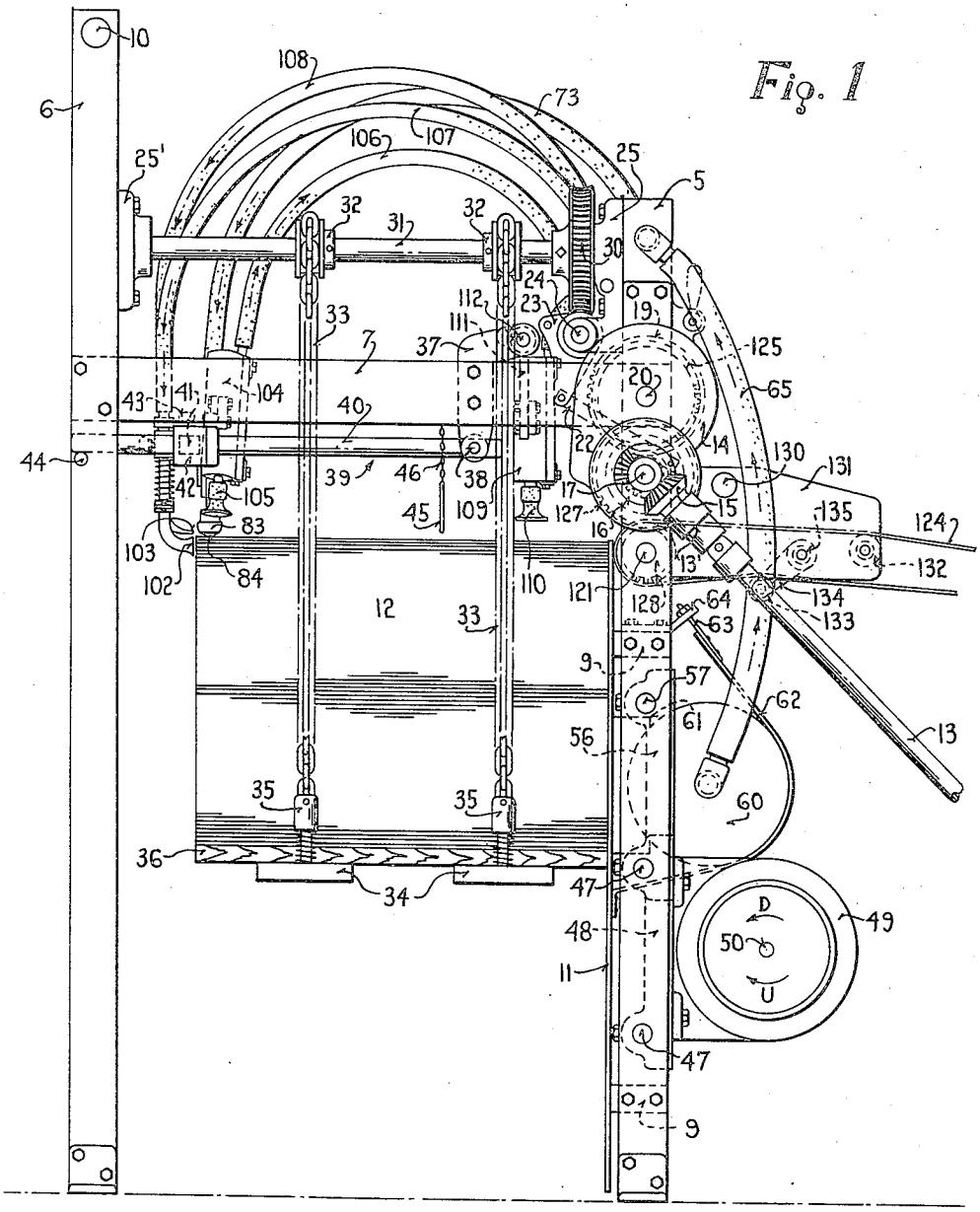
Feb. 4, 1941. L. C. WILLIAMS 2,230,633

SHEET FEEDER

Original Filed Dec. 19, 1936 4 Sheets-Sheet 1

Fig. 1



INVENTOR

LEO C. WILLIAMS

BY J. A. Hobson Jr.

ATTORNEY

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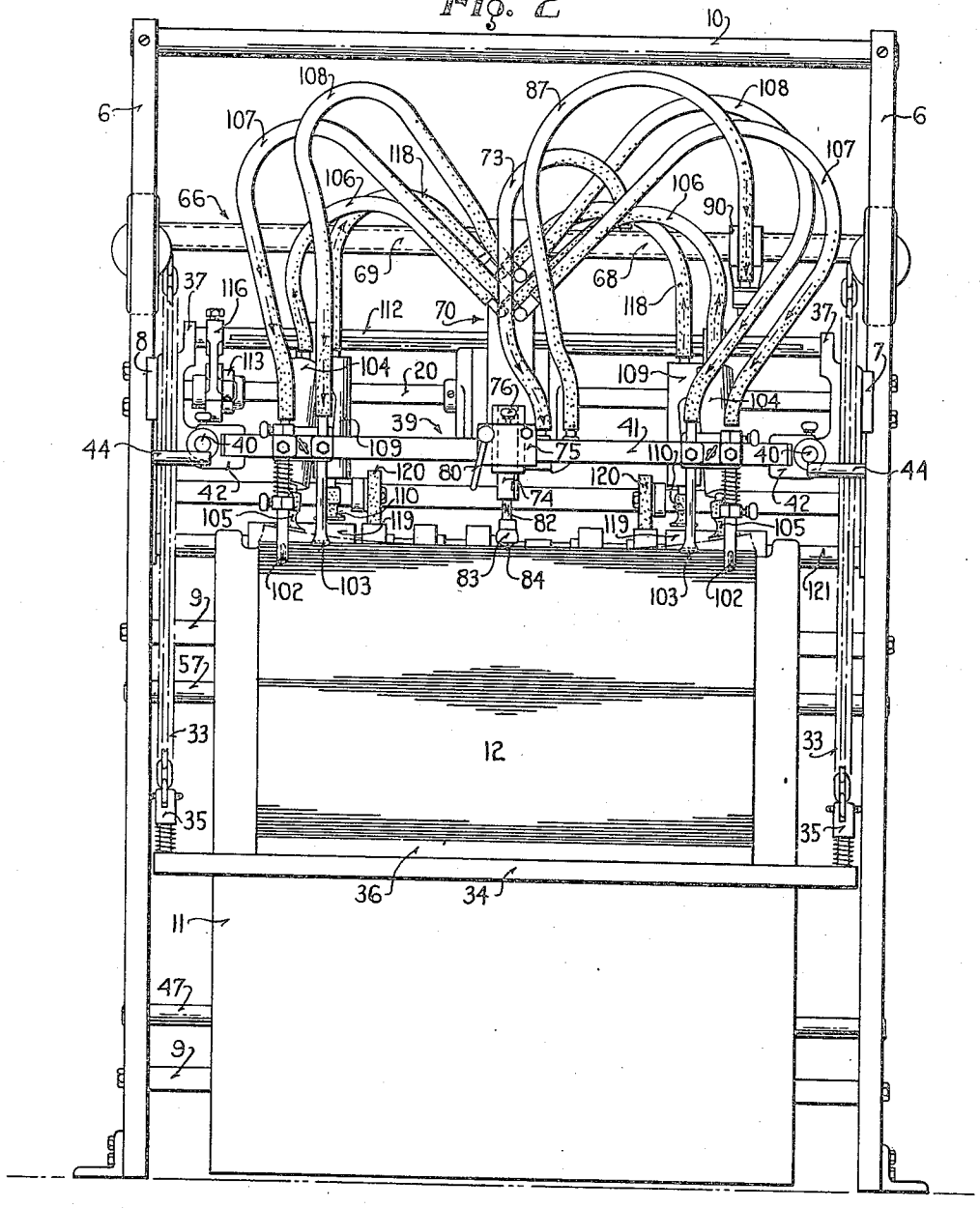
SHEET FEEDER

