength and length and are arranged in such a position initially with respect to the rocking movement of the combing wheel frame as to give a practically uniform vertical lifting force to the combing wheels throughout the range of working motion. This is necessary for the reason that the same pressure should be given or exerted by each combing wheel, although one may be working in a position an inch lower than the other. The pressure head structure 168 comprises a casing having a diaphragm piston therein which is connected with the piston rod 181. The lower end of this piston rod 181 is connected to the combing wheel frame by a pivot 182. When compressed air is admitted to the pressure head 168 the diaphragm and pivot rod connected therewith are depressed which depresses the combing wheel frame against the tension of springs 169, which brings the combing wheels down upon the pile of sheets. The limit of the upward and downward movement of the combing wheel is secured by the engagement of the piston against either the lower or the upper side of the casing of pressure head 168.

It will be understood that the pneumatic pressure delivered at one combing wheel pressure head is always the same as that delivered simultaneously at the other, and therefore it is extremely important for uniform combing that the counterbalancing effects of the springs must also be simultaneously the same. For this reason as above stated, the springs are so connected and arranged with respect to the rocking movement of the combing wheel frame as to give practically uniform vertical lifting force to the combing wheels throughout the range of their working motion.

Valve control of pneumatic supply to the pneumatic pressure heads of the combining wheels; tail clamps and drop roller latches.— Referring to Figs. 14 and 24 to 29 inclusive, 183 indicates the cylinder and 184 the piston of the pneumatic valve which controls the passage of air from the chamber 185, connected with the source of air pressure supply to 186; 186 is connected with the pneumatic heads above referred to, and also when the piston drops it permits the passage of compressed air from 186 to the exhaust 187, to relieve said pneumatic heads of pressure. The general construction and operation of this valve has been fully described in the prior art. The piston 184 is in the nature of a gravity-actuated piston but to insure its positive and quick actuation the spring 188 is provided to press upon the upper end thereof. A valve trip member 189 is pivotally secured at 190 to a bracket 191 connected with the drop roller shaft 192. The lower forward end of this arm 189 has an inclined face 193 adapted normally to lie in the path of travel of the advancing sheet, while said member 139 has an upward extension 194 above the pivot connection 190. To this upper extension 194 is secured the upwardly extending parallel arm 195. This arm 195 is adjustably connected with the extension 194 so that its upper end may be moved toward or away from the upper end of said extension 194. The member 195 is adapted to actuate the piston 184 of the pneumatic valve in the following manner. When the drop roller is depressed as shown in Fig. 30, the arm 191 and the tripping member 189 are brought to such position as to carry the member 195 beneath the lower end of this piston 184 as clearly shown in this figure. When the shaft is rotated to bring the drop roller into the elevated position, as shown in Fig. 25, the arm 195 elevates the piston 184 as clearly shown in this figure. With the parts as shown in Fig. 25, the sheet now advances to encounter face 193 of the trip member 189. Passing under this face the forward end of the trip member is raised to the position shown in Fig. 28, which carries the extension 195 from under the piston 184, permitting the same to fall. Fig. 29 shows the tripping member in substantially the same position as in Fig.

28, but the drop roller is now lowered to the operative position and the sheet further advanced. In Fig. 30 the sheet has passed beyond the tripping member 189 and the same has fallen behind the sheet, bringing the extension 195 under the piston 184 as above described.

In the position of the parts shown in Fig. 25 it will be evident that the air pressure supply is in communication with the pneumatic heads of the combing wheels, which maintains said wheels in the depressed or working position. The air pressure supply is also in communication with the pressure heads of the tail clamps 77, see Fig. 22, to cause the elevation of said clamps so as to free the same from the sheets which the combing wheel is acting upon. At the same time the air pressure is in communication with the heads 196, see Figs. 5 and 12, the piston rod of which serves as a latch for arm 197, which is connected with the drop roller shaft 192. This serves to maintain the drop roller latched in the elevated position and prevents it from coming down on the sheets while the valve is in said position.

In the position shown in Fig. 28 the valve piston 184 has fallen, so that communication is closed between the source of supply of compressed air and the pressure heads, and opened between said pressure heads and the exhaust, which results in the elevation of the combing wheels by the springs 169, the descent of the tail weights 77 on the pile of sheets and the depression or withdrawal of the latching piston 198 from the path of travel of arm 197 of the drop roller shaft, so that the said drop roller is free to fall upon the sheet when so permitted by the cam hereinafter described, see Fig. 13. The valve cylinder 183 is inclosed in the valve casing 199. This casing is provided with channels and chambers as follows.

As already mentioned, the chamber and channel 185 communicates with the source of air supply 200 and the chamber and channel 186 which is connected through pipe 201, see Fig. 23, to the combing wheel head 168, see Fig. 13, and through pipe 202 to the drop roller latch head 196, see Figs. 5 and 12. Air pressure is also communicated from the combing wheel head 168 through pipe 203 to the tail clamp head 204, and the blowing nozzles 82 and 83 connected therewith, see Figs. 1, 13, 14 and 22.

It is to be noted that the air pressure for the blowing nozzles always corresponds to the air pressure for operating the combing wheels. If the paper should be hard to comb as above described, and the air pressure is increased to effect a greater pressure on the combing wheels it will then blow with more pressure through the nozzles into the pile thereby still further aiding the combing action. If the paper combs too freely a reduction in the air pressure both decreases the pressure of the combing wheels on the paper and also the quantity of air blown into the pile. As above described, the low pressure reservoir is maintained at any required pressure by the adjustment of the tension of the spring 105 on the valve piston 104, see Fig. 11.

Detector.—The following detector is provided on the feeding machine, operating to control the actuation of the drop roller.

