Feb. 10, 1948. L. C. WILLIAMS 2,435,915

SHEET HANDLING APPARATUS

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Fig. 1

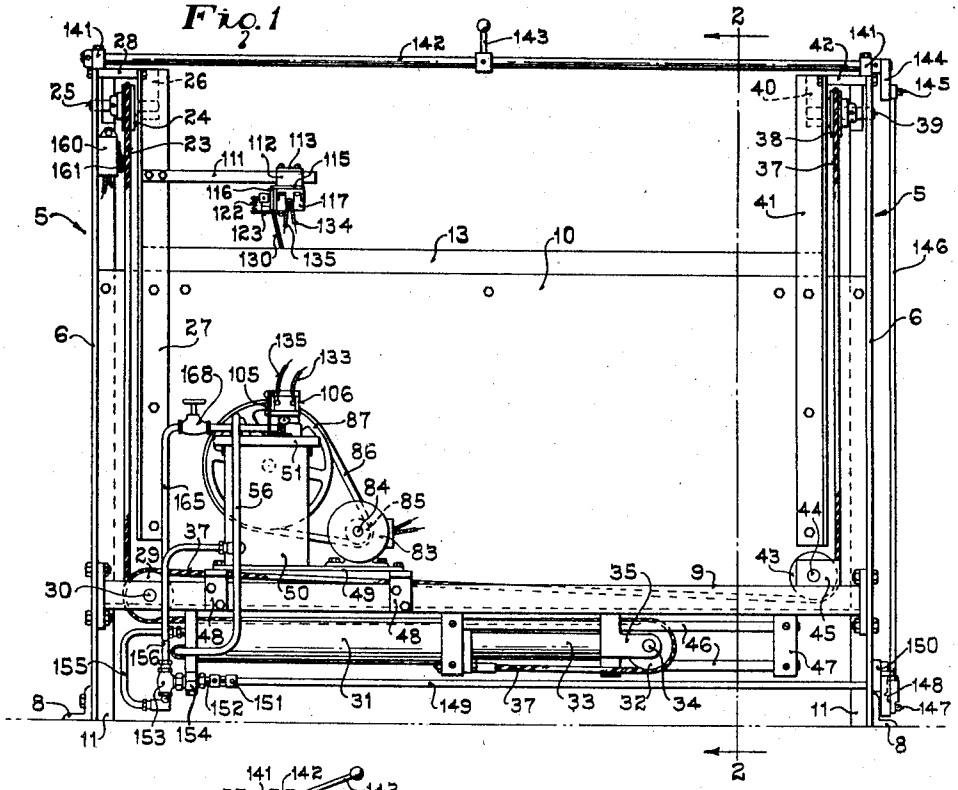
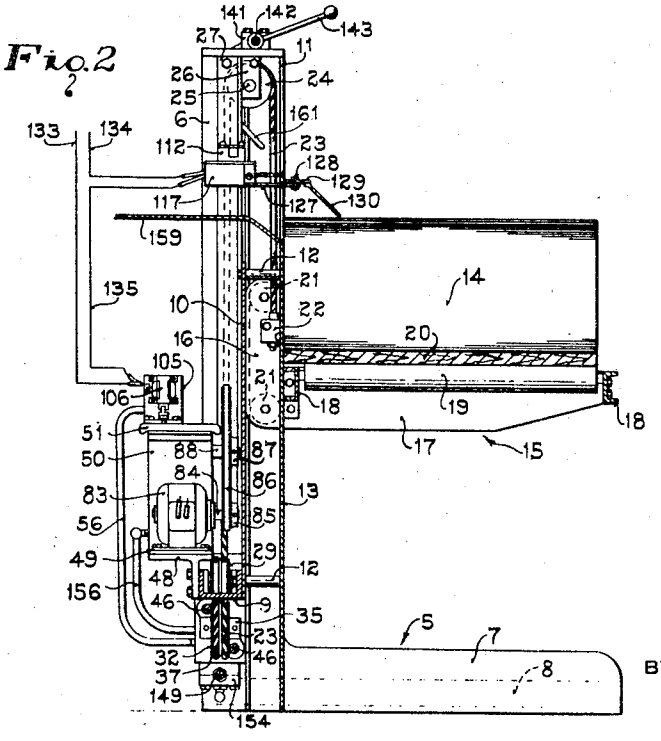


Fig. 2



INVENTOR
LEO C. WILLIAMS
BY
Edward W. Grimm
AGENT

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SHEET HANDLING APPARATUS

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Fig. 3

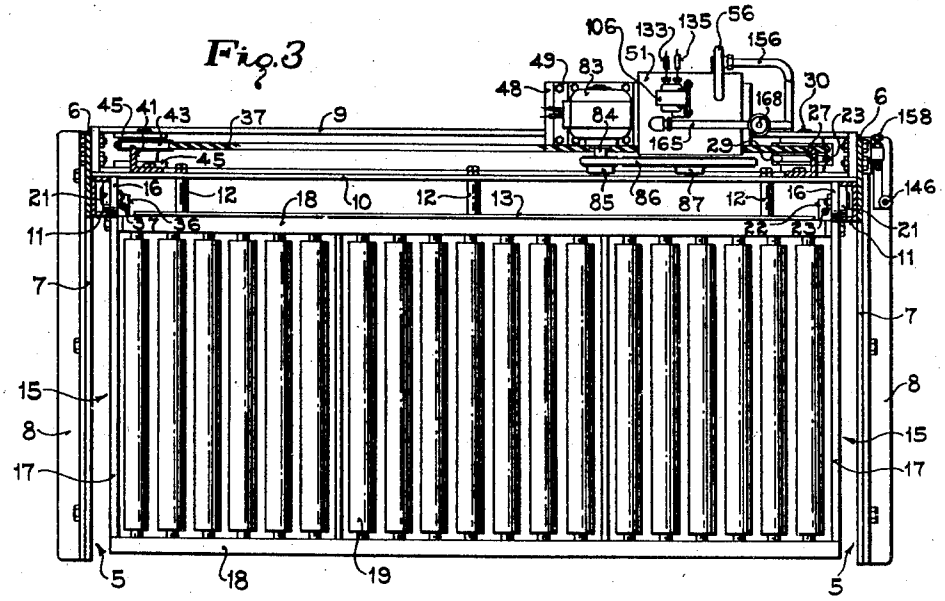


Fig. 4

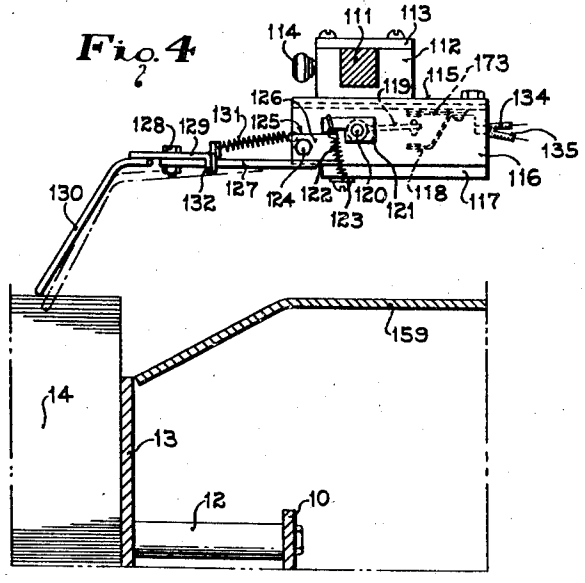
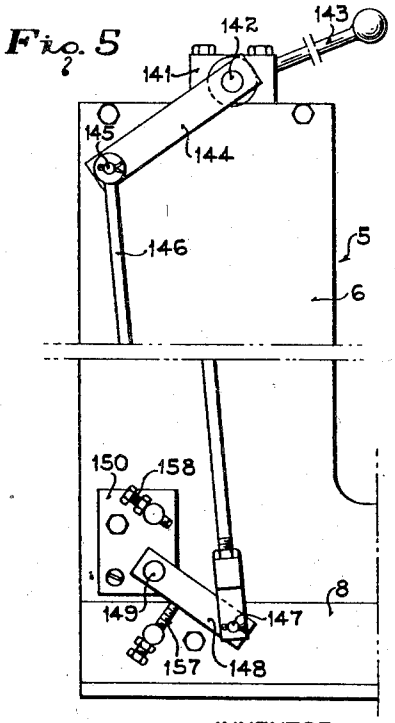