Original Filed Dec. 19, 1936 4 Sheets-Sheet 2

Fig. 2



INVENTOR
LEO C. WILLIAMS
BY
J. A. Hobson Jr.
ATTORNEY

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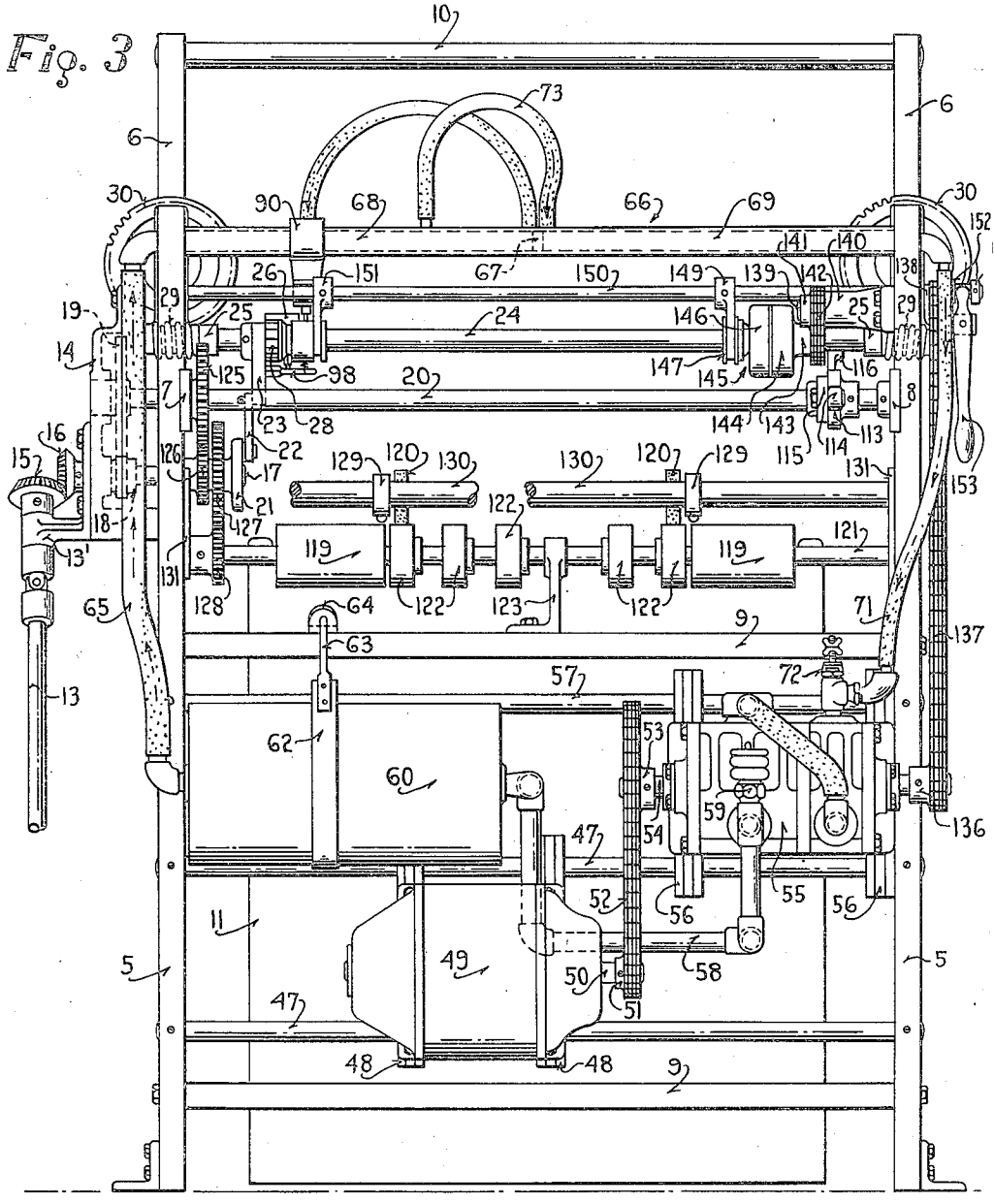
SHEET FEEDER

Original Filed Dec. 19, 1936 4 Sheets-Sheet 3

Fig. 3



INVENTOR

LEO C. WILLIAMS

BY

J. A. Hobson Jr.

ATTORNEY

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Original Filed Dec. 19, 1936 4 Sheets-Sheet 4