Referring to Figs. 31, 32 and 33, the detector comprises a caliper device, one element of which is the steel guide or prong 205, which lies in a channel of and projects partly over the axis of the feed roller 133; the upper surface being practically in line with the upper surface of the roller; the other element of the caliper is the pivoted counterweighted arm 206 secured to the structure 207 which is adjustably connected to the stationary framework of the machine. By a suitable adjustment of this structure as hereinafter to be described, is secured the desired space between the lowest point of member 206 and the top of guide 205. This space is just sufficient for the passage of a single sheet therethrough, sufficient clearance ordinarily being allowed for the usual variation in thickness between different sheets. Rigid with arm 206 is the vertical extension 208, the upper end of which is adapted normally to lie against the nozzle 209, see Figs. 33 and 57, which communicates with the chamber above the diaphragm in pneumatic head 210. The counterbalancing effect of member 206 serves normally to maintain the upper end of arm 208 in engagement with the nozzle 209. The chamber of head 210 is connected through pipe 211 with the high pressure reservoir 95. The communication between the chamber of head 210 and pipe 211 is through a very minute aperture of considerably less area than that of the opening of nozzle 209. For example, the area of opening of nozzle 209 should be eight times that of the aperture 212. A convenient way of securing this very minute aperture having an exact relationship with the area of the nozzle 209 is shown in Fig. 56, Sheet 11. This view is enlarged several times in order to show clearly the idea, namely, a hole is drilled through the member 210, into which is inserted a pin 213 which fits perfectly. This pin is slightly flattened on one side and by micrometer measurements an exact ratio between the opening secured thereby, and the opening of the nozzle 209 may be calculated to a nicety, or with mathematical precision; it being understood that an approximately accurate relation between said two apertures is essential for the successful operation of said valve. Piston 214 is provided with a

piston rod 215; the lower end of which engages with arm 216. This arm 216 is pivotally supported at one end and is controlled by the spring 217. The arm 216 is provided with a downwardly extending latch arm 218 having a hook at its lower end. This hook is adapted to engage with the arm 219 connected with the drop roller shaft 192.

It will be understood that the adjustment of the structure 207 is such as to maintain the member 206 sufficiently spaced above the guide 205, to permit the required clearance for a sheet to travel between said elements 205 and 206. While this condition pertains the nozzle 209 is maintained closed by the arm 208 and the pressure of air passing through aperture 212 is sufficient to maintain the piston 214 depressed against the actuation of the spring controlled arm 216. This maintains the latch 218 in the withdrawn position, that is, out of the path of travel of the arm 219, carried on the drop roller shaft 192. When, however, two sheets come together or two sheets approach the elements 205 and 206, not sufficiently combed apart, they will cause the slight elevation or lifting of element 206, sufficient to separate the arm 208 from the end of nozzle 209. This immediately permits the escape of air from the chamber of 210 above the diaphragm thereof faster than it can enter through aperture 212. This permits the raising of the piston 214 in response to the actuation of spring 217, through lever 216 and permits the latch 218 to move into the path of travel of arm 219 to prevent the descent of the drop roller.

Adjustment of the caliper device.—The bracket 207 is secured on the stud 220 which is rigidly connected with bracket 224 forming part of the stationary framework of the machine. Part of the bracket 207 has the formation of a sleeve 221 which slides over said stud 220 and is maintained in position by a nut 222. The lower end of stud 220 is hollow that is, formed into a sleeve in which is seated spring 223; the lower end of which bears upon a clip 225 which is secured to the sleeve 221. It will thus be seen that the compresion spring which exerts tension between the stud 220 and the clip 225, which is connected with the sleeve 221, serves to press the sleeve 221 home against the adjusting nut 222, so that by turning the nut 222 an exceedingly fine adjustment is secured between bracket 207, and consequently the lower point of element 206 and the upper surface of element 205. The nut 222 is provided with graduations, see Fig. 34, which, in coöperation with the single mark on the sleeve 221, serves to indicate an extremely minute adjustment of the caliper elements.

Drop roller mechanism.—The drop rollers 226 are supported on the brackets 227, see Figs. 5 and 13, carried on the shaft 192 and are adapted to be lowered and elevated into and out of the coöperating position with the feed roller 133. The rocking movement of the drop roller shaft 192 is secured by the cam 228 coöperating with the roller 229 on the arm 230 which is connected with the shaft 192. The positive coöperation between roller 229 and cam 228 being secured by the spring 231. This cam 228 is mounted on the shaft 136.

Table raising mechanism.—Referring to Fig. 13, the rod 232 is pivotally connected at its lower end with an arm 233 secured to the drop roller shaft 192, see Fig. 12, the upper end of rod 232 has a link connection with the pivot 234. This pivot 234 is carried on the outer end of one element of the arm 235 and is mounted on shaft 236. To shaft 236 are secured two arms 237, one for each combing wheel. The lower end of arm 237 is provided with a latching projection 238, which is adapted to coöperate with the latch element 239 secured to arm 240 which is pivoted at 241 and has an extension 242 beyond the pivot 241 the outer end of which is pivotally connected with the rod 243, the lower end of which is provided with a shoe 244, adapted to rest upon the top of the pile of sheets. When the pile of sheets is sufficiently high the shoe is raised to a position causing the engagement of the latch elements 238 and 239. When the pile of sheets becomes sufficiently low to cause the disengagement of latching elements 238 and 239, the arm 237 is permitted to respond to the spring actuation with the rocking of the drop roller. Connected with the shaft 236 is the arm 245, see Fig. 3, the upper end of which is connected with the reciprocating rod 246, supported at its outer end by the bracket 247; this rod 246 is adapted to actuate the pawl 248 (in the manner described in the prior patent to me, No. 789,809; May 16, 1905).

Starting and stopping mechanism.—The low pressure chamber 96 is connected through the hollow frame 249 through channel 250 with the air chamber 200 forming part of the framework of the machine. The end of chamber 200 is provided with two openings, opening 251 communicating with channel 250, while opening 252 communicates with channel 253 to the atmosphere. These openings 251 and 252 are controlled by the valve 254 adapted to rock on shaft 255 which is journaled in the stationary framework of the machine. This shaft is actuated by the arm 256, said valve being moved into either of two positions. In the position shown in Fig. 38, the valve closes opening 252 and leaves opening 251 open in which position communication is maintained between channel 250 and chamber 200, that is, chamber 200 is in communication with air

pressure supply. In Fig. 37 the valve is shown in dotted lines in the opposite position in which port 252 is open and 251 closed, so that the chamber 200 is in communication with the atmosphere to relieve any pressure that may be in said chamber. Loosely journaled on the hub of arm 256 is the arm 257. Arm 256 is connected with the spring 259 which normally maintains the said lever, and consequently the valve 254 in the position in which chamber 200 is open to atmosphere, being the position shown in Fig. 5.