Fig. 5



INVENTOR
LEO C. WILLIAMS

BY

Edward W. Grimm
AGENT

Feb. 10, 1948. L. C. WILLIAMS 2,435,915

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Fig. 7

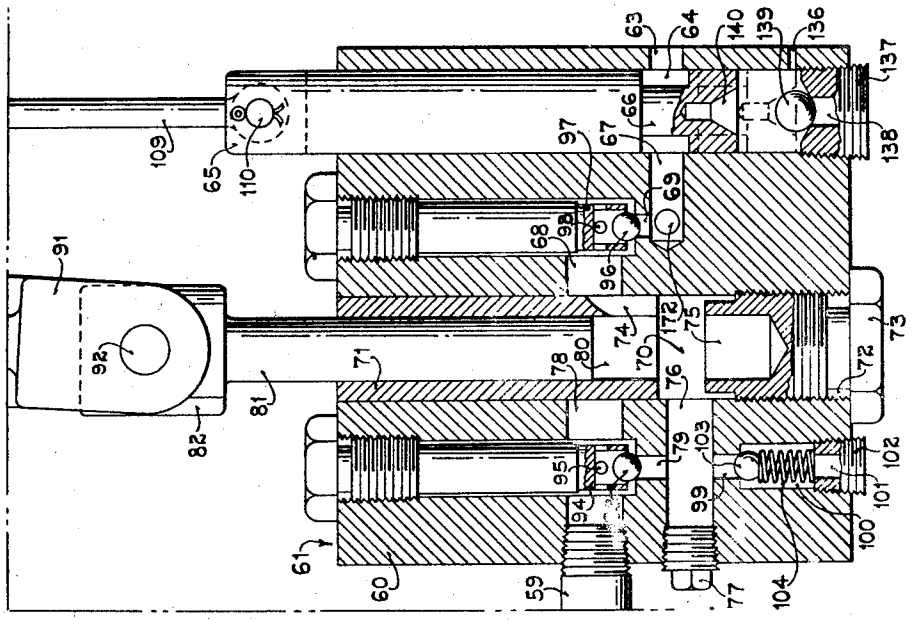
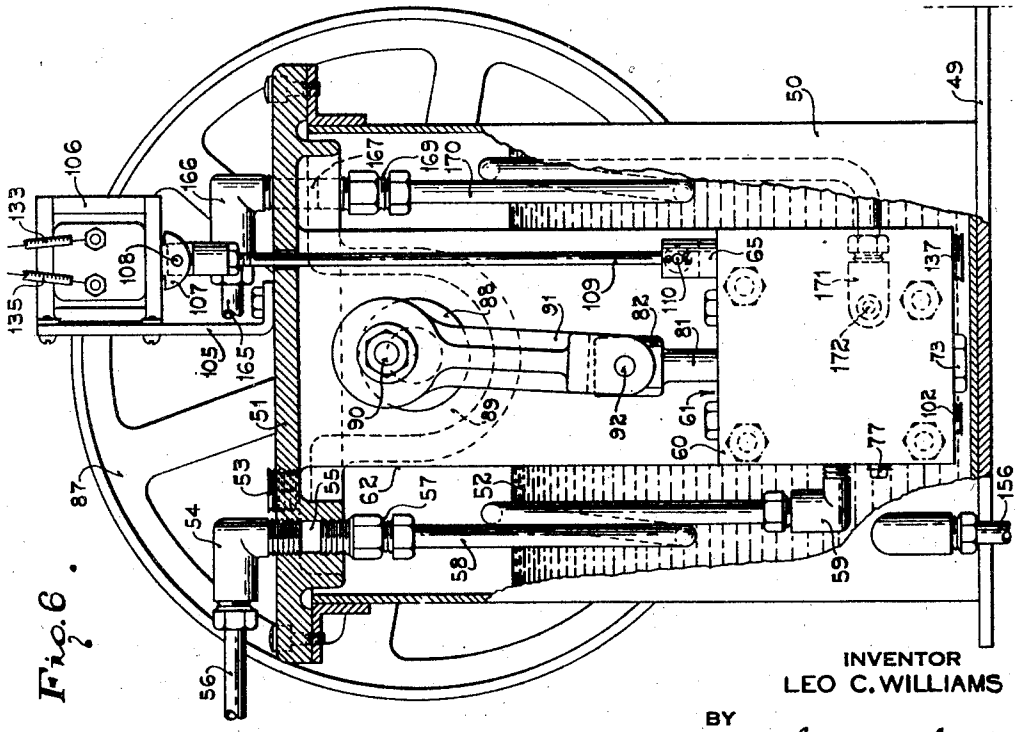


Fig. 6.



INVENTOR
LEO C. WILLIAMS

BY

Edward W. Grimm
AGENT

Patented Feb. 10, 1948 2,435,915

UNITED STATES PATENT OFFICE

2,435,915

SHEET HANDLING APPARATUS

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

Application January 6, 1942, Serial No. 425,720

17 Claims. (Cl. 271—62)

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This invention relates to sheet handling apparatus and more particularly to pile elevators therefor which are employed to support and elevate a pile of sheets into position for feeding of the sheets by hand or automatically one after another from the top of said pile. The invention also relates to pile deliveries which support and lower a pile of sheets delivered thereto from a machine.

One object of the present invention is to provide a pile elevator which is intermittently actuated by improved and simplified hydraulic mechanism.

Another object of the present invention is to provide a pile elevator which is intermittently actuated by improved hydraulic mechanism and controlled electrically through movement of the pile and removal of sheets therefrom or delivery of sheets thereto.

Another object of the present invention is to provide improved hydraulic mechanism for intermittently actuating a pile elevator and including a fluid supplying pump and a fluid controlling valve novelly constructed and arranged as a single unit to insure low manufacturing cost and foolproof operation.

Another object of the present invention is to provide improved hydraulic mechanism for intermittently actuating a pile elevator and including a fluid controlling valve which, through novel association thereof with a fluid supplying pump, eliminates all fluid by-pass means heretofore necessary to enable continued operation of said pump without corresponding movement of the pile elevator.

Another object of the present invention is to provide improved hydraulic mechanism for intermittently actuating a pile elevator, and which includes a continuously operated fluid supplying pump and an intermittently operated fluid controlling valve disposed wholly within the fluid supply to insure that no air is drawn into the hydraulic system thereby, at the same time eliminating packing and providing lubrication for said pump and said valve.