Fig. 4

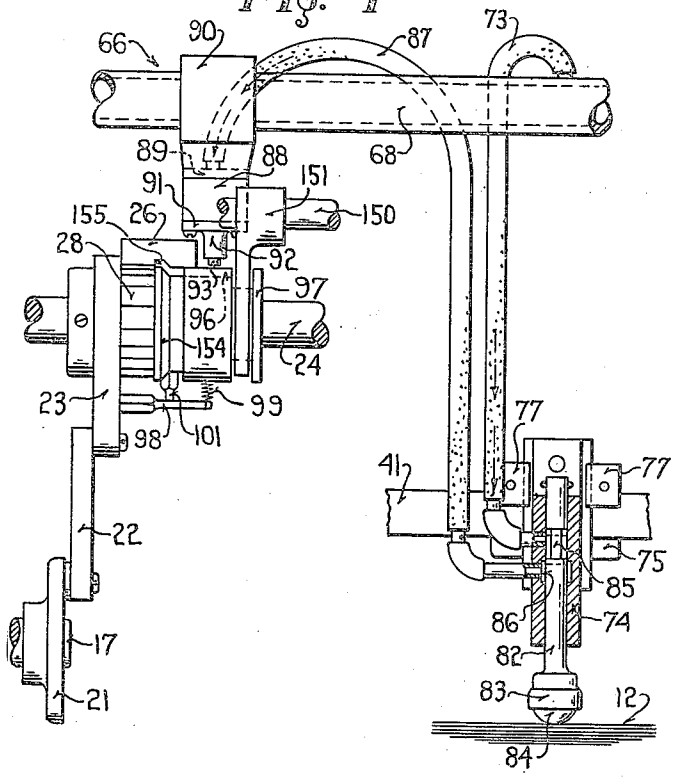


Fig. 5

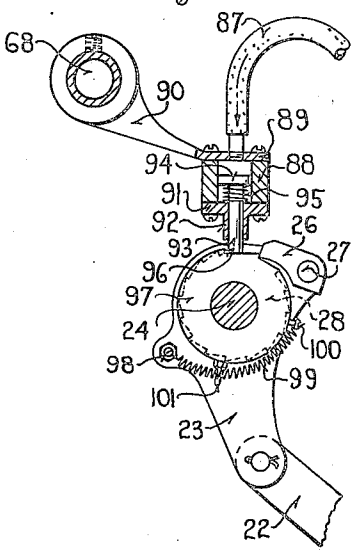


Fig. 8

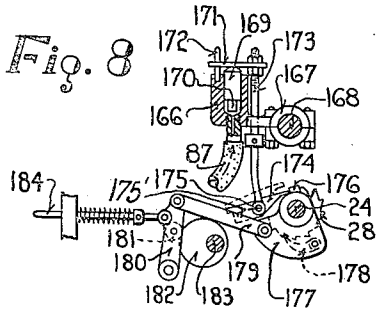


Fig. 9

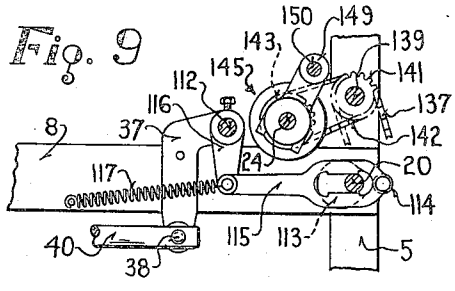


Fig. 7

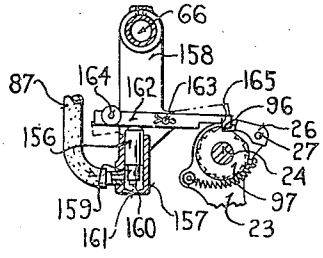
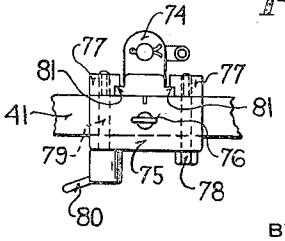


Fig. 6



INVENTOR
LEO C. WILLIAMS
BY
J. A. Hobson Jr.
ATTORNEY

Patented Feb. 4, 1941 2,230,633

UNITED STATES PATENT OFFICE

2,230,633

SHEET FEEDER

Leo C. Williams, Pearl River, N. Y., assignor to Dexter Folder Company, Pearl River, N. Y., a corporation of New York

Original application December 19, 1936, Serial No. 116,692. Divided and this application March 29, 1939, Serial No. 264,714

24 Claims. (Cl. 271—62)

This invention relates to sheet feeders and while capable of general use is particularly adapted for embodiment in feeders for feeding sheets of tin, black iron, aluminum and the like, to printing presses, punch presses, coating and varnishing machines, shears and slitters, buffing and cleaning machines, and various other instrumentalities employed in the processing or making of metal articles or containers.

One object of the present invention is to provide an improved feeder of novel, simple, and durable construction that will rapidly and efficiently feed sheets of metal to various types of equipment such as mentioned above.

Another object of the present invention is to provide a feeder with pile elevating mechanism and control means therefor so constructed that compressed air may be utilized in the operation of said means and control thereby of said pile elevating mechanism.

These and other objects of the present invention will appear as the following description thereof proceeds and in order to more clearly understand said invention reference may be had to the accompanying drawings which illustrate one embodiment thereof.

In said drawings:

Fig. 1 is a side elevation of a feeder embodying the present invention and particularly adapted for feeding metal sheets;

Fig. 2 is a rear elevation of the feeder shown in Fig. 1;

Fig. 3 is a front elevation of said feeder with parts omitted for purposes of clearer illustration;

Fig. 4 is an enlarged front elevation, partly in section, of the pile elevating mechanism and pneumatic control means therefor;

Fig. 5 is a side elevation, partly in section, of the mechanism and means shown in Fig. 4;

Fig. 6 is a top plan view of the valve supporting bracket shown in Fig. 4;

Fig. 7 is a view similar to Fig. 5 of another pneumatic control means embodying the present invention;

Fig. 8 is a view similar to Fig. 7 of another pneumatic control means embodying the present invention; and

Fig. 9 is a fragmentary side elevation, partly in section, showing the mechanism for operating the sheet forwarding devices, and part of the drive for continuous and rapid operation of the pile elevator.

Referring to the drawings, wherein like reference characters designate like parts throughout the several views, it is pointed out that the present application is a division of the pending application Serial No. 116,692 of Leonard Baker, George A. Martin and Leo C. Williams, filed December 19, 1936 and relates mainly to the pile elevator of the feeder and the elevator operating and controlling means. The various movable parts of the feeder as well as certain stationary parts thereof may be mounted on a frame of any suitable construction and the movable parts may be actuated or driven by any suitable means. As herein shown, said frame and driving means are preferably constructed as follows.

The feeder frame is comprised by front uprights 5 and rear uprights 6 connected together by side members 7 and 8 (Figs. 1 to 3, inclusive). The uprights 5 and 6 are bolted or otherwise suitably secured to the machine foundation, the front uprights 5 being connected together by cross members 9 bolted or otherwise suitably secured thereto, and the rear uprights 6 being connected together at the tops thereof by a stay shaft 10. The cross members 9 have bolted or otherwise suitably secured thereto a metal apron or plate 11 against which the front side of a supply or pile of metal or other sheets 12 bears during elevation of the same by mechanism to be hereinafter described.

Referring now more particularly to Figs. 1 and 3, the drive for the feeder is preferably comprised by an inclined driven jack shaft 13 which, in turn, is driven from any suitable source of power (not shown). The upper end of this jack shaft 13 is journalled in a suitable bearing 13' bolted or otherwise suitably secured on a gear guard 14 that is likewise secured on one of the front uprights 5.

Fixed on the upper end of jack shaft 13 is a bevel gear 15 which meshes with a similar gear 16 fixed on a short shaft 17 journalled in suitable bearings in the gear guard 14 and the adjacent front upright 5. Disposed within the gear guard 14 and fixed on the short shaft 17 is a spur pinion 18 which meshes with a spur gear 19 also disposed within said guard and fixed on a cam shaft 20 projecting therein. This cam shaft 20 is journalled in suitable bearings in the front uprights 5 and also has a bearing in the gear guard 14 through which it projects into said guard to receive the gear 19. The cam shaft 20 is utilized to operate various parts of the feeder to be hereinafter described. The feeder includes a pile elevator and operating mechanism therefor preferably constructed as follows.

The short shaft 17 has fixed thereon a crank

disc 21 pivotally connected with one end of a link 22 the opposite end of which is pivotally connected with a pawl carrier 23 that is loosely mounted on a shaft 24 (Figs. 3, 4 and 5). This shaft 24 extends transversely of the feeder and is journalled in suitable bearings in brackets 25 (Fig. 1) that are bolted or otherwise suitably secured to the front uprights 5 at the upper ends thereof. The shaft 24 is operated at suitable intervals to raise the pile elevator hereinafter described and said operation of said shaft is preferably effected by pawl and ratchet mechanism of the general type disclosed in the Patent No. 2,149,130 to Leonard Baker, granted February 28, 1939.

This pawl and ratchet mechanism includes a pawl carrier such as indicated at 23 (Figs. 3, 4 and 5) having a pawl 26 pivoted thereon at 27 and adapted, under certain conditions, to engage a ratchet 28 fixed on the shaft 24. It will thus appear that through oscillation of the pawl carrier 23 by the described driving connections therefor with the jack shaft 13 and engagement of the oscillating pawl 26 with the ratchet 28, the shaft 24 will be intermittently rotated. Under these conditions right and left hand worms 29 (Fig. 3) fixed on shaft 24 will likewise be rotated. These worms 29 mesh with right and left hand worm gears 30 that are fixed on shafts 31 (Fig. 1) journalled in suitable bearings provided by the brackets 25 on the front uprights 5 and 25' on the rear uprights 6. Fixed on shafts 31 are toothed sheaves 32 in the teeth of which are engaged links of chains 33 so that when the shafts 31 are rotated in the proper direction by the described driving means therefor, said chains will be raised and thus raise an elevator comprising cross beams 34 to which the lower ends of said chains are secured as by suitable couplings or connections 35. The elevator 34 has placed thereon a pile board 36 which, together with the pile of metal or other sheets 12, is positioned on said elevator through the rear of the feeder when the elevator is lowered by means for this purpose hereinafter described.