The arm 257 is provided with the two hand operating rods 260 and 261, one extending to the back of the side of the machine and the other to the front. These rods 260 and 261 are connected with the arm 257 with the studs 262 and 263. These studs also project on either side of the upper end of arm 256 and serve to limit the independent motion of arms 256 and 257. The latch member 264 is pivotally mounted at 265. This latch is provided with the wheel 266. The arm 257 is provided at its upper end with the two inclined surfaces adapted to engage with the wheel 266 to lift the latch 264 so that the arm 256 will come under and engage in the notch of said latch; said latch being held down by gravity in the operating position, that is, with the air chamber 200 in communication with the source of air pressure supply. To arbitrarily unlatch arm 256 to move the valve into the inoperative position, that is to shut off the supply of compressed air and open chamber 200 to the atmosphere, the arm 257 is moved from left to right in Fig. 4 causing the inclined surface at the upper end of said arm to engage wheel 266 to lift latch 264 out of engagement with the upper end of arm 256, so that the same may respond to the actuation of spring 259. Latch 264 is also provided with a tail 270, see Figs. 4 and 5. This tail is connected with the piston rod of the diaphragm piston in the head 271, which is controlled in the manner hereinafter to be described. When this diaphragm piston is operated pneumatically the latch 264 is actuated to release the arm 256 automatically.

Cam controlled valve.—Referring to Figs. 20 and 21, these figures show a valve for controlling the supply or flow of compressed air from the high pressure supply reservoir 95 to the various pneumatic devices hereinafter mentioned. Pipe 276 leads from the high pressure tank or reservoir 95 to chamber 277 of the valve casing 278. Chamber 279 is connected by a pipe 280 leading to the diaphragm of the pneumatic heads of the side guide and the trips pneumatically operated on the apron, while chamber 281 communicates with the atmosphere. The piston 282 closes communication between these two chambers in the usual way. This piston is operated by the arm 283 actuated by the cam 284 on shaft 136. Positive relation between 283 and 284 is maintained by the spring 285 bearing on the top of the piston. This cam of course is so proportioned and operated as to operate the valve relatively to the other actuations of the machine.

Referring to Figs. 44 to 48 inclusive, I have provided the finger or trip 308, pivotally mounted at 309, which trip is adapted by its formation, to hang by gravity, with its lower extension slightly in advance of the guide 286. The horizontal arm 310, which is connected with the structure supporting arm 308, is adapted to engage with the nozzle 311, which limits the upward movement of said arm 310, and consequently the movement of arm 308 in one direction. The arm 312, which is also connected with the member 308, serves as a gravity weight, and is also adapted to cooperate with pin 313, for the purpose hereinafter to be described. When the arm 308 is in the position shown in Fig. 46, which is the normal position, it is adapted to be encountered by the front edge of the sheet passing beneath the guide 314 and over the guide 315. When so encountered the arm 308 is carried to the position shown in Fig. 47, which causes the downward movement of arm 310 away from the end of nozzle 311; the result of which movement is as follows:

Referring to Fig. 48, the pipe 316 is connected with high pressure air supply, and communicates, through an extremely restricted opening 317, with the channel 318, which channel communicates with nozzle 311. The opening in nozzle 311 is several times greater than the opening 317. Channel 318 communicates through pipe 319 with the diaphragm chamber 320. It will be understood that there are two guides 286 and consequently two trip fingers 308, and also two diaphragm chambers 320; the diaphragm of each chamber operating the same piston 321 against the actuation of spring 322, see Fig. 39.

Returning to Figs. 46 and 48, when the arm 310 is against the nozzle 311 closing the same, as shown in these figures, a pressure will be maintained in chamber 318, which is communicated to the diaphragm chamber or chambers 320. It will thus be seen that when there is pressure in either chamber 320 the piston 321 will be pushed in against the actuation of spring 322 as shown in Fig. 40. When the arm 310 is depressed as shown in Fig. 47, the air will be permitted to escape faster through nozzle 311 than it can enter through nozzle 317, as already explained in connection with a similar device shown in Figs. 33 and 57. The purpose of this mechanism is as follows:

Where the sheet advances straight and

squarely encounters both of the fingers 308, then both fingers are moved forward into the position shown in Fig. 47, relieving the air pressure from both of the channels 318, and consequently from both of the diaphragm chambers 320. This results in permitting the return of the piston 321 in response to the actuation of spring 322 as shown in Fig. 39. This results in bringing the head 323 of piston 321 over the rim 324 of the piston 325 and latching the same in the depressed position as shown in Fig. 64, for the purpose hereinafter specified.

It thus follows that until or unless the sheet comes forward squarely against both of said fingers 308 to move them forward into the position shown in Fig. 47, the pressure will not be relieved from both the diaphragm chambers 320 to permit the movement of the piston 321 into the latching position shown in Fig. 64, as above described. When the piston 325 is held latched in the depressed position as above described, it is prevented from being actuated by air pressure delivered to diaphragm chamber 326, which is delivered thereto through pipe 292, connected with flexible pipe 280 by flexible pipe 290 and pipe 291, by the cam controlled valve shown and described in Fig. 21. This piston 325 is connected with a valve piston 327 and controls the flow from chamber 328 which is connected with the high pressure air chamber 329 to chamber 330, which is connected through pipe 331 which is connected with a passage in framework 332 leading to the chamber 333 located in the part 334 of the framework of the machine. The chamber 333 in part 334 is connected with pipe 335, see Fig. 7. Pipe 335 is connected by hose 336 with pipes 337 and 338. Pipe 337 leads to the diaphragm head 271, while pipe 338 leads to the diaphragm chamber 339, see Fig. 52.

In Fig. 40 the piston 325 is shown unlatched and elevated by the pressure delivered through pipe 292 by the cam controlled valve shown in Fig. 21. When this piston 325 is elevated as shown in Fig. 40, compressed air is permitted to pass from high pressure air supply in 329 to pipe 331. As just hereinabove described, said pressure is delivered to the diaphragm heads 271 to cause the depression of the arm 270 of latch 264 to cause the movement of the latch into the unlatching position as shown in Fig. 5. At the same time air pressure is delivered to the diaphragm chamber 339, see Fig. 52, to cause the elevation of the piston 540 and piston rod 541 to actuate the lever 342 which actuates the foot trip 343 to prevent the depression of the printing roller which is a well known device and need not be described here. At the same time the lever 344, which is on the same shaft 345 as lever 342, is elevated to actuate through connecting rod 346 the bell lever 347 to throw open the electric switch 348 on the rheostat 349, which controls the current to the motor. This brings the press to a stop.