Another object of the present invention is to provide improved pile elevator control means wherein the operation thereof, to render the pile elevator actuating mechanism ineffective, is delayed by novel means for this purpose until the elevator and pile of sheets thereon is raised by said mechanism an amount sufficient to enable feeding of a number of sheets from said pile before elevation thereof is again necessary, thereby eliminating frequent operation of said control means.

A still further object of the present invention is to provide a pile delivery which receives sheets from a machine or other mechanism and is intermittently lowered by improved hydraulic mechanism and controlled electrically through delivery of sheets thereupon.

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Another object of the present invention is to provide improved pile delivery control means wherein the operation thereof, to render the pile delivery actuating mechanism ineffective, is delayed by novel means for this purpose until the delivery and pile of sheets thereon is lowered by said mechanism an amount sufficient to enable delivery of a number of sheets upon said pile before lowering thereof is again necessary, thereby eliminating frequent operation of said control means.

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 front elevation of a pile elevator and hydraulically actuated operating mechanism therefor embodying the present invention;

Fig. 2 is a vertical longitudinal sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a top plan view, partly in section, of the pile elevator and hydraulic mechanism shown in Figs. 1 and 2;

Fig. 4 is an enlarged fragmentary side elevation, partly in section, of pile engaged electrical control means for the hydraulic pile elevator actuating mechanism, looking from the left of Fig. 1;

Fig. 5 is an enlarged side elevation of mechanism for manually controlling the lowering of the pile elevator;

Fig. 6 is an enlarged front elevation, partly in section, of a combined fluid reservoir, pump and control valve unit for the hydraulic pile elevator actuating mechanism; and

Fig. 7 is an enlarged vertical transverse sectional view of the fluid pump and control valve housing shown in Fig. 6.

The hydraulically actuated pile elevator as herein shown and hereinafter described is particularly adapted for supporting and elevating a pile of scored and slotted corrugated or fiber container blanks to the feeding in level of a container stitching or taping machine, at which level said blanks are hand folded and hand fed one after another to said stitching or taping machine for stitching or taping of the free ends or manufacturer's seam thereof. It is to be expressly understood, however, that said hydraulically actuated pile elevator is, as well understood in the art, equally adaptable for use in connection with hand or automatic feeding of all kinds and weights of sheet material such as, paper, cardboard, metal, wood, etc., to printing presses, coating and varnishing machines, slitters, punch

presses, buffing and cleaning machines, and various other instrumentalities acting on such sheets. The elevator or delivery is also adapted for receiving sheets thereupon and the control mechanism lowers the same intermittently as the pile of sheets increases in height to maintain the top thereof at a substantially constant level.

Referring now to the drawings wherein like reference characters designate like parts throughout the several views, the pile elevator and the hydraulically actuated operating mechanism therefor are mounted on a frame comprised by a pair of transversely spaced L-shaped side members indicated broadly at 5 and each preferably in the form of a flat steel plate having a vertically extending portion 6 and a horizontally extending portion 7 (Figs. 1, 2 and 3). The side frame members 5 are supported on the machine foundation as by brackets 8 bolted or otherwise suitably secured thereto, and connected together by a channel cross beam 9 which is bolted or otherwise suitably secured to the upright portions 6 of said members near the lower ends thereof. The side frame members 5 are further connected together by a vertically extending metal plate 10 that is bolted or otherwise suitably secured to the front sides of vertically extending channel members 11 which, in turn, are bolted or otherwise suitably secured to said side frame members on the inner sides thereof. Spaced rearwardly from the plate 10, as by spacers 12, and bolted or otherwise suitably secured to said plate is another plate 13 against which the front side of a pile or supply of container blanks or other sheets 14 bears during elevation of the same by mechanism to be hereinafter described.

The pile of container blanks or other sheets 14 is supported on a pile elevator comprised by a pair of transversely spaced L-shaped side members indicated broadly at 15 (Figs. 2 and 3) and each preferably in the form of a flat steel plate having a vertically extending portion 16 and a horizontally extending portion 17. The elevator side members 15 are connected together at the front and rear thereof by transversely extending channel members 18 which are bolted or otherwise suitably secured thereto. The channel members 18 have journalled therein rollers 19 on which the pile of container blanks or other sheets 14 may be freely moved into proper position on the elevator. Accordingly, the pile of container blanks or other sheets 14 is preferably placed on a pile board 20 and the latter and pile are then run on the elevator from either side thereof when said elevator is lowered to loading position as hereinafter described. The elevator is guided for vertical movement by rollers 21 which are journalled in spaced relation on the elevator side members 15 and arranged to run in the channel members 11.

The pile elevator and pile of container blanks or other sheets 14 thereon are intermittently raised by hydraulically actuated mechanism to maintain the top of the pile at a proper feeding level. This mechanism is preferably mounted and constructed as follows. Connected with one of the elevator side members 15 as at 22 (Figs. 2 and 3) is one end of a cable 23 which extends upwardly and forwardly around a suitably grooved sheave 24 (Figs. 1 and 2). This sheave 24 is journalled on a pin 25 which is fixed in a block 26 and extends laterally therefrom through the adjacent channel member 11 and the upright portion 6 of the adjacent side frame member 5. The block 26 is welded or otherwise suitably secured to the upper end of an angle iron 27 which is spaced from the adjacent side frame member 5, as by a spacer 28, and bolted or otherwise suitably secured to the plate 10.

From the sheave 24 the cable 23 extends downwardly to the channel cross beam 9 at which point said cable passes under and around a suitably grooved sheave 29 through a suitable opening formed in said cross beam and into which the latter sheave projects (Figs. 1, 2 and 3). The sheave 29 is journalled on a pin 30 which is secured in any suitable manner in the channel cross beam 9. From the sheave 29 the cable 23 extends transversely beneath the channel cross beam 9 and above a horizontally arranged hydraulic cylinder 31, and then passes around a suitably grooved sheave 32 and back to said cylinder to which the opposite free end of said cable is then anchored in any suitable manner. The hydraulic cylinder 31 is bolted or otherwise suitably secured to the channel cross beam 9 on the underside thereof and is provided with a hydraulically actuated piston rod or ram 33 projecting outwardly through one end of said cylinder. The sheave 32 is journalled as at 34 on a yoke 35 which is secured in any suitable manner on the outwardly projecting end of the piston rod or ram 33.

Connected with the other elevator side member 15 as at 36 (Fig. 3) is one end of a cable 37 which extends upwardly and forwardly around a suitably grooved sheave 38 (Fig. 1). This sheave 38 is journalled on a pin 39 which is fixed in a block 40 and extends laterally therefrom through the adjacent channel member 11 and the upright portion 6 of the adjacent side frame member 5. The block 40 is welded or otherwise suitably secured to the upper end of an angle iron 41 which is spaced from the adjacent side frame member 5, as by a spacer 42, and bolted or otherwise suitably secured to the plate 10. From the sheave 38 the cable 37 extends downwardly to the channel cross beam 9 at which point said cable passes under and around a suitably grooved sheave 43 (Figs. 1 and 3). This sheave 43 is journalled on a pin 44 which is secured in any suitable manner in blocks 45 that are disposed on opposite sides of said sheave and welded or otherwise suitably secured to the channel cross beam 9.