The elevator 34 and pile of sheets 12 thereon are raised intermittently as the sheets are fed off the top of said pile by separating and forwarding means hereinafter described, and to keep the top of said pile at a predetermined level for the operation of said means the elevator and its operating mechanism are, in accordance with the present invention, controlled by pneumatic means preferably mounted, constructed and operated as follows.

Bolted or otherwise suitably secured on the side members 7, 8 are brackets 37 to which are pivoted, as at 38, a frame indicated broadly at 39 (Figs. 1 and 2). This frame 39 comprises side members 40 and a rear cross member 41. This cross member 41 is bolted or otherwise suitably secured to brackets 42 slidably mounted on the side members 40. The cross member 41 and parts carried thereby are therefore adjustable forwardly and rearwardly along said side members and may be secured in any desired position of adjustment thereon by thumb screws 43 or the like.

During automatic feeding of sheets from the top of pile 12, in a manner hereinafter described, the frame 39 and parts carried thereby are positioned as shown more clearly in Fig. 1 wherein it will be noted that the rear of said frame is supported by pins 44 secured on the rear uprights 6. When sheets are being hand fed from the top of the pile the frame 39 and parts carried thereby are swung upward and held against accidental displacement by a pin 45 removably secured in a suitable opening in one of the brackets 37. This pin 45 is secured to one end of a small chain 46 the opposite end of which is connected in any suitable manner to the side member 8.

As before stated, pneumatic means are employed to control the operation of the elevator and in accordance with the present invention compressed air is employed to actuate said means. The source of compressed air and the driving means therefor are preferably mounted, constructed and operated as follows. Extending across the feeder frame and secured in any suitable manner to the front uprights 5 thereof are cross shafts 47 (Fig. 3). These cross shafts 47 have bolted or otherwise suitably secured thereto brackets 48 which, in turn, have bolted or otherwise suitably secured thereto an electric motor 49 connected with a suitable source of current and controlled for starting, stopping and reversing purposes by suitable switch means (not shown). Fixed on the armature shaft 50 of motor 49 is a sprocket 51 around which passes a chain 52 that also passes around a sprocket 53 that is fixed on the shaft 54 of a pump 55 suitably constructed to supply air under pressure from one part thereof and to create vacuum in another part thereof.

This air and vacuum pump 55 is bolted or otherwise suitably secured above and to one side of the motor 49 on brackets 56 which, in turn, are bolted or otherwise suitably secured on one of the cross shafts 47 and a third cross shaft 57 located thereabove and secured in any suitable manner on the front uprights 5. Connected with the exhaust or air pressure side or part of pump 55 is one end of a conduit 58 in which is located a valve 59 for controlling the pressure of air delivered from the pump through said conduit to the parts hereinafter described and connected therewith. The opposite end of this conduit 58 is connected with a compressed air tank 60. A block 61 (Fig. 1) is provided with an arcuate face to receive a portion of tank 60 and said tank and said block are clamped against the pile guiding plate 11 by a strap 62 passing around the tank and having its lower end secured to said plate. The upper end of the strap 62 is adjustably secured, as by an adjusting bolt 63 thereon, to a bracket 64 that is bolted or otherwise suitably secured to the upper cross member 9.

The compressed air tank 60 has connected therewith one end of a conduit 65 the opposite end of which is connected with a tubular shaft indicated broadly at 66 (Figs. 2 and 3) extending transversely of the feeder and secured in any suitable manner in the front uprights 5. This tubular shaft 66 is divided, as by a plug 67 therein, into an air supply conduit 68 and a vacuum conduit 69 both connected with a valve mechanism indicated broadly at 70. The construction and operation of this valve mechanism is the same as that of the valve mechanism disclosed in application Serial No. 116,692 above referred to and needs no further detail description herein. The vacuum conduit 69 has connected therewith one end of a conduit 71 the opposite end of which is connected with the vacuum side or part of the pump 55. The conduit 71 has disposed therein adjacent the pump 55 a vacuum regulating valve 72 of any suitable construction.

The valve mechanism 70, through the described connections therefor with the pump 55, controls the delivery of air under pressure to pile and sheet winding devices, and the making and breaking of vacuum in the sheet separating and forwarding devices hereinafter referred to.

Air under pressure will, through the described connections between pump 55 and tank 60, be continuously maintained in the latter and in the conduits 65 and 68. The conduit 68 has connected therewith one end of a flexible conduit 73 the opposite end of which is connected with a valve housing 74 (Figs. 2, 4 and 6). This valve housing 74 is removably and adjustably mounted in a bracket 75 (Figs. 4 and 6) secured to, and adjustable along, the rear cross bar 41 of the frame 39 as by a thumb screw 76 or the like. This bracket 75 is provided on the front thereof with a pair of clamps 77 one of which is secured to the bracket by a machine screw 78. The other clamp is secured to bracket 75 by an adjusting screw 79 provided with a handle 80. The valve housing 74 is provided with a tenon 81 engaged by the clamps 77. By manipulation of the handle 80 the clamp connected therewith may be loosened or tightened to provide for vertical adjustment of the valve housing 74 and mounting and removal of the same on and from the bracket 75 respectively, as desired.

Slidably mounted in the housing 74 is a valve 82 the stem of which, in the position of the parts shown in Figs. 2 and 4, projects downwardly through the housing to form a feeler provided on the lower end with a socket 83 in which is freely mounted a ball 84 that rests continuously on the top of the pile of sheets 12. The valve 82 is provided with a reduced portion 85 and the valve housing 74 is provided in the bore thereof with a chamber 86. When the top of the pile of sheets 12 is at proper height the valve 82 through engagement of ball 84 with the pile will be positioned as shown in Fig. 4 wherein it will be noted that the reduced portion 85 of the valve is disposed slightly above chamber 86 so that air under pressure supplied in the valve housing and around the reduced portion of the valve by conduit 73 cannot reach the chamber 86.

As sheets are fed one after another from the top of the pile, and with the ball 84 engaged therewith, the valve 82 will lower by gravity so that when a sufficient number of sheets have been so fed, the reduced portion of the valve will extend or drop into the chamber 86 thus establishing communication between the latter and the conduit 73. Under these conditions, air under pressure will be delivered into a conduit 87 having one end connected with the chamber 86 and the opposite end connected with a plunger housing 88 (Figs. 4 and 5). This housing 88 has a cover plate 89 bolted or otherwise suitably secured thereto and provided by an arm 90 which, in turn, is bolted or otherwise suitably secured to the tubular shaft 66 at a point adjacent the previously described pawl 26 and ratchet 28.

The plunger housing 88 is provided at the bottom thereof with a cover plate 91 bolted or otherwise suitably secured to said housing and having a tubular guide 92 for the stem 93 of a plunger 94 disposed within said housing as clearly shown in Fig. 5. A spring 95 encircling the stem 93 and interposed between the bottom cover plate 91 and the plunger 94 normally tends to lift the plunger and the stem so that the latter is removed from the path of travel of a shoulder 96 formed on a pawl mask 97 freely mounted on, and slidable along, the shaft 24.