It will thus be seen that where both of the trips 308 are moved forward at the proper moment at the cycle of the machine's operation the pressure is relieved from both chambers 320 to permit the latching of the piston 325. Where, however, by cause of the sheet not being fed forward squarely only one of the trips 308 is actuated, there is still pressure in one or the other of said diaphragm chambers 320, which prevents the movement of piston 323 in response to actuation of spring 322 into the latching position, so that when the cam operated valve shown in Fig. 21 is moved to admit compressed air into the diaphragm chamber 326 under piston 325, the actuation of piston 325 moves valve piston 327 to open the passage way for compressed air to the diaphragm chamber 339, see Fig. 52, to prevent the printing operation of the press, and to throw the current from the motor driving the press, and at the same time compressed air is delivered to head 271, which throws the latch 264 into the unlatched position which permits the movement of latch 340 into the engaging position with arm 341, on drop roller shaft 192. This serves to prevent the feeding of a sheet which may be just combed forward ready to be delivered by the drop roller 226 and feed rollers 133.

It might be noted that latch 340, see Fig. 5, is pivotally connected with the arm 257 and naturally falls into the latching position when the arm 257 is in the position shown in Fig. 5.

It will thus be noted that unless the sheet comes squarely up to both guides 286 to trip both trips 308 within a required period of each cycle of the machine, the drop and feed rollers for delivering the combed sheets are made inoperative, and the press cylinder is prevented from being lowered into the printing position automatically, and also current is cut out of the motor driving the press. It will be noted that this last step need not be necessary, and the connecting rod 346 may be dispensed with, the other mechanism still preventing a sheet from being fed to the press unless it is fed squarely and also preventing a sheet from being fed from the drop and feed rollers until the feeder is again started by the operator in the manner above described.

Between piping 331 and the frame 332, I provide a hand controlled valve or cock 350, see Figs. 53, 54 and 55. This serves to interrupt the passage of compressed air from pipe 331 to the heads above described, so that the operator may arbitrarily prevent the said automatic actuation above described to bring the machine under his own control

when necessity requires it. It is obvious that such a condition is necessary in starting the machine until the sheets get to their proper positions, and so on. Fig. 54 shows the cock in the position in which the passage of compressed air from 331 to the diaphragm heads is not interrupted. Fig. 53 shows the position in which such passage is interrupted and communication is established between said diaphragm chambers and outside atmosphere, to relieve pressure on said heads.

Pneumatic actuation of side guide.—On 292, see Fig. 51, is a hose 351, which leads to the diaphragm chambers 352, see Figs. 50 and 51, so that at the proper period in the operation of the machine, high pressure air supply is admitted to the diaphragm 352 by the cam actuated valve as shown in Fig. 21, which causes the reciprocating actuation in one direction, against spring 389 of the reciprocating rod 366 through the piston rod 353, pivoted lever 354, and connecting rod 355, with each rotation of said cam. The movement in the other direction is caused by the actuation of spring 389 when pressure is relieved from diaphragm chamber 352.

Side guide construction and operation.—The reciprocating rod 366 is seated in a bored out portion of the member 367, which is slidably connected with the parallel bars 390 and 391, see Fig. 59, Sheet 12, which extend across the machine, and is connected with, and actuated by, the connecting rod 355 in the manner above described. Upon this reciprocating rod 366 is mounted the upwardly projecting bracket 368, see Figs. 50, 51, 59, 60, 61 and 63. To this bracket 368 is pivoted at 369 the upper jaw member 370. This jaw member 370 is provided with the two inclined faces on the underside thereof which are adapted to engage with the roller 371 on the fixed bracket 372, which is secured to the stationary framework of the machine. From which arrangement it will be understood that by the reciprocation of the jaw member 370 with the reciprocating rod 366, the jaw member will be actuated to open and close in the way already known in the art. The following differences however, are to be noted between this and former structures; the horizontal extension 373 of the jaw member coöperates with the reciprocating bar 366 to form the gripping surfaces for engaging the sheet. It will be noticed that the upper side of bar 366 is slightly flattened as shown in Fig. 60. It will be noted also that the stop 374, which is mounted on the bracket 372, has a recessed or concave formation very close to its lower extension for the following purpose. This stop 374 arrests the movement of the sheet after it has entered in between the jaws of the side guide. When the jaws release the sheet after registering the same, the parts assuming the positions, shown in Fig. 51, the sheet is drawn from between the jaws transverse the longitudinal extension of the jaws, that is, the edge of the sheet would be dragged along against the bottom of the stop 374, if the sheet were perfectly square. To prevent any distortion by this stop of the sheets not perfectly square, the recessed or concave formation 375 of the stop is provided to permit the edge of the sheet to slip into said recess 375, thus preventing any obstruction or distortion of the sheet by the stop. This provides that the sheet will be fed so as to lie perfectly flat or true on the printing cylinder, that is, to have a true register.

The spring actuation of the jaw 370 is secured by the following mechanism. Pivotally secured at 376 to the upwardly extending arm 377 of jaw member 370 is the spring rod 378, upon which is provided the spring 379 in the barrel or tube 380 to the upper end of which is threaded the cylinder 381 which engages the upper end of the spring. This forms a convenient means for adjusting the tension of the spring simply by turning the threaded cylinder 381 in one direction or the other as desired. The barrel 380 is trunnioned at 382 to bracket 368, see Fig. 59. By the arrangement thus described, the spring exerts a greater pressure on the gripping jaw 370 when the jaw is in the closed position, and exerts a minimum pressure when the jaw is in the raised position, because the pivot 376 in such raised position, approaches the dead center.

Upon the arm or jaw member 370 is provided the latch member 383 which is adapted to coöperate with the hook 384, which is pivoted at 385 to a projection 386 of bracket 368. To hook 384 is secured the leaf spring or spring blade 387, which is adapted to encounter the stationary rod 388 at the end of each movement to the left of the reciprocating rod 366, which serves to push the hook into engagement with the latch member 383, when the jaw member 370 is raised, as shown in Fig. 51. At the end of the movement of rod 366, in the other direction, that is, to the right, the jaw member 370 is again raised by encountering the roller 371 sufficiently to release the hook 384 engaging the latch member 383, so as to permit the hook 384 to drop by gravity, see Fig. 50. The purpose of this construction is to permit the forward movement or the movement to the right of the jaw members without permitting the same to close as would normally be the case, in order to permit the forward movement of the jaw member before the sheet has been withdrawn therefrom.