From the sheave 43 the cable 37 extends transversely along the upper side of the channel cross beam 9 and then passes over and around the sheave 29 which is suitably grooved to also receive said cable. From the sheave 29 the cable 37 extends back over the hydraulic cylinder 31 and beneath the channel cross beam 9, and then passes around the sheave 32 and back again to said cylinder to which the free opposite end thereof is then anchored in any suitable manner, the sheave 32 being suitably grooved to also receive said cable. It will thus appear that when the piston rod or ram 33 is hydraulically advanced toward the right as viewed in Fig. 1, corresponding movement will be imparted to the yoke 35 and sheave 32, and those portions of the cables 23 and 37 extending from the hydraulic cylinder 31 around the sheave 32 and to the sheave 29 will be lengthened. This obviously shortens those portions of the cables 23 and 37 between the elevator side members 15 and the sheaves 24 and 38 resulting in raising of the elevator and pile 14 thereon. The piston rod or ram 33 is guided for right line movement by a pair of rods 46 (Figs. 1 and 2) which are slidably

engaged by the yoke 35 and have opposite extremities thereof secured on the hydraulic cylinder 31 and in a block 47 that is welded or otherwise suitably secured to the underside of the channel cross beam 9. It is to be understood that any suitable means other than a cable connection between the piston rod or ram 33 and the elevator is contemplated.

Delivery of fluid under pressure into the hydraulic cylinder 31 to intermittently advance the piston rod or ram 33 and thereby intermittently raise the elevator and pile of container blanks or other sheets thereon is, in accordance with the present invention, effected and controlled by improved pump and valve means preferably mounted, constructed, arranged and operated as follows. Secured to the channel cross beam 9 through the medium of brackets 48 is a small platform 49 (Figs. 1, 2 and 3) having welded or otherwise suitably secured thereto a receptacle or tank 50 which is closed at the top thereof by a cover 51 bolted thereto. The receptacle or tank 50 is adapted to contain a supply of oil as indicated at 52 (Fig. 6) which is introduced therein through a suitable opening 53 formed in the cover 51 for this purpose. Connected with the cover 51, as by a fitting 54, and communicating with the interior of the receptacle or tank 50 through a suitable opening 55 formed in said cover is one end of a conduit 56 the opposite end of which is connected with the hydraulic cylinder 31 at the left hand end thereof as viewed in Fig. 1 to direct fluid under pressure into said cylinder at said end as hereinafter described.

Threaded in the opening 55 in cover 51, as by a fitting 57, and communicating with the conduit 56 is one end of a conduit 58 (Fig. 6) which is disposed wholly within the fluid supply tank or receptacle 50. The opposite end of this conduit 58 is connected, as by a fitting 59, with the housing 60 of a combined fluid supplying pump and fluid controlling valve unit indicated broadly at 61 which, as herein shown, is also disposed within the tank 50 and wholly submerged in the fluid 52 in said tank. The pump and valve unit 61 may be supported in various ways in the tank 50 but, as herein shown, said unit is preferably bolted or otherwise suitably secured to the lower end of a depending bracket 62 which is secured to or formed integrally with the cover 51.

Referring now more particularly to Fig. 7 of the drawings, the housing 60 of the pump and valve unit 61 has formed therein at one side thereof a fluid inlet port 63 which opens outwardly into the fluid supply 52 and inwardly into a cylindrical bore 64 in said housing. Slidably mounted in the cylindrical bore 64 in housing 60 is a fluid controlling valve 65 provided with a reduced portion 66 for establishing communication at certain intervals between the port 63 and a passage 67. This passage 67 is formed in the housing 60 preferably in line with the port 63 and connected with a passage 68 through a port 69. The passage 68 in housing 60 communicates with a chamber 70 formed by the lower end of a bushing 71 fixed in a cylindrical bore 72 in said housing, and the upper end of a plug 73 which is threaded in said bore, said communication being established through a suitable opening 74 formed in the lower end of the bushing 71. The plug 73 is counter-bored as at 75 to provide a trap for any impurities present in the fluid 52. Formed in the housing 60 and preferably in line with the chamber 70 is a passage 76 having one end opening into said chamber and the opposite end closed by a plug 77. This passage 76 is connected with a fluid outlet port or passage 78 through a port 79, the latter passage having threaded therein the fitting 59 of the conduit 58.

Fitted for reciprocation in the bore 80 of bushing 71 is a plunger pump 81 which projects upwardly through the housing 60 and is provided on the upper end thereof with an enlarged head portion 82. The plunger pump 81 is continuously reciprocated by mechanism preferably mounted, constructed and operated as follows. Bolted or otherwise suitably secured to the platform 49 is an electric motor 83 (Figs. 1, 2 and 3) connected with a suitable source of current and controlled for starting and stopping purposes by suitable switch means (not shown). Fixed on the armature shaft 84 of electric motor 83 is a pulley 85 around which passes a belt 86 that also passes around and drives a pulley 87. This pulley 87 is fixed on and drives a short crank shaft 88 (Fig. 6) which extends through a suitable opening 89 formed in the rear side of the fluid supply tank or receptacle 50, and is journalled in a suitable bearing in the depending bracket 62. Pivotally connected as at 90 with the crank shaft 88 is the upper end of a connecting rod 91, the lower end of which is pivotally connected as at 92 with the head portion 82 of the plunger pump 81. It will thus appear that the plunger pump 81 through the described driving connections therefor with the electric motor 83 will be operated continuously during the lifting of the elevator, and raised and lowered out of and into the chamber 70 during each revolution of the crank shaft 88.

Under these conditions, and with the fluid controlling valve 65 raised to the full line position thereof shown in Fig. 7, the fluid 52 is intermittently drawn from the tank or receptacle 50 through the port 63, the reduced portion 66 of the valve 65, the passage 67, the port 69, the passage 68, the opening 74, and into the chamber 70. Fluid so drawn into the chamber 70 is then forced therefrom by the plunger pump 81 through the passage 76, the port 79, the passage 78, the conduits 58, 56, and into the left hand end of the hydraulic cylinder 31 (Fig. 1), resulting in step by step movement of the piston rod or ram 33 toward the right and intermittent raising of the pile elevator and pile of container blanks or other sheets thereon. When the fluid controlling valve 65 is lowered to the dotted line position thereof shown in Fig. 7, said valve closes the fluid inlet port 63, thus disconnecting the fluid supply 52 from the plunger pump 81 so that no fluid can be drawn by said pump into the chamber 70 as described upon continued action thereof. In this manner the plunger pump 81 is rendered ineffective to supply fluid into the hydraulic cylinder 31 with the result that no movement is imparted to the pile elevator and pile of container blanks or other sheets thereon.

It will therefore be noted that through the novel arrangement of the fluid controlling valve 65 between the fluid supply 52 and the plunger pump 81, by-passing of the fluid is unnecessary to enable continuous operation of said pump without imparting raising movement to the pile elevator and pile of container blanks or other sheets thereon, thereby enabling the use of a fluid controlling valve much simpler in construction and requiring less power to operate. It will further be noted that arrangement and operation

of the plunger pump 81 and the fluid controlling valve 65 in the fluid supply 52 insures that no air is drawn into the hydraulic system, eliminates packing, and provides lubrication for said pump and said valve.