When air under pressure is admitted in conduit 87, however, as previously described, said air enters the plunger housing 88 and exerts downward pressure on the plunger 94, thus forcing the stem 93 downwardly into the path of the shoulder 96 on the pawl mask 97 as clearly shown in Fig. 5. This pawl mask is connected with the oscillating pawl carrier 23 by means of a pin 98 on the latter and a spring 99 having one end connected with said pin and the opposite end connected with the pawl mask 97 as by a machine screw 100.

Under operating conditions and when the pile elevator is at rest, the spring 99 holds a pin 101 on mask 97 in engagement with the pin 98 on the oscillating pawl carrier 23 and said carrier and mask are rotated together and the latter holds the pawl 26 out of engagement with the ratchet 28. When the mask 97 is stopped through engagement of plunger stem 93 with shoulder 96 as previously described, the pawl 26 through continued oscillation of the pawl carrier 23 will ride off a high part of the mask on to a low part thereof and engage the ratchet 28. The shaft 24 will thus be actuated intermittently by the pawl and ratchet mechanism, and through the described connections for said shaft with the elevator, the latter and the pile of sheets will be raised until the top of the pile is at the proper height.

As the pile thus raises, the valve 82 is lifted, thus raising the reduced part 85 out of the chamber 86 and disconnecting the source of air under pressure from the plunger housing 88. The spring 95 then lifts the plunger 94 and stem 93 so that the latter is disengaged from shoulder 96 on the mask 97. The spring 99, which enables continued oscillation of the pawl carrier when the mask is stopped, now acts on the mask to turn the latter and engage the pins 98 and 101. The high part of the mask is thus brought under the pawl 26 to lift the latter out of engagement with the ratchet 28, and the pawl and its carrier, together with the mask, again oscillate idly until further elevation of the pile is necessary at which time said pile will again be elevated as previously described.

Mounted on the rear cross bar 41 at opposite sides thereof, are pile and sheet winding devices indicated at 102 and 103, respectively, and vacuum sheet separating devices comprised by cylinders 104 and suction cups 105 that are raised and lowered through the making and breaking of vacuum in said cylinders (Figs. 1 and 2). These sheet separating devices are constructed and operated in the same manner as the sheet separating devices disclosed in application Serial No. 116,692 and need no detail description herein. It might be pointed out, however, that the cylinders 104 have connected therewith corresponding ends of flexible conduits 106 the opposite ends of which are connected with the valve mechanism 70 for controlling the making and breaking of vacuum in said cylinders at predetermined intervals. Likewise, the pile and sheet winding devices 102 and 103 have connected therewith corresponding ends of flexible conduits 107 and 108, respectively, the opposite ends of which are connected with the valve mechanism 70 for controlling the delivery of air under pressure through said devices at predetermined intervals to wind the pile prior to operation of the sheet separating devices and to wind the sheets

as they are separated one after another from the pile by said sheet separating devices.

The separated and winded sheets are forwarded one after another from the pile by vacuum sheet forwarding devices comprised by cylinders 109 (Figs. 1 and 2) and suction cups 110 that are raised and lowered relative to the cylinders through the making and breaking of vacuum therein. These sheet forwarding devices are also constructed and operated in the same manner as the sheet forwarding devices disclosed in the application Serial No. 116,692 and need no detail description herein. It is pointed out, however, that the sheet forwarding devices have swinging movement to advance the separated and winded sheets from the pile 12, and for this purpose the cylinders 109 are secured on arms 111 (Fig. 1) which, in turn, are fixed on a rock shaft 112 that extends transversely of the feeder frame and is journalled in suitable bearings in the brackets 37. The sheet forwarding devices are rocked forwardly by a cam 113 (Figs. 2, 3 and 9) fixed on and rotated by the cam shaft 20. This cam 113 engages a cam roller 114 journalled on a cam strap 115 extending over the cam shaft 20 and connected with an arm 116 that is fixed on the rock shaft 112. Rearward movement of the sheet forwarding devices is effected by a spring 117 (Fig. 9) having one end connected with the arm 116 and the opposite end connected with the side member 8 in any suitable manner. The making and breaking of vacuum in the cylinders 109 is also affected by the valve mechanism 70 at proper intervals, and for this purpose the cylinders 109 are connected by flexible conduits 118 with said valve mechanism.

After the uppermost sheet has been separated and forwarded from the pile, it is received by conveying means for carrying said sheet into the machine or instrumentality with which the feeder is associated. As herein shown, this conveying means is preferably operated and constructed as follows. A lifted and forwarded sheet is delivered by the sheet forwarding devices between feed and drop rollers 119 and 120 respectively (Figs. 2 and 3). The feed rollers 119 are fixed in spaced relation on a shaft 121 extending transversely of the feeder and journalled in suitable bearings on the front uprights 5 thereof. This shaft 121 also has fixed thereon between the feed rollers 119, auxiliary feed rollers 122 (Fig. 3) that are disposed along said shaft in spaced relation. An additional bearing for the feed roller shaft 121 is provided by a bracket 123 located intermediate the ends of said shaft and bolted or otherwise suitably secured to the upper cross member 9.

The shaft 121, the feed rollers fixed thereon, and conveyor tapes 124 passing around said rollers are driven from the continuously rotated cam shaft 20 as follows. This cam shaft has fixed thereon a large gear 125 (Figs. 1 and 3) which meshes with a smaller gear 126 that is loosely mounted on the short shaft 17 and compounded or integrally formed with a larger gear 127 also loosely mounted on said shaft. The gear 127 meshes with a gear 128 that is fixed on the feed roll shaft 121 and which through the described driving connections therefor with the cam shaft 20 drives the feed roller shaft 121, the feed rollers 119, 122 and the sheet conveying tapes 124.

The drop rollers 120 (Figs. 2 and 3) are journalled on arms 129 fixed on a rock shaft 130 which extends transversely of the machine and is journalled in suitable bearings in side plates 131 projecting forwardly of the feeder and bolted or otherwise suitably secured to the front uprights 5 thereof. The drop rollers 120 may be operated by any suitable mechanism such, for example, as shown in application Serial No. 116,692, and the operation of the drop rollers is so timed that they are raised when the sheet forwarding devices deliver a sheet on to the feed rollers 119, 122. After such delivery of the sheet and breaking of vacuum in the sheet forwarding devices, the drop rollers are lowered to engage the sheet and assist feeding of the same forwardly from the feeder by the feed rollers 119, 122 and the conveyor tapes 124. The front portions of tapes 124 pass around other rollers (not shown) and said tapes travel over a roller 132 that extends transversely of the feeder and is journalled in suitable bearings in the side plates 131. The tapes 124 also pass over tightening rollers 133 (Fig. 1) journalled on arms 134 which are fixed on a shaft 135 extending transversely of the feeder and secured against rotation on the side plates 131.

The feeder is provided with mechanism for lowering and raising the elevator so that a supply of sheets may be placed on said elevator and moved into proper position for feeding. This mechanism is also utilized to reload the feeder and, in accordance with the present invention, is preferably constructed and operated as follows. Fixed on the shaft 54 of the pump 55 at the end thereof opposite that carrying the large sprocket 53 is a small sprocket 136 (Fig. 3) around which passes a chain 137. This chain 137 also passes around a sprocket 138 that is fixed on a short shaft 139 journalled in suitable bearings in one of the front uprights 5 and a bracket 140 bolted or otherwise suitably secured thereto.