Adjustment of side guide.—As above stated, the supporting member 367 of the side guide has a channeled engagement with the horizontal bars 390 and 391. The slidable adjustment of the member 367 is se-

cured by means of a lug 392 which is clamped to bar 390 by means of the set screw 393, see Fig. 63. To lug 392 is swiveled the adjusting screw 394, which is tapped into a lug connected with the casing of diaphragm chamber 352. This adjusting screw 394 is provided with a knurled thumb head 395 so that by turning the screw in either direction the exact position of the side guide structure is secured. By disengaging or unclamping the lug 392 from the bar 390 the member 367, carrying the entire side guide structure can be slid off the ends of the bars 390 and 391 and carried and secured to the other side of the machine in the same way. The main or preliminary adjustment of the member 367 is secured by the proper clamping of lug 592 on bar 390; while the final or finer adjustment is secured by the adjusting screw 394.

Additional high pressure air supply.—As already described, the high pressure air supply is delivered to chamber 95. From air chamber 95 leads the pipe 356, see Fig. 7, to a hose which in turn connects with pipe 358, which pipe 358 connects with the passage 359 in the framework 360, see Figs. 7 and 42, which passage 359 leads to chamber 361 in the frame member 362, said chamber 361 being connected through passage 363 by frame member 364, with the chamber 329, see Fig. 42.

Connections with chamber 329.—Chamber 329 is connected with valve chamber 328, see Fig. 40, with pipe 316, see Figs. 7 and 48, and with the pneumatic elements for controlling suitable sheet retarding devices, not claimed herein.

Detectors at the fly.—Referring to Figs. 44 to 48 inclusive, the pin 313 is mounted on the arm 396 which is pivoted at 397 and has a substantially horizontal extension carrying the counterweight 398. The normal actuation of this arm 396 by counterweight 398 would be to bring the pin 313 in engagement with the arm 312 to cause the closure of the nozzle 311 by the arm 310, that is, by the position shown in Fig. 46, that is to say, the actuation of the pin 313 against arm 312 would be against the actuation of the sheet. The normal actuation of member 396 by counterweight 398 is, however, normally prevented as follows: The arm 399 is pivotally mounted at 400 and is provided with the counterweight 401, which is slidably mounted for purposes of adjustment. Beyond the pivot 400 is the extension 402 which is adapted to project beneath the counterweight 398. The normal position of member 399 is secured by its engagement with the cross rod 403, that is, the limit of its downward movement is secured by this engagement of the part extending over the cross rod 403; the limit of its upward movement is secured by the engagement therewith of the part extending beneath the cross rod 403. In the normal position of member 399 as shown in Fig. 44, the extension 402 encounters the counterweight 398 and by cause of the counterweight 401 is able to lift the counterweight into the position in which the pin 313 is out of engagement with the arm 312 as shown in Figs. 44 and 46. In case however, there should be an obstruction of the sheet being delivered from the press roller to the fly 404, the crumpling or corrugation of the sheet between the member 399 and guide 405 will cause the lifting of the member 399, and the depression of extension 402 away from counterweight 398, which will permit the pin 313 to encounter the arm 312 and force the same even against the actuation of a sheet fed against the lever 308, to cause the closure of the nozzle 311 by the arm 310, which will cause the stoppage of the machine in the manner above described.

It is to be noted that the structure carrying the various trip arms 312 and 308 and guide 314 and associated mechanism, which includes the shaft 406 and arm 407, (the last two elements forming part of the printing press), is raised into the position shown in Fig. 45, by certain mechanism of the printing press not shown when the sheet is delivered at the time the nippers close on the press cylinder. In this position it may be noted that the arm 310 is permitted to close the nozzle 311. The nozzle is also closed as shown in Fig. 46 when the sheet is not in a position to actuate 308. These positions however, are positions in which the press will not be stopped because the actuation of the cam is so timed as not to be affected except when the sheet should be in the required position.

The operation of my device is as follows: It may be stated that the specific feeding device above described, and illustrated, is adapted for use with a two-revolution press. Referring to Fig. 3, the pile of sheets 75 is shown in position on the table for the feeding operation. The machine is started by pushing the rod 260 to actuate levers 256 and 257 in the manner hereinabove described. The pile of sheets is combed forward by the combing wheel 76 when in the position shown in Fig. 13; the blowing devices, the presser feet and the drag-weight coöperating with the combing wheels to keep the sheets properly directed as already described.

While the machine works normally, the top sheet will pass beneath fingers 189 raising the same to cause the raising of the combing wheel out of contact with the sheets, while at the same time the presser feet 77 are permitted to descend upon the rear of

the pile, immediately back of the top sheet, leaving the same free to be withdrawn from the pile.

The sheet is now ready to be acted upon by the drop and feed rollers 266 and 133, which, at the proper time, by cam actuation, coöperate to draw the sheet away from the pile and deliver it to the tapes 273 of the apron. As the sheet travels along the tapes 273 and moves over the inclined board 272, it is flattened out, as to any sag that might occur between the tapes.

Before reaching feeding guides 286 however, the finger or trips 308 are encountered by the sheet, and, if the sheet is traveling true and square, both of said trips 308 are actuated in the manner described, to secure the normal operation of the machine as above described, that is, to prevent the stopping of the feeder and of the press, which would be the case if the sheet did not come squarely in contact with said trips.

While the sheet now dwells against the guides 286 the side guide shown in Figs. 50 and 51 operates upon the sheet in the manner already clearly described, to bring it to proper register. The nippers on the cylinder of the press, not shown, now engage the sheet in the usual way; the guide 286 being raised simultaneously to the position shown in Fig. 53; it being understood that this mechanism is part of a standard printing press. The sheet is now carried around the cylinder, in the usual way, and printed and is then delivered between guides 399 and 405, and onto the flies 404, when the machine is operating normally. In case there should be any choking of the sheets between 399 and 405, the frame of which 399 forms a part, is raised thereby, which results in the closing of nozzles 311 shown in Figs. 54 and 55 of the pneumatic chamber, which in turn results in the stopping of the feeding machine in the manner already described.

What I claim is:—

1. In a sheet feeding machine, a combing wheel, regulatable pneumatically operated means for pressing said wheel upon the sheet, means for blowing air between the sheets and means for securing a constant pressure relation between said combing wheel and blowing means.