To prevent return flow of fluid from the hydraulic cylinder 31 through the conduits 56 and 58 and consequently dropping of the elevator and pile of container blanks or other sheets thereon, the housing 60 has incorporated therein an upwardly opening check valve preferably in the form of a ball 93 (Fig. 7) which is adapted to drop and close the end of the port 79 opening into the passage 78 when no fluid under pressure is being forced through said port by the plunger pump 81. The fluid previously admitted into the cylinder 31 to intermittently raise the pile elevator and pile of container blanks or other sheets thereon is then trapped therein, thus maintaining the elevator and pile in raised position. The ball check valve 93 is retained in a valve cage 94 which is threaded in a suitable opening in the housing 60 and provided with a plurality of fluid passages or ports 95. It is clear that the check valve 93 may be incorporated in the fitting 59 as desired.

To prevent return flow of fluid from the chamber 70, the housing 60 has incorporated therein an upwardly opening check valve preferably in the form of a ball 96 which is adapted to drop and close the end of the port 69 opening into the passage 68 on the pressure stroke of the plunger pump 81. The ball check valve 96 is retained in a valve cage 97 which is threaded in a suitable opening in the housing 60 and provided with a plurality of fluid passages or ports 98.

In order to guard against overloading of the pile elevator which would result in breaking of the cables 23, 37 and damage to said elevator and the hydraulic mechanism, the housing 60 has formed therein a relief port 99 (Fig. 7) having one end opening into the passage 76 and the opposite end opening into a passage 100 also formed in said housing. This passage 100 opens into the fluid supply 52 through a port 101 formed in an adjusting screw 102 threaded in said passage. The relief port 99 is normally closed by a downwardly opening pressure relief valve disposed within the passage 100 and preferably in the form of a ball 103 which is held against the port 99 by a compression spring 104 interposed between said ball and the adjusting screw 102. The tension of the spring 104 on the ball relief valve 103 is so regulated by the adjusting screw 102 that the fluid pressure required to effect elevation of the maximum load capable of being handled on the elevator is not sufficient to cause opening of said valve. Should, however, the fluid pressure exceed a predetermined amount due to overloading of the pile elevator or for any other reason, the relief valve 103 is caused to open and permit the fluid to flow from the passage 76 back into the fluid supply 52 through the relief port 99, the passage 100 and the port 101, thus preventing actuation of the piston rod or ram 33 and raising of the pile elevator and pile of container blanks or other sheets thereon. It is clear that the relief valve described may be connected with the fluid outlet 78 or fitting 59 as desired.

It will be noted that arrangement of the fluid controlling valve 65, the plunger pump 81, the fluid check valves 93 and 96, and the safety pressure relief valve 103 in the housing 60 as a single unit insures low manufacturing cost and foolproof operation of the hydraulic mechanism.

As hereinbefore stated, the fluid controlling valve 65 is raised and lowered to render the plunger pump 81 effective and ineffective to supply fluid into the hydraulic cylinder 31, and while this may be accomplished in any suitable manner and by any suitable means for this purpose, said operation, as herein shown, is preferably effected by electrically actuated means controlled by switch means responsive to variations in the height of the pile of container blanks or other sheets on the elevator. The contacts of the switch are normally open until a sufficient number of sheets have been fed from the top of the pile, whereupon the switch closes under the control of the pile to actuate the electrical means, thereby raising the fluid controlling valve 65 and rendering the plunger pump 81 effective to supply fluid under pressure into the hydraulic cylinder 31 to intermittently raise the elevator and pile of container blanks or other sheets thereon. Upon raising of the elevator and pile of container blanks or other sheets thereon, the switch is again opened by the pile and opening of the switch controls the lowering of the fluid controlling valve 65 to render the plunger pump 81 ineffective to further raise the elevator and pile thereon. Said electrically actuated means and pile controlled switch means are preferably mounted, constructed and operated as follows.

Bolted or otherwise suitably secured to the cover 51 of the fluid supply tank or receptacle 50 is a bracket 105 (Fig. 6) to which is bolted or otherwise suitably secured a solenoid 106 having a core 107. Pivotally connected as at 108 with the lower end of the core 107 of solenoid 106 is the upper end of a rod 109 which extends downwardly into the tank or receptacle 50 through a suitable opening formed for this purpose in the cover 51 and has its lower end pivotally connected as at 110 with the upper end of the fluid controlling valve 65.

Bolted or otherwise suitably secured to the angle iron 27 near the top thereof and projecting inwardly therefrom is a bar 111 (Figs. 1 and 4). Engaged over and slidable along the bar 111 is a block 112 which is held against displacement from said bar by a plate 113 that is bolted or otherwise suitably secured on the upper side of said block. The block 112 and parts carried thereby hereinafter described may be adjusted along the bar 111 in accordance with variations in width of the container blanks or other sheets being handled on the elevator and may be secured in any desired position of adjustment by a thumb screw 114 or the like.

Secured in any suitable manner to the underside of the block 112 is a plate 115 having a downwardly bent side portion 116. Bolted or otherwise suitably secured to the plate 115 is a switch box 117 provided therein with a pair of spaced stationary contact members 118 and a movable contact member 119 (Fig. 4) which bridges or closes the circuit between the pair of spaced members 118. The movable contact member 119 is carried by a pin 120 which is journalled in the switch box 117 and projects outwardly therefrom and through a suitable opening formed in the side portion 116 of the plate 115. Secured in any suitable manner to the outwardly projecting end of the pin 120 is a small contact actuating arm 121. The contacts 118 and 119 are normally held open by a light pull spring 122 having one end connected with the arm 121 and the

opposite end connected with a strip 123 projecting laterally from the switch box 117 and bolted or otherwise suitably secured to the underside thereof.

Pivotally mounted as at 124 to swing in a vertical plane on the side portion 116 of the plate 115 is a lever 125 having a forwardly extending short arm 126 adapted to engage the arm 121, and a rearwardly extending long arm 127 (Fig. 4). Pivotally mounted as at 128 to swing in a horizontal plane on the free end of the arm 127 is an arm 129 having welded or otherwise suitably secured thereto a feeler 130 which extends rearwardly and downwardly and also inwardly at an angle into engagement with the top of the pile of container blanks or other sheets 14 at one side and front thereof. The feeler 130 is held in its original angular pile engaging position by a light pull spring 131 having opposite extremities thereof connected with the arms 126 and 129, respectively, said angular position being determined by a depending lug 132 formed on the free end of the arm 129 at one side thereof and engaging the side of arm 127. It will thus appear that when handling container blanks, upon hand folding of opposite side portions of the topmost blank inwardly toward each other on the pile, prior to feeding of said blank into the stitching or taping machine, the feeler 130 will yield inwardly and upwardly in horizontal and vertical directions due to the described pivotal arrangement thereof, thus preventing no interference in the folding operation.

It will be understood that the switch 117 and actuating means therefor including the feeler 130 may be arranged in a well known manner to operate on the rear of the pile 14 instead of on the front of said pile as herein shown, and that the feeler 130 may be operated at predetermined intervals in a well known manner into and out of engagement with the top of the pile 14. It will also be understood that the horizontal swinging movement of the feeler 130 and the inward angular position of said feeler may be eliminated when the pile elevator is employed in connection with hand or automatic feeding of container blanks or other sheets that are not folded prior to feeding of the same, in which event the feeler 130 may be secured to or formed integrally with the arm 127.

The solenoid 106 and one of the stationary contact members 118 have connected therewith lead wires 133 and 134, respectively, which are connected with a suitable source of electric current (Fig. 2). The other stationary contact member 118 and the solenoid 106 are connected together by a wire 135 so that when the contact member 119 is lowered into engagement with both of the spaced stationary contact members 118 the electric circuit for the solenoid 106 will be completed.