This short shaft 139 has fixed thereon a sprocket 141 (Figs. 3 and 9) around which passes a chain 142 that also passes around a sprocket 143. The sprocket 143 and a part 144 of a clutch indicated broadly at 145 (Fig. 3) are secured to or formed integrally with each other and loosely mounted on the worm shaft 24. This clutch 145 is of well known construction needing no detailed description herein and includes another part 146 which is fixed on the worm shaft 24. The parts of the clutch 145 may be connected or disconnected by a device 147 loosely and slidably mounted on the worm shaft 24 and provided with a collar 148 in a groove of which extends an operating fork 149. This fork 149 is fixed on a shaft 150 extending transversely of the feeder and slidably mounted in suitable bearings in the brackets 25 that are secured to the front uprights 5. The slidable shaft 150 also has fixed thereon a fork 151 (Figs. 3 and 4) engaging in a groove of the pawl mask 97 that is slidably as well as rotatably mounted on the worm shaft 24. The shaft 150 is provided on one end thereof with spaced collars 152 having engaged therebetween the upper end of a lever 153 which is pivotally mounted in any suitable manner on one of the front uprights 5.

When it is desired to initially load the feeder the elevator may, for this purpose, be lowered to the proper position by moving the lever 153 to the left (Fig. 3) and starting the motor 49 so that the armature shaft 50 thereof rotates in the direction of the arrow D shown in Fig. 1 of the drawings. When the lever 153 is moved as aforesaid, the slidable shaft 150 is moved to the right (Fig. 3) and thereby moves the device 147 to the right and connects the two parts of the clutch 145. At the same time, the fork 151 and the pawl mask 97 (Figs. 3 and 4) are moved to the

right so that a bevelled annular flange 154 on the mask will lift the pawl 26 out of engagement with the ratchet 28 if said pawl is not already disengaged therefrom. This pawl 26, as will be noted in Fig. 4 of the drawings, is provided with a slot 155 enabling the pawl to engage the ratchet when the mask is in its normal operating position and stopped by the means for this purpose hereinbefore described.

The pawl 26 having been disengaged from the ratchet and the parts of the clutch 145 having been connected, as described, the shaft 24 is rotated by the pump 55 counterclockwise as viewed in Figs. 1 and 9, thereby rotating the described connections for said shaft with the elevator chains 33 so that the latter and the cross beams 34 and pile board 36 are lowered. As soon as these have reached the proper position for loading, the handle 153 is swung to the right (Fig. 3) thereby disconnecting the parts of the clutch 145, moving the pawl mask 97 back to its normal position, and stopping rotation of shaft 24 by the pump. The motor 49 is then stopped and the elevator is loaded with a supply or pile of sheets in the usual manner.

The elevator and said pile or supply are then raised to proper position for feeding of the sheets successively from the top of said pile or supply. This is accomplished by starting the motor 49 so that the armature shaft thereof rotates in the direction of the arrow U shown in Fig. 1 of the drawings. The lever 153 is then swung to the left (Fig. 3) to connect the parts of the clutch 145 and shift the mask 97, as before described. The worm shaft 24 thus being connected with the pump shaft 54 and the latter now being driven in the same direction as the armature shaft 50, the elevator and the pile of sheets thereon are raised until the top of the pile reaches the proper level for feeding of the sheets one after another therefrom.

At this time the lever 153 is again swung to the right (Fig. 3) thus disconnecting the parts of the clutch 145 and moving the pawl mask 97 back again to its normal position. The motor 49 is then stopped and the worm shaft 24 now being disconnected from the pump shaft 54, feeding of the sheets from the top of the pile one after another may now be accomplished automatically as previously described or by hand, as desired. In either case, the motor 49 is now started so that the armature shaft 50 is rotated in the direction of the arrow D (Fig. 1). When the supply of sheets has been exhausted, the feeder may be reloaded by lowering and raising the elevator as described and through the medium of the mechanism for this purpose driven from the pump shaft 54.

The operation of the feeder will be clearly understood from the foregoing description thereof and may be briefly summarized as follows. The elevator having been loaded and the pile of sheets having been moved upwardly to proper position by the described means for this purpose, automatic feeding of the sheets one after another from the top of the pile may be accomplished by driving the jack shaft 13 and parts connected therewith and rotating the pump shaft 54 through operation of the armature shaft 50 of the motor 49 in the direction of the arrow D (Fig. 1). Air under pressure supplied from the pump 55 to the pile winding devices 102 is delivered therethrough against the rear upper corner portions of the pile of sheets 12 so that said portions are winded or partially separated. The suction cups 105 of the sheet separators, through the described connections therefor with the pump 55 then act to engage and lift the uppermost sheet at the rear thereof.

After the sheet has been engaged and lifted, as described, it is winded by compressed air supplied by the described means for this purpose through the sheet winding devices 103 and delivered thereby between said sheet and the sheet therebelow. This completely lifts and separates the sheet from the one below and the separated, lifted and winded uppermost sheet is then engaged near the front thereof by the suction cups 110 of the sheet forwarding devices that have been swung rearwardly by the described means for this purpose. These devices lift the sheet at the front thereof and swing forwardly, thus carrying the sheet between the driven feed rollers 119, 122 and the drop rollers 120 which at this time are raised. The sheet forwarding devices then release the sheet whereupon the drop rollers are lowered thereon and the feed rollers and the tapes 124 carry the separated and forwarded sheet on to the machine or instrumentality with which the feeder is associated. These operations are repeated in the order named, once during each cycle of operation of the feeder, so that the sheets are fed automatically in succession from the top of the pile to said machine or instrumentality.

During repeated cycles of operation of the feeder to automatically feed sheets from the top of the pile 12, the pile is elevated step by step by the described means for this purpose, in order to keep the top of the pile at the described or required height. The control means for the pile elevating mechanism may include, as before described, the valve 82 (Fig. 4), the air operated plunger in housing 88, and the compressed air delivery connections for housing 88 with the valve housing 74 and between the latter and the pump 55.

Instead of employing a plunger such as mounted in the housing 88, a plunger 156 (Fig. 7) may be employed. This plunger 156 is mounted in a housing 157 secured to a bracket 158 mounted on and depending from the tubular shaft 66. The plunger 156 projects upwardly out of the housing 157 and is provided on the lower end with a reduced portion 159. This reduced portion 159 is provided on the bottom thereof with a lug 160 which, when the plunger 156 is in its lowermost inoperative position in the housing 157, engages the V-shaped interior bottom portion 161 of the housing and holds the plunger slightly thereabove to prevent it from becoming "air-bound." The flexible conduit 87 connected with the valve housing 74 is, in this case, connected with the plunger housing 157 at the bottom thereof and delivery of compressed air through the conduit 87 into the housing 157 and under the plunger 156 is controlled by the valve 82.

In the construction shown in Fig. 7 a pawl 162 is provided and this pawl is pivoted as at 163 on the bracket 158 above the plunger 156. When the top of the pile of sheets 12 is at the proper height, no compressed air will be delivered in the housing 157 and the pawl 162 will be held in the dotted line position thereof shown in Fig. 7 by a counterweight 164 that is secured in any suitable manner on said pawl. In this event, the nose 165 of pawl 162 will be held up above the path of travel of the shoulder 96 of mask 97 so that the latter and the carrier 23 for pawl 26

will oscillate idly as previously described. When the top of the pile 12 and valve 82 lower sufficiently so that said valve admits compressed air in the conduit 87 and the housing 157, said air will raise the plunger 156 and swing the pawl 162 to the full line position thereof shown in Fig. 7. The nose 165 of the pawl then engages the shoulder of mask 97 to stop rotation of the same and enable the ratchet or shaft 24 to be actuated, as previously described, to raise the elevator and the pile of sheets.