2. In a sheet feeding machine, a combing wheel, air pressure means of varying range for communicating pressure to the wheel, means for blowing air between the sheets and means for securing a constant pressure relation between said combing wheel and blowing means.

3. In a sheet feeding machine, the combination of a combing wheel, means for imparting a varying pneumatic pressure to the wheel, means for blowing air between the sheets and means for securing a constant pressure relation between said combing wheel and blowing means.

4. In a sheet feeding machine, having pneumatically controlled sheet separator and trip mechanisms, an air pressure system for controlling said pneumatically controlled mechanisms, comprising two reservoirs, one having a high constant pressure and the other a low variable pressure.

5. In a sheet feeding machine, having pneumatically operated sheet separator and trip mechanisms, an air pressure system for operating said pneumatically operated mechanisms, comprising two reservoirs, one having a high constant pressure and the other a low variable pressure, and means for maintaining said different pressures.

6. In a sheet feeding machine, a combing wheel, a pressure shoe having a double pivotal support and adapted to engage the pile of sheets at substantially the middle of the rear edge thereof, and an adjustable weight connected therewith.

7. In a sheet feeding machine, a combing wheel, a pressure shoe pivotally supported and adapted to engage the pile of sheets at substantially the middle of the rear edge thereof, a threaded rod connected therewith and a weight threaded thereon and adjustable to vary the pressure of the presser foot.

8. In a sheet feeding machine, a combing wheel, a pressure shoe pivotally supported and adapted to engage the pile of sheets at substantially the middle of the rear edge thereof, a threaded rod connected therewith and a weight threaded thereon and adjustable to vary the pressure of the presser foot or to relieve the pressure thereof entirely.

9. In a sheet feeding machine, a combing wheel, a pressure shoe pivotally supported and adapted to engage the pile of sheets at substantially the middle of the rear edge thereof, a threaded rod connected therewith and a weight threaded thereon and adjustable to vary the pressure of the presser foot, said shoe arranged to bear the hardest at the extreme back of the pile and gradually less on the sheets that are combed into more advanced position.

10. In a sheet feeding machine, having pneumatically operated sheet separator and trip mechanisms, an air pressure system for operating said pneumatically operated mechanisms, comprising two reservoirs, one connected with the sheet separator mechanism and the other connected with the trip mechanism, and one of said reservoirs having a high constant pressure and the other having a low variable pressure.

11. In a sheet feeding machine, having pneumatically controlled sheet separator and trip mechanisms, an air pressure system for controlling said pneumatically operated mechanisms, comprising two reservoirs, one

connected with the sheet separator mechanism and having a low variable pressure, the other connected with the trip mechanism and having a high constant pressure, and a regulating valve between said reservoirs.

12. In a sheet feeding machine, having a pneumatically operated combing wheel, an air pressure system comprising two reservoirs, one having a constant pressure and the other a lower variable pressure, and a regulating valve between said reservoirs for maintaining the required pressure of the higher pressure reservoir, the means for operating the combing wheel being actuated by the pressure of the lower pressure reservoir.

13. In a sheet feeding machine, having pneumatically operated sheet separator and trip mechanisms, an air pressure system for controlling said pneumatically operated mechanisms, comprising two reservoirs having different pressures, one pressure constant and the other variable, and an escape valve connected with the reservoir having the variable pressure, the means for operating the sheet separator mechanism being actuated by the pressure of the variable pressure reservoir.

14. In a sheet feeding machine, having pneumatically operated sheet separator mechanism, an air pressure system for operating said separator mechanism, comprising two reservoirs one having a constant pressure and the other a variable pressure of different degree, a regulating valve between said reservoirs and means for supplying a sufficient quantity and pressure of air, to maintain the required pressure in one reservoir and cause sufficient flow through the valve to maintain the required supply in the other reservoir.

15. In a sheet feeding machine, having a pneumatically operated combing wheel, an air pressure system connected with the combing wheel, comprising two reservoirs, a blower delivering to one reservoir and a valve for automatically maintaining the required constant pressure in one reservoir and permitting overflow from said reservoir to the other reservoir.

16. In a sheet feeding machine, having means for blowing air between the sheets, an air pressure system comprising two reservoirs, a blower delivering to one reservoir and a valve for maintaining required constant pressure in one reservoir and permitting the overflow to the other reservoir, and an escape valve for maintaining the required pressure in the latter reservoir, said blowing means being connected with said last mentioned reservoir.

17. In a sheet feeding machine, having pneumatically operated sheet separator and trip mechanisms, an air pressure system comprising two reservoirs having different pressures, one high and constant and the other low and variable, and a valve connected with the variable pressure reservoir for maintaining the required pressure therein, said valve comprising a piston, a spring for controlling same and manually operative means for varying the tension of the spring.

18. In a sheet feeding machine, having pneumatically controlled sheet separator and tripping mechanisms, an air pressure system for controlling said pneumatically controlled mechanisms, comprising two reservoirs having pressures of different degree, one constant and the other variable, and means for maintaining in one reservoir a pressure in excess of the highest pressure required in the other.

19. In a sheet feeding machine, having pneumatically controlled sheet separator and tripping mechanisms, an air pressure system connected with said pneumatically controlled mechanisms, comprising two reservoirs having different pressures, one high and constant and the other low and variable, means for maintaining in one reservoir a pressure in excess of the highest pressure required in the other, and a valve between said reservoirs to permit overflow from high pressure reservoir to low pressure reservoir.

20. In a sheet feeding machine, comprising a pneumatically operated sheet detector and other pneumatically operated devices, a high constant pressure reservoir and a low variable pressure reservoir, the sheet detector being actuated by the pressure of the high pressure reservoir.

21. In a sheet feeding machine, comprising pneumatically operated side guides and other pneumatically operated devices, an air pressure system comprising a high constant pressure reservoir and a low variable pressure reservoir, the side guides being actuated by the pressure of the high pressure reservoir.

22. In a sheet feeding machine, comprising pneumatically operated means for stopping the machine and other pneumatically operated devices, an air pressure system comprising a high constant pressure reservoir and a low variable pressure reservoir, the means for stopping the machine being actuated by the pressure of the high pressure reservoir.