Assuming now that the top of the pile 14 is disposed at the normal feeding level at which time the switch 117 is open, and the fluid controlling valve 65 is in its lowered dotted line position shown in Fig. 7 closing the fluid inlet port 63. Under these conditions the plunger pump 81 reciprocates without pumping fluid as hereinbefore described and no upward movement is imparted to the elevator and pile of container blanks or other sheets thereon. As the container blanks or other sheets are fed one after another from the top of the pile, however, the feeler 130 will lower by gravity so that when a sufficient number of said blanks or sheets have been so fed, the arm 126 through

engagement with the arm 121 will swing the latter clockwise as viewed in Fig. 4, thereby lowering the contact member 119 and closing the switch 117, thus completing the electric circuit for the solenoid 106. The solenoid 106 is then energized and draws the core 107 upwardly, thereby raising the fluid controlling valve 65 to the full line position thereof shown in Fig. 7. Under these conditions the fluid inlet port 63 is opened, and upon continued reciprocation of the plunger pump 81 fluid is drawn from the supply 52 and delivered under pressure into the hydraulic cylinder 31 as hereinbefore described, thus raising the elevator and pile of container blanks or other sheets thereon.

As the pile thus raises, the feeler 130 engaged with the top of the pile also raises and swings the arm 126 downwardly, thereupon the spring 122 operates to raise the contact member 119 and again open the switch 117. Opening of the switch 117 deenergizes the solenoid 106 whereupon the fluid controlling valve 65 drops such as by gravity to the dotted line positoin thereof shown in Fig. 7, thus again closing the fluid inlet port 63 and rendering the plunger pump 81 ineffective as hereinbefore described to further raise the elevator and pile of container blanks or other sheets thereon.

Lowering of the fluid controlling valve 65 as aforesaid to stop further raising of the elevator and pile of container blanks or other sheets thereon is, in accordance with another aspect of the present invention, delayed or retarded so that, upon opening of the switch 117, raising of the elevator will not be directly stopped but, on the contrary, will continue to raise the pile an amount sufficient to enable feeding of a number of blanks or sheets from the top thereof before raising of the elevator and said pile is again necessary. In this manner the pile is raised to the normal feeding range upon a single operation of the switch 117, whereas the switch would otherwise operate for each sheet particularly if they are relatively thick, thus eliminating frequent operations of said switch, preventing excessive wear of the same and frequent repairs or replacements thereto.

The feeler 130 and its associated devices switch 117, solenoid 106, and fluid controlling valve 65 constitute supply control means and various ways and means may be employed in connection with any part thereof to delay or retard the operation of the same whereby delay in the lowering movement of the fluid controlling valve 65 is effected. Preferably, such delaying means is associated with the fluid controlling valve 65 and preferably too is effected by fluid means which may be constructed and arranged as follows. Formed in the housing 60 at the side thereof having the fluid inlet port 63 and spaced from said port is a restricted port 136 (Fig. 7) having one end opening into the fluid supply 52 and the opposite end opening into the bore 64. The bore 64 is closed at the lower end thereof by a plug 137 having an open ended port 138 therein communicating with the fluid supply 52 and with said bore. The port 138 is normally closed by an upwardly opening check valve preferably in the form of a ball 139. The lower end of the fluid controlling valve 65 is countersunk as at 140 to receive the ball 139 when said valve is lowered.

It will thus appear that when the fluid controlling valve 65 is raised to effect raising of the elevator and pile of container blanks or other sheets thereon as hereinbefore described, said raising of said valve creates vacuum in the lower

end of the bore 64 whereupon the ball check valve 139 is raised by the fluid pressure on the underside thereof, thus permitting the fluid 52 to flow into said bore through the port 138. When the switch 117 is opened as hereinbefore described, and the fluid controlling valve 65 begins to drop by gravity, at which time the port 138 is again closed through dropping of the ball check valve 139, the fluid previously admitted into the bore 64 must be forced therefrom by the fluid controlling valve 65 through the restricted port 136 and back into the supply 52 before said valve can drop to the dotted line position thereof shown in Fig. 7, thus materially retarding or delaying the lowering movement of the fluid controlling valve 65.

When the pile of container blanks or other sheets is exhausted through intermittent raising of the elevator and feeding of said blanks or sheets one after another therefrom, the elevator may be quickly lowered to the machine foundation to receive a new pile of blanks or other sheets. As herein shown, this rapid lowering of the elevator is preferably effected as follows. Bolted or otherwise suitably secured to the channel members 11 on the tops thereof are blocks 141 (Figs. 1, 2 and 5) in which is journalled opposite extremities of a transversely extending rock shaft 142 having fixed thereon a handle 143. Fixed on one end of the rock shaft 142 is an arm 144 having pivotally connected therewith as at 145 the upper end of a rod 146 the lower end of which is pivotally connected as at 147 with an arm 148. This arm 148 is fixed on a transversely extending rock shaft 149 having one end thereof extending through a suitable opening formed in one of the side frame members 5 and journalled in a suitable bearing in a bracket 150 that is bolted or otherwise suitably secured to said side frame member.

The opposite end of the shaft 149 is connected, as by a universal coupling 151 (Fig. 1), with the operating stem 152 of a normally closed globe valve 153 which is of a well known type needing no detail description herein. The globe valve 153 is carried in a bracket 154 that is secured to or formed integrally with the hydraulic cylinder 31. Connected with one side of the globe valve 153 is one end of a conduit 155 the opposite end of which is connected with the hydraulic cylinder 31 at the same end thereof in which is connected the conduit 56. Connected with the opposite side of the globe valve 153 is one end of a conduit 156 the opposite end of which is connected with the fluid supply tank or receptacle 50 at the lower end thereof. Rocking movement of shaft 149 in opposite directions to open and close the globe valve 153 is limited by stop screws 157 and 158 which are adjustably threaded in the adjacent bracket 8 and the bracket 150, respectively, and adapted to be engaged by the arm 148.

While the container blanks or other sheets are fed from the top of the pile and intermittent raising of the elevator and said pile is effected by the plunger pump 81, the handle 143 is disposed in the raised position thereof shown in Fig. 5, and the arm 148 is disposed in engagement with the stop screw 157. Under these conditions the globe valve 153 is closed so that the fluid forced into the hydraulic cylinder 31 by the plunger pump 81 will be effective to raise the elevator and pile of container blanks or other sheets thereon as hereinbefore described. When the pile of container blanks or other sheets is exhausted, however, the elevator may be quickly lowered to the machine foundation by moving the handle 143 downwardly (Fig. 5) until the arm 148 through the described connections therefor with said handle is raised into engagement with the stop screw 158, thus rocking the shaft 149 and opening the globe valve 153. Opening of the globe valve 153 releases the fluid in the left hand end (Fig. 1) of the hydraulic cylinder 31, whereupon the elevator due to its own weight, drops by gravity to the machine foundation, assisted, if necessary, by pressure applied manually on said elevator. As the elevator thus drops by gravity to the machine foundation, the fluid in the hydraulic cylinder 31 is forced therefrom and into the tank or receptacle 50 through the conduit 155, the opened globe valve 153, and the conduit 156.