When the top of the pile has reached the proper height the valve 82 will cut off the supply of compressed air to conduit 87 and housing 157 whereupon the plunger 156 will drop by gravity in the housing and the pawl 162 will be swung to its dotted line inoperative position by the counterweight 164. The carrier 23, the pawl 26 thereon, and the mask 97 will then oscillate idly until it is again necessary to elevate the pile 12, whereupon the above described operation of the pawl and ratchet control means is repeated so that shaft 24 may be actuated to raise the elevator.

Instead of employing control means and pawl and ratchet mechanism such as shown in Fig. 7, control means and pawl and ratchet mechanism such as illustrated in Fig. 8 may be utilized. In this case, the flexible conduit 87 connected with the housing 74 for valve 82 is connected with a housing 166 at the bottom thereof. This housing 166 is provided with an extension 167 that is secured in any suitable manner on a shaft 168. The shaft 168 extends transversely of the feeder and is secured in any suitable manner to the frame thereof. Mounted in the housing 166 and projecting upwardly therethrough is a plunger 169 provided on the bottom thereof with a reduced portion 170 which normally engages the V-shaped bottom of the housing when no compressed air is being supplied therein through the conduit 87.

Extending over, and engaged with, the upper end of plunger 169 is a plate 171 provided with a pin 172 that is guided in a suitable opening in the top of the housing 166. Said plate 171 has connected therewith the upper end of a rod 173 the lower end of which is pivotally connected at 175 with a pawl 174 which is pivoted, as at 175', on a stationary part of the feeder. The nose of pawl 174 normally stands in line with a lug 176 formed on a pawl carrier 177 that is loosely mounted on the worm shaft 24 adjacent the ratchet 28 fixed thereon. The carrier 177 has mounted thereon a spring pressed pawl 178 for engaging the ratchet 28 and is pivotally connected with one end of a link 179 the opposite end of which is pivotally connected with an arm 180. This arm 180 is pivotally mounted on a stationary part of the feeder and provided with a roller 181 adapted to be engaged by a cam 182.

Cam 182 is fixed on a suitable driven shaft 183 of the feeder and the arm 180 has connected therewith a spring pressed rod 184 that normally tends to maintain roller 181 in engagement with said cam. When the top of the pile of sheets is at the proper height, however, and no compressed air is supplied in housing 166 through conduit 87, the nose of pawl 174 is disposed in line with lug 176 and prevents the spring pressed rod 184 from swinging arm 180 and carrier 177 a sufficient distance to enable the ratchet 28 and shaft 24 to be actuated by pawl 178.

As the sheets are fed off the top of the pile, and it becomes necessary to lift it, the valve 82 admits compressed air in conduit 87 and housing 166 thus raising plunger 169, plate 171, rod 173 and pawl 174. The cam 182 and the spring pressed rod 184 now actuate carrier 177 and pawl 178 so that ratchet 28 and shaft 24 are rotated and the elevator and pile of sheets thereon is raised. When the top of the pile is at the proper height valve 82 cuts off compressed air in conduit 87 and housing 166 whereupon the plunger 169, the plate 171, the rod 173, and the pawl 174 drop by gravity so that the nose of said pawl is again positioned in line with lug 176 and prevents spring pressed rod 184 from swinging carrier 177 a sufficient distance to enable pawl 178 to actuate ratchet 28 and rotate shaft 24. When the top of the pile again is below the predetermined height, the pawl and ratchet mechanism and control means therefor shown in Fig. 8 is again actuated, as described, to raise the pile. These operations are repeated from time to time as described, so that the top of the pile of sheets 12 is always maintained at proper height.

The operation of a feeder constructed in accordance with the present invention will be clearly understood from the foregoing description and while said description and the accompanying drawings set forth with more or less particularity several embodiments of the invention, it is to be expressly understood that said invention is not limited to said embodiments or otherwise than by the terms of the appended claims.

What I claim is:

1. The combination with pawl and ratchet means for moving a supply of sheets, and pneumatic means for controlling the operation of said pawl and ratchet means, of an untimed gravity valve continuously engaged with and controlled by the supply and controlling the operation of said pneumatic means.

2. The combination with means for moving a supply of sheets, and a compressed air actuated plunger for controlling the operation of the supply moving means, of valve means engaged with and actuated by the supply for controlling the operation of said plunger, said valve means having untimed operation and continuously contacting said sheet supply.

3. In a sheet feeder, the combination with pawl and ratchet means for lifting a pile of sheets, and a compressed air actuated element controlling the pawl and ratchet means and raising of the elevator and pile thereby, of untimed valve means continuously engaged with the top of the pile and controlled thereby for controlling the operation of said compressed air actuated element.

4. The combination with pawl and ratchet mechanism for moving a supply of sheets, and a compressed air actuated plunger controlling the operation of said pawl and ratchet mechanism, of valve means engaged with and controlled by the supply and controlling the operation of said plunger, said valve means having untimed operation and continuously contacting said sheet supply.

5. The combination with pawl and ratchet mechanism for moving a supply of sheets, and a compressed air actuated plunger controlling the operation of said pawl and ratchet mechanism, of movable untimed valve means continuously engaged with and controlled by the supply and controlling the operation of said plunger.

6. In a sheet feeder, the combination with pawl and ratchet mechanism for elevating a pile of sheets, a compressed air actuated plunger controlling the operation of said pawl and ratchet

mechanism, and a source of compressed air, of untimed valve means interposed between the source of compressed air and the plunger and connected with both of the same, the valve of said means continuously resting on and being controlled by the pile and adapted to connect said source with and disconnect the same from said plunger.

7. The combination with pawl and ratchet mechanism for moving a supply of sheets, a mask controlling the operation of said pawl and ratchet mechanism, and a compressed air actuated plunger controlling the operation of said mask, of movable untimed valve means continuously engaged with and controlled by the supply and controlling the operation of said plunger.

8. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, and means controlled by removal of sheets from the supply for rendering said pneumatically actuated means effective to engage and stop said pawl controlling means.

9. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, and means controlled by movement of the supply for rendering said pneumatically actuated means ineffective and thereby preventing the same from engaging and stopping said pawl controlling means.

10. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, and means engaged with the supply and controlled by removal of sheets therefrom for rendering said pneumatically actuated means effective to engage and stop said pawl controlling means.

11. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, and means engaged with the supply and controlled by movement thereof for rendering said pneumatically actuated means ineffective and thereby preventing the same from stopping said pawl controlling means.

12. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, pump means adapted to be connected with the pneumatically actuated means for rendering the same effective to engage and stop said pawl controlling means, and valve means controlled by removal of sheets from the supply for connecting said pump means with said pneumatically actuated means.

13. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically actuated means for engaging and stopping the pawl controlling means, pump means adapted to be disconnected from the pneumatically actuated means for rendering said pneumatically actuated means ineffective and thereby preventing the same from engaging and stopping said pawl controlling means, and valve means controlled by movement of the supply for disconnecting said pump means from the pneumatically actuated means.

14. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of compressed air actuated means for engaging and stopping the pawl controlling means, a source of compressed air adapted for connection with the compressed air actuated means to thereby engage the same with the pawl controlling means, and valve means connected with the compressed air actuated means and the source of compressed air and comprising a movable valve engaged with the supply and operable through removal of sheets therefrom to connect said source of compressed air with said compressed air actuated means.

15. In a sheet feeder of the type having means for moving a supply of sheets, a ratchet connected with said means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of compressed air actuated means for engaging and stopping the pawl controlling means, a source of compressed air adapted for connection with the compressed air actuated means to thereby engage the same with the pawl controlling means, and valve means connected with the compressed air actuated means and the source of compressed air and comprising a movable valve engaged with the supply and operable through removal of sheets therefrom to connect said source of compressed air with said compressed air actuated means, said movable valve being operable, upon sufficient

movement of said supply, to disconnect the source of compressed air from the compressed air actuated means, and prevent the latter from stopping the pawl controlling means.

16. In a sheet feeder, means for moving a supply of sheets, pneumatically actuated means for controlling the operation of said supply moving means, pump means, valve means controlling connection of the pump means with and disconnection of the same from the pneumatically actuated means, supporting means for the valve means and providing for adjustments of the valve means to various positions, and connections for the valve means with the pneumatically actuated means and the pump means and providing for said adjustments of said valve means without disconnection thereof from said pneumatically actuated means and said pump means.

17. In apparatus of the type having means for feeding sheets relative to a sheet supply and thereby varying the quantity of sheets therein, mechanism for imparting motion to the supply of sheets to compensate for feeding of sheets relative thereto, pneumatically controlled means for controlling operation of said mechanism, and a pneumatic pump adapted for connection with or disconnection from the penumatically controlled means to thereby control operation thereof, the combination with a housing interposed between and connected with the pneumatically controlled means and the pump, of an untimed valve in said housing and an untimed sheet feeler for the valve, the feeler and the valve having motion imparted thereto through contact of the feeler by the sheets and variations in quantity of sheets in said sheet supply, whereby said valve may operate to connect said pump with or disconnect the same from said pneumatically controlled means.

18. In apparatus of the type having means for feeding sheets relative to a sheet supply and thereby varying the quantity of sheets therein, mechanism for imparting motion to the supply of sheets to compensate for feeding of sheets relative thereto, pneumatically controlled means for controlling operation of said mechanism, and a pneumatic pump adapted for connection with or disconnection from the pneumatically controlled means to thereby control operation thereof, the combination with a housing interposed between and connected with the pneumatically controlled means and the pump, of a valve in said housing and a feeler for the valve, the feeler being continuously engaged with the sheet supply and the feeler and the valve having motion imparted thereto through variations in quantity of sheets in said sheet supply, whereby said feeler controls operation of said valve and connection thereby of said pump with or disconnection of the same from said pneumatically controlled means.

19. In apparatus of the type having means for separating sheets from a supply thereof, means for removing separated sheets from the sheet supply, mechanism for imparting motion to the sheet supply to compensate for separation and removal of sheets therefrom, pneumatically controlled means for controlling operation of said mechanism, and a pneumatic pump adapted for connection with or disconnection from the pneumatically controlled means to thereby control operation thereof, the combination with a housing interposed between and connected with the pneumatically controlled means and the pump, of a valve in the housing having a stem projecting therefrom constituting a sheet feeler continuously engaged with the sheet supply, the feeler and the valve having motion imparted thereto through motion of said sheet supply or removal of sheets therefrom, whereby the valve may operate to connect said pump with or disconnect the same from said pneumatically controlled means.

20. In apparatus of the type having means for separating sheets from the top of a pile thereof, means for removing separated sheets from the top of the pile, mechanism for elevating the pile to compensate for separation and removal of sheets from the top thereof, pneumatically controlled means for controlling operation of said mechanism, and a pneumatic pump adapted for connection with or disconnection from the pneumatically controlled means to thereby control operation thereof, the combination with a housing interposed between and connected with the pneumatically controlled means and the pump, of a valve in the housing having a stem projecting therefrom provided with a rotatable terminal continuously engaged with the top of the pile of sheets and constituting a sheet feeler, said feeler and the valve having motion imparted thereto through elevation of the pile or removal of sheets from the top thereof, whereby said valve may operate to connect said pump with or disconnect the same from said pneumatically controlled means.

21. In apparatus of the type having means for feeding sheets relative to a supply of sheets and thereby varying the quantity of sheets therein, mechanism for imparting motion to the supply of sheets to compensate for feeding of sheets relative thereto, a housing having a plunger arranged therein and projecting therefrom for controlling operation of said mechanism, and a pneumatic pump adapted for connection with the housing to thereby pneumatically actuate the plunger, the combination with the housing and the pump, of untimed valve means interposed between and connected therewith and provided with an untimed sheet feeler, said feeler and the valve means having untimed motion imparted thereto through engagement of the feeler by the sheets and variations in quantity of sheets in said sheet supply, whereby said valve may operate to connect said pump with or disconnect the same from said housing and pneumatic actuation of said plunger by the pump may be effected or prevented.

22. In apparatus of the type having means for feeding sheets relative to a supply of sheets and thereby varying the quantity of sheets therein, mechanism for imparting motion to the supply of sheets to compensate for feeding of sheets relative thereto, a housing having a plunger arranged therein and projecting therefrom for controlling operation of said mechanism, and a pneumatic pump adapted for connection with the housing to thereby pneumatically actuate the plunger, the combination with a valve housing interposed between and connected with the plunger housing and the pump, of an untimed valve in the valve housing having a stem projecting therefrom constituting a feeler continuously engaged with the sheet supply, said feeler and the valve having untimed motion imparted thereto through engagement of the feeler by the sheets and variations in quantity of sheets in said sheet supply, whereby said valve may operate to connect said pump with or disconnect the same from the plunger housing and pneumatic

actuation of said plunger by the pump may be effected or prevented.

23. In apparatus of the type having means for feeding sheets relative to a supply of sheets and thereby varying the quantity of sheets therein, mechanism for imparting motion to the supply of sheets, a ratchet connected with said mechanism for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of pneumatically controlled means for engaging and stopping the pawl controlling means, and means responsive to variations in quantity of sheets in said supply for rendering the pneumatically controlled means effective to engage and stop the pawl controlling means or for rendering said pneumatically controlled means ineffective and thereby preventing the same from engaging and stopping said pawl controlling means.

24. In apparatus of the type having means for feeding sheets relative to a supply of sheets and thereby varying the quantity of sheets therein, means for imparting motion to the supply of sheets to compensate for feeding of sheets relative thereto, a ratchet connected with said last named means for operating the same, a driven pawl for engaging and driving the ratchet, and pawl controlling means driven in synchronism with the pawl to prevent engagement thereof with the ratchet and stopped to enable the pawl to engage the ratchet and drive it, the combination of a housing having a plunger therein projecting therefrom for engagement with or disengagement from the pawl controlling means to stop the same or provide for operation thereof, pneumatic means for operating the plunger, and untimed valve means interposed between and connected with said housing and the pneumatic means and provided with an untimed feeler, said feeler and the valve means having untimed motion imparted thereto through engagement of the feeler by the sheets and variations in quantity of sheets in said sheet supply, whereby said valve means may operate to connect said pneumatic means with or disconnect the same from said housing and pneumatic actuation of said plunger by the pneumatic means may be effected or prevented.

LEO C. WILLIAMS.