23. In a sheet feeding machine, comprising a pneumatically operated combing wheel and other pneumatically operated devices, an air pressure system comprising a high constant pressure reservoir and a low variable pressure reservoir, the combing wheel being actuated by the pressure of the low pressure reservoir.

24. In a sheet feeding machine, comprising a pneumatically operated tail clamp and

other pneumatically operated devices, an air pressure system comprising a high constant pressure reservoir and a low variable pressure reservoir, the tail clamp being actuated by the pressure of the low pressure reservoir.

25. In a sheet feeding machine, comprising a pneumatically operated blowing nozzle, and other pneumatically operated devices, an air pressure system comprising a high constant pressure reservoir and a low variable pressure reservoir, the blowing nozzle being supplied by the low pressure reservoir.

26. In a sheet feeding machine, having a pneumatically operated combing wheel, an air pressure system comprising two reservoirs having different pressures, one high and constant and the other low and variable, means for maintaining in one reservoir a pressure in excess of the highest pressure required in the other, and a regulatable valve connected with the low pressure reservoir to vary required pressure therein, the combing wheel being connected with said low pressure reservoir and operated by the pressure of the same.

27. In a sheet feeding machine, having sheet separating means and valve trips for controlling the same, an air pressure system comprising two reservoirs, one having a high constant pressure and the other a low and variable pressure, the sheet separating means connected with the low pressure reservoir.

28. In a sheet feeding machine, the combination of a combing wheel, and a tail clamp, pneumatic means for varying the pressure exerted by the combing wheel and pneumatic means for moving the tail clamp, and means for simultaneously controlling said pneumatic means, comprising a valve and a valve trip actuated by the advancing sheet.

29. In a sheet feeding machine, a combing wheel, a coöperating pneumatically controlled drop roller, and an air pressure system connected with the drop roller actuating means, comprising a reservoir for air under pressure, a chamber connected therewith, a port between said chamber and the reservoir, a port between said chamber and the atmosphere, and a valve device for controlling said ports so as to close one and open the other simultaneously.

30. In a sheet feeding machine, comprising a pneumatically operated combing wheel, an air pressure reservoir, an escape valve connected therewith, means for arbitrarily adjusting the escape valve to maintain any desired pressure in the reservoir, and means for connecting the reservoir with the pneumatic means for operating the combing wheel, whereby the pressure exerted by the combing wheel may be varied simply by varying the adjustment of said valve.

31. In a sheet feeding machine, comprising a pneumatically operated combing wheel, an air pressure reservoir, an escape valve connected therewith, means for arbitrarily adjusting the escape valve to maintain any desired pressure in the reservoir and means for connecting the reservoir with the pneumatic means for operating the combing wheel and also with the blowing nozzle, whereby the pressure exerted by the combing wheel and the efficiency of the blowing nozzle may be varied simply by varying the adjustment of said valve.

32. In a sheet feeding machine, a combing wheel, means operatively connected therewith for blowing air between the sheets, and an air pressure system connected with the blowing means, comprising a reservoir for air under pressure, a chamber connected therewith, a port between said chamber and the reservoir, a port between said chamber and the atmosphere, a valve device for controlling said ports so as to close one and open the other simultaneously, spring means for actuating said valve and latching means for controlling the spring actuation.

33. In a sheet feeding machine, the combination of a combing wheel, supporting means therefor, including a casing having a journaled support movable about a substantially vertical axis and means for moving said casing about said vertical axis to change the direction of the comb.

34. In a sheet feeding machine, a combing wheel, a pneumatically operated tail clamp operatively connected therewith and an air pressure system connected with the tail clamp, comprising a reservoir for air under pressure, a chamber connected therewith, a port between said chamber and the reservoir, a port between the chamber and the atmosphere, a valve device for controlling said ports so as to close one and open the other simultaneously, spring means for actuating said valve, latching means for controlling the spring actuation and pneumatic means for controlling the latching means.

35. In a sheet feeding machine, a pneumatically actuated combing wheel and an air pressure system connected therewith, comprising a reservoir for air under pressure, a chamber connected therewith, a port between the chamber and the reservoir, a port between the chamber and the atmosphere, a valve device for controlling said ports so as to close one and open the other simultaneously, spring means for actuating said valve, latching means for controlling the spring actuation and manually operated means for actuating the valve against the spring actuation.

36. In a sheet feeding machine, the com-

bination of a combing wheel, supported and movable about a substantially horizontal axis, spring means for moving the wheel away from the sheet, and pneumatically operated means for moving the wheel to and pressing the same against the sheet.

37. In a sheet feeding machine, the combination of a combing wheel, supported and movable about a substantially horizontal axis, spring means for moving the wheel away from the sheet, pneumatically operated means for moving the wheel to and pressing the same against the sheet, and a regulatable valve in connection with the pneumatic means for controlling the amount of pressure exerted upon said wheel.

38. In a sheet feeding machine, a combing wheel, a drop roller, and an air pressure system connected with the combing wheel and drop roller actuating means, comprising a reservoir for air under pressure, a chamber connected therewith, a port between the chamber and the reservoir, a port between the chamber and the atmosphere, a valve device for controlling said ports so as to close one and open the other simultaneously, spring means for actuating said valve, latching means for controlling the spring actuation, and manually operated means for arbitrarily actuating the latch.

39. In a sheet feeding machine, the combination of two combing wheels supported and movable about a substantially horizontal axis, pneumatically operated means for lowering the wheels and spring means for lifting them, the springs so connected and arranged with respect to the rocking movement of the combing wheel as to give practically uniform vertical lifting force to the combing wheels throughout the range of their working motion.

40. In a sheet feeding machine, the combination of a plurality of combing wheels, supporting frames for said wheels mounted and movable about horizontal axes, pneumatically operated means for lowering the frames and spring means for lifting the frames, an adjustable valve connected with the pneumatic means for controlling the pressure exerted upon the frames simultaneously, the springs connected and arranged so as to give practically uniform vertical lifting force to the combing wheels throughout the range of their working motion and consequently so as to give a constant uniform opposing force to the pneumatic force supplied thereto.

41. In a sheet feeding machine, the combination of a combing wheel, a plurality of pneumatic devices, including a pneumatically controlled drop roller, and a controlling valve therefor, a pair of detector elements projecting into the path of travel of the sheet, an air chamber, for each detector element, connected with air pressure supply, through a relatively small aperture, a pneumatically operated locking device for the controlling valve, also connected with each air chamber, a relief vent in said air chamber, and an element, controlled by the detector, for controlling the relief vent.