The elevator having been lowered to the machine foundation is then loaded with a new pile of container blanks or other sheets positioned thereon in the usual manner from either side thereof. It might be mentioned at this time that when the elevator is rapidly lowered to the machine foundation as aforesaid, the plunger pump 81 through lowering of the feeler 130, closing of the switch 117 and raising of the fluid controlling valve 65 thereby, will supply fluid into the hydraulic cylinder 31, said fluid, however, upon entering the hydraulic cylinder 31 will flow out again and back into the tank or receptacle 50 through the conduit 155, the opened globe valve 153 and the conduit 156, thus preventing raising of the elevator while a new pile of container blanks or other sheets is being loaded thereon. It will be understood that when the elevator is lowered to the machine foundation for loading or reloading purposes the plunger pump 81 may be stopped by stopping the electric motor 83 in the usual manner.

The new pile of container blanks or other sheets having been properly positioned on the elevator, the latter and the pile are then raised until the top of said pile is brought into proper position for feeding of the blanks or other sheets one after another therefrom. For this purpose the handle 143 is again raised to its normal position (Fig. 5) to lower the rod 146 and the arm 148 until the latter engages the stop screw 157. Lowering of the arm 148 as aforesaid, rocks the shaft 149 clockwise as viewed in Fig. 5, thus again closing the globe valve 153. Thereupon the fluid forced into the hydraulic cylinder 31 by the plunger pump 81 acts as hereinbefore described to intermittently advance the piston rod or ram 33 and raise the elevator and the new pile of container blanks or other sheets thereon until the top of said pile reaches the normal level for feeding of the blanks or sheets one after another therefrom.

As the new pile thus raises, the top of said pile engages and raises the feeler 130, thereby opening the switch 117. The fluid controlling valve 65 then drops slowly by gravity as hereinbefore described, during which time raising of the elevator and pile continues until the top of the pile reaches the normal feeding level, whereupon the fluid inlet port 63 is again closed by said valve and the elevator is stopped. Feeding of the container blanks or other sheets one after another from the top of the new pile may now be resumed and continued through intermittent raising of the elevator and pile controlled by the feeler 130. The folded container blanks are fed one after another into the stitching or taping machine over an upwardly and forwardly extending plate 159 which forms part of said machine.

It will be apparent that should the switch 117, for any reason, fail to render the plunger pump

81 ineffective through the described means for this purpose when the pile of container blanks or other sheets is completely exhausted, the hydraulic mechanism, if allowed to continue in operation, would raise the elevator beyond the normal feeding level and cause damage to the switch 117 and component parts thereof, and also possible damage to the hydraulic mechanism. Means is, therefore, provided independent of the switch 117 to stop the elevator when said elevator reaches a predetermined elevated position. Said means stops the plunger pump 81, and, as herein shown, is preferably comprised by a normally closed switch 160 (Fig. 1) which is arranged in a well known manner in the electric circuit for the electric motor 83. This switch 160 is bolted or otherwise suitably secured to one of the channel members 11 near the top thereof and is provided with an actuating arm 161 that extends into the path of upward movement of one of the elevator side members 15 (Fig. 2). The switch 160 is so located on the channel member 11 that the arm 161 thereof will be engaged by the elevator side member 15 before the elevator is raised an amount sufficient to cause damage to the switch 117 and possible damage to the hydraulic mechanism.

It will thus appear that should the switch 117, for any reason, fail to render the plunger pump 81 ineffective through the described means for this purpose, the elevator upon continued upward movement thereof will engage and raise the arm 161 of switch 160 and thus open said switch. Opening of the switch 160 breaks the circuit to the electric motor 83, thus stopping said motor and further operation of the plunger pump 81 thereby. Stopping of the plunger pump 81 throws the hydraulic mechanism out of operation and prevents further raising of the elevator. When the elevator is rapidly lowered as hereinbefore described to reload it with a pile of container blanks or other sheets, the arm 161 of switch 160 returns to its original position and closes said switch, thus again starting the motor 83 to enable raising of the elevator and new pile of container blanks or other sheets thereon as hereinbefore described.

It will be noted that the cover 51 for the tank or receptacle 50 supports the pump and valve unit 61, the pump operating mechanism, the check and relief valves 93, 96, 103, the solenoid 106, and the conduits 56 and 58, all of which may be bench assembled, thus reducing elevator erecting time.

The mechanism described hereinbefore can also be utilized as an intermittently operated pile delivery mechanism. This is accomplished by reversing the direction of intermittent operation of the elevator by the mechanism and in the manner now to be described. Connected with the left hand end (Fig. 1) of the hydraulic cylinder 31 is one end of a conduit 165 the opposite end of which is connected, as by a fitting 166, with the cover 51 of the tank or receptacle 50 (Fig. 6). The conduit 165 communicates with the interior of the tank or receptacle 50 through a suitable opening 167 formed in the cover 51 for this purpose. A suitable valve 168 (Fig. 1) is connected in the conduit 165 which may be opened for fluid flow therethrough for operation of the elevator as a pile delivery. Preferably the valve 168 is associated with a needle valve which controls the speed of flow therethrough. Threaded in the opening 167 in cover 51, as by a fitting 169, and communicating with the conduit 165 is one end of a conduit 170 (Fig. 6) which is disposed wholly within the tank or receptacle 50. The opposite end of this conduit 170 is connected, as by a fitting 171, with the pump and valve housing 68 and communicates with the passage 67 in said housing through a port 172 (Fig. 7).

The elevator is raised to its upper position by the plunger pump 81 and since the latter is not needed in the lowering operation of the elevator it is not necessary to drive the same and it may be stopped by shutting off the motor 83. With the elevator ready to receive sheets thereon, the valve 168 is opened to begin the downward operation. Sheets are delivered from the left-hand side of Figure 2 along the plate 159 and delivered onto the pile beneath the feeler 130. As the sheets pile up thereon the feeler 130 is raised until the switch contacts 119 and 173 (Fig. 4) are closed. The switch contacts 173 are like the contacts 118 and close the circuit in the same way to energize the solenoid 106. Energization of the solenoid 106 raises the fluid controlling valve 65 and opens the conduits 165 and 170 to the fluid supply 52, whereupon fluid flows out of the left-hand end (Fig. 1) of the cylinder 31 under the pressure exerted by the weight of the elevator and the latter is lowered. As the elevator lowers, the feeler 130 is lowered, which in turn drops the switch contact 119 to break its engagement with the contacts 173, whereupon the solenoid 106 is deenergized. The fluid controlling valve 65 then slowly drops by gravity, but its downward movement is delayed by the fluid trapped in the chamber therebelow. As the fluid slowly leaks out through the restricted port 136 the fluid controlling valve 65 drops to close the connection between the conduits 165, 170, the passage 67 and the port 63 to the fluid supply 52, whereupon fluid can no longer escape from the left-hand end (Fig. 1) of the cylinder 31 and the elevator thereupon stops until another series of sheets is delivered to the elevator and again raises the feeler 130 and the above described operation is repeated. It is clear that a suitable switch may be used if desired to disconnect one of the set of contacts 118 or 173 and connect the other set into the circuit in order to avoid any possibility of closing the circuit to the solenoid 106 through the contacts not intended to operate.

The present description and its accompanying drawings set forth with more or less particularity one embodiment of the present invention, but it is to be expressly understood that said invention is not limited to said embodiment or otherwise than by the terms of the appended claims.

What I claim is:

1. The combination with hydraulically actuated means for intermittently imparting vertical movement to a pile of sheets, means engaged with the pile having a first position for operation of said hydraulically actuated means and a second position for discontinuing said operation, and means controlled by the pile engaging means and movable in one direction to render the hydraulically actuated means effective and in the opposite direction to render said hydraulically actuated means ineffective; of means associated with said last named means for delaying the movement thereof in said opposite direction after the pile engaging means has moved to its second position.