42. In a sheet feeding machine, the combination of a combing wheel, a plurality of pneumatic devices, including a pneumatically controlled drop roller, and a controlling valve therefor, intermittently actuated, a pair of detector elements projecting into the path of travel of the sheet, an air chamber for each detector element, connected with air pressure supply, through a relatively small aperture, a pneumatically operated locking device for the controlling valve, connected with each air chamber, a relief vent in the air chamber, and an element controlled by each detector for controlling its respective relief vent.

43. In a sheet feeding machine, the combination of a drop and feed roller, the drop roller adapted to be lowered and elevated, a combing wheel also adapted to be lowered and elevated, and a tail clamp also adapted to be lowered and elevated, pneumatically operated means for simultaneously depressing the combing wheel, elevating the tail clamp and latching in the elevated position the drop roller.

44. In a sheet feeding machine, the combination of a drop and feed roller, the drop roller adapted to be lowered and elevated, a combing wheel also adapted to be lowered and elevated, and a tail clamp also adapted to be lowered and elevated, pneumatically operated means for simultaneously depressing the combing wheel, elevating the tail clamp and latching, in the elevated position, the drop roller, and means controlled by the advancing sheet for controlling the said pneumatically operated means.

45. In a sheet feeding machine, the combination of a pneumatically operated combing wheel, a cooperating drop roller, a pneumatically controlled latch therefor, a controlling valve for said latch, intermittently actuated, a pair of detector elements projecting into the path of travel of the sheet, an air chamber for each detector element, connected with air pressure supply through a relatively small aperture, a pneumatically operated locking device for the controlling valve connected with each air chamber, a relief vent in the air chamber, and an element controlled by each detector for controlling its respective relief vent.

46. In a sheet feeding machine, the combination of a combing wheel, a plurality of pneumatically operated devices, including a drop roller, an electric motor, a switch in the circuit of the motor, pneumatic switch

operating means, a controlling valve for said pneumatically operated devices and pneumatic switch operating means, intermittently actuated, a pair of detector elements projecting into the path of travel of the sheet, an air chamber for each detector element connected with air pressure supply through a relatively small aperture, a pneumatically operated locking device for the controlling valve, connected with each air chamber, a relief vent in the air chamber, and an element controlled by each detector, for controlling its respective relief vent.

47. In a sheet feeding machine, the combination of a combing wheel, a pivotally mounted supporting casing therefor, spring controlled means for supporting the free end of said casing, means for adjusting the spring controlled supporting means, a pneumatically operated piston rod also connected with said casing, and an adjustable bracket supporting the said spring means and pneumatic means.

48. In a sheet feeding machine, the combination of a combing wheel, a pivotally mounted supporting casing therefor, spring means for supporting the free end of said casing and pneumatic actuating means in opposition to the spring supporting means, means for adjusting the spring supporting means, said spring means comprising two parallel springs always under tension, of such strength and length and arranged in such position, initially with respect to the rocking movement of the said casing, as to give a practically uniform vertical lifting force to the combing wheel throughout the range of working motion.

49. In a sheet feeding machine, the combination of a plurality of combing wheels, pivotally mounted supporting casings therefor, spring supporting means connecting with said casings, and pneumatically operated piston rods, also connected with said casings, and adapted to act in opposition to said spring supporting means.

50. In a sheet feeding machine, the combination of a plurality of combing wheels, pivotally mounted supporting casings, therefor, spring supporting means connecting with said casings, and pneumatically operated piston rods also connected with said casings and adapted to act in opposition to said spring supporting means, the said spring supporting means comprising springs always under tension, of such strength and length, and arranged in such position initially, with respect to the rocking movement of each casing, as to give a practically uniform vertical lifting force to the combing wheel, throughout the range of working motion, so that the counterbalancing effect of said springs upon all the combing wheels shall be simultaneously the same.

51. In a sheet feeding machine, the combination of drop and feed rollers, a combing wheel, pneumatically actuated means for controlling the pressure exerted by said wheel, a valve for controlling said pneumatic means, comprising a valve cylinder, a movable piston and means for controlling the movement of piston, comprising a sheet actuated trip, pivotally connected with the drop roller shaft, adapted to engage and lift the piston, when raised by the movement of the drop roller shaft, and to release the piston when encountered and moved by the advancing sheet.

52. In a sheet feeding machine, the combination of a combing wheel, and a tail clamp, pneumatic means for varying the pressure exerted by the combing wheel and pneumatic means for varying the pressure exerted by the tail clamp and means for simultaneously controlling said pneumatic means, comprising a valve and a valve trip actuated by the advancing sheet.

53. In a sheet feeding machine, the combination of a combing wheel, a pivotally mounted supporting casing therefor, spring means for supporting the free end of said casing, pneumatic actuating means in opposition to the spring supporting means, said spring means comprising two parallel springs always under tension, of such strength and length and arranged in such position, initially with respect to the rocking movement of the said casing, as to give a practically uniform vertical lifting force to the combing wheel throughout the range of working motion, and means for adjusting the spring supporting means.

54. In a sheet feeding machine, the combination of a drop and feed roller and a combing wheel, pneumatic means for varying the pressure exerted by the combing wheel on the sheet, a pneumatically actuated latch for the drop roller, and a sheet actuated valve trip for controlling said pneumatic actuations.

55. In a sheet feeding machine, the combination of a drop and feed roller, means for actuating the drop roller, a latch for controlling said actuation, pneumatic means for actuating the latch, comprising a pneumatic chamber with a piston operating therein, said chamber having a relatively small air inlet and a relatively large relief vent and a sheet caliper device having a movable element for controlling the relief vent.

56. In a sheet feeding machine, the combination of a drop and feed roller, means for actuating the drop roller, a latch for controlling said actuation, and pneumatic latch controlling means controlled by a sheet caliper device, comprising a fixed guide on one side of the path of travel of the sheet, and a

movable element supported on the other side of said travel, and means for supporting the movable element comprising a bracket to which the movable element is pivoted, a sleeve supporting the bracket, a hollow stud supporting the sleeve, a spring operating between stud and bracket and a nut threaded on the stud for limiting the spring actuation of the bracket.

HOWARD K. KING.

Witnesses:
MAE HOFMANN,
HOWARD S. OKIE.