2. The combination with hydraulically actuated means for intermittently imparting vertical movement to a pile of sheets, a feeler engaged with the pile having a first position for operation of said hydraulically actuated means and a second position for discontinuing said operation, and

an element controlled by the feeler and movable in one direction to provide for operation of the hydraulically actuated means and in the opposite direction to discontinue operation of said hydraulically actuated means; of fluid means associated with said element for delaying the movement thereof in said opposite direction after the feeler has moved to its second position.

3. The combination with hydraulically actuated means for intermittently imparting vertical movement to a pile of sheets, means engaged with the pile having a first position for operation of said hydraulically actuated means and a second position for discontinuing said operation, and valve means controlled by the pile engaging means and movable in one direction to provide for operation of the hydraulically actuated means and in the opposite direction to discontinue operation of said hydraulically actuated means; of means for delaying the movement of said valve means in said opposite direction after the pile engaging means has moved to its second position.

4. The combination with hydraulically actuated means for intermittently imparting vertical movement to a pile of sheets, and a feeler engaged with the pile having a first position for operation of said hydraulically actuated means and a second position for discontinuing said operation; of a valve controlled by the feeler and power operated in one direction to provide for operation of the hydraulically actuated means and gravity operated in the opposite direction to discontinue operation of said hydraulically actuated means; and fluid means associated with said valve for delaying the movement thereof in said opposite direction after the feeler has moved to its second position.

5. The combination with means to raise an elevator, hydraulic means for intermittently imparting downward movement to said elevator and a pile of sheets thereon, and a feeler engaged with the pile having a first position for operation of said hydraulic means and a second position for discontinuing said operation; of a valve; power means controlled by said feeler and operating the valve in one direction to provide for operation of the hydraulic means and operated in the opposite direction to discontinue operation of said hydraulic means; and fluid means associated with said valve for delaying the movement thereof in said opposite direction after the feeler has moved to its second position.

6. The combination with means for intermittently raising a pile of sheets into position for handling of said sheets one after another; of means for controlling the operation of said pile raising means and including a feeler continuously engaged with the top of the pile and mounted for movement in vertical and horizontal planes by manipulation of the sheet to enable handling of each sheet without interference thereby.

7. The combination with means for intermittently raising a pile of sheets into position for handling of said sheets one after another, and control means for controlling the operation of said pile raising means; of a feeler continuously engaged with the top of the pile for controlling the operation of said control means; and means pivotally mounting the feeler for swinging movement in vertical and horizontal planes by manipulation of the sheet to enable handling of each sheet without interference thereby.

8. The combination with means for intermittently raising a pile of sheets into position for handling of said sheets one after another, and electric switch means for controlling the operation of said pile raising means; of a feeler connected with the switch means and continuously engaged with the top of the pile for controlling the operation of said switch means; and means pivotally mounting the feeler for swinging movement in vertical and horizontal planes by manipulation of the sheet to enable handling of each sheet without interference thereby.

9. In mechanism for hydraulically imparting intermittent upward movement to a pile of sheets: the combination of a receptacle adapted to contain a supply of fluid; a housing in said receptacle mounted below the top of the receptacle so as to be wholly submerged in the fluid therein; a fluid inlet port and fluid outlet port in said housing; a continuously reciprocating plunger pump in the housing; a slide valve interposed between the pump and the source of motive fluid and movable to connect said source with and disconnect the same from said pump; mechanism including a solenoid connected with said valve for moving the latter to connect the source of motive fluid with the pump; a normally open switch connected with the solenoid; and a feeler engaged with the pile and operable through removal of sheets therefrom for closing said switch and energizing the solenoid to effect movement of the valve and thereby connect the source of motive fluid with the pump; and a check valve between the plunger pump and source of fluid supply in said receptacle.

10. In hydraulic mechanism for intermittently imparting upward movement to a pile of sheets including a cylinder, of means for supplying and controlling the delivery of fluid into said cylinder and comprising: a receptacle adapted to contain a supply of fluid; a cover for said receptacle; a housing carried by said cover and wholly submerged in the fluid in the receptacle; a plunger pump in the housing for supplying fluid from said fluid supply through said housing and into the cylinder; driven means on the cover for continuously reciprocating said plunger pump; a valve in the housing and movable in opposite directions to control the delivery of fluid into the cylinder by the pump; and pile controlled means on the cover controlling the operation of said valve.

11. A pump and valve assembly for supplying and controlling the delivery of fluid to a cylinder having hydraulically actuated means therein for intermittently imparting upward movement to a pile of sheets and comprising: a receptacle adapted to contain a supply of fluid; a housing in said receptacle and wholly submerged in the fluid therein, said housing having a fluid inlet port and a fluid outlet port; a plunger pump in the housing and continuously reciprocated to draw fluid from said fluid supply into said housing through the inlet port and force said fluid therefrom through the outlet port into the cylinder; a pile controlled valve arranged in the housing between the plunger pump and the fluid inlet port and reciprocal to connect the latter with and disconnect the same from said pump, whereby delivery of fluid into the cylinder by the pump is controlled, and a check valve between the plunger pump and the fluid supply within the receptacle.

12. A pump and valve assembly for supplying and controlling the delivery of fluid to a cylinder having hydraulically actuated means therein for intermittently imparting upward movement to a pile of sheets and comprising: a receptacle adapted to contain a supply of fluid; a housing in

said receptacle and wholly submerged in the fluid therein, said housing having a fluid inlet port and a fluid outlet port; a plunger in the housing and continuously reciprocated to draw fluid from said fluid supply into said housing through the inlet port and force said fluid therefrom through the outlet port into the cylinder; a pile controlled valve arranged in the housing between the plunger pump and the fluid inlet port and reciprocal to connect the latter with and disconnect the same from said pump, whereby delivery of fluid into the cylinder by the pump is controlled; and check valves arranged in the housing between the pile controlled valve and the plunger pump and between the latter and the fluid outlet port for preventing return flow of fluid from said housing and the cylinder, respectively.

13. A pump and valve assembly for supplying and controlling the delivery of fluid to a cylinder having hydraulically actuated means therein for intermittently imparting upward movement to a pile of sheets and comprising: a receptacle adapted to contain a supply of fluid; a housing in said receptacle and wholly submerged in the fluid therein, said housing having a fluid inlet port and a fluid outlet port; a plunger pump in the housing and continuously reciprocated to draw fluid from said fluid supply into said housing through the inlet port and force said fluid therefrom through the outlet port into the cylinder; a pile controlled valve arranged in the housing between the plunger pump and the fluid inlet port and reciprocal to connect the latter with and disconnect the same from said pump, whereby delivery of fluid into the cylinder by the pump is controlled; check valves arranged in the housing between the pile controlled valve and the plunger pump and between the latter and the fluid outlet port for preventing return flow of fluid from said housing and the cylinder respectively; and a pressure relief valve arranged in the housing between the plunger pump and the fluid outlet port and adapted to automatically open when the fluid pressure exceeds a predetermined amount.

14. A pump and valve assembly for supplying and controlling the delivery of fluid to a cylinder having hydraulically actuated means therein for intermittently imparting upward movement to a pile of sheets and comprising: a receptacle adapted to contain a supply of fluid; a continuously reciprocating plunger pump in said receptacle and submerged in the fluid therein for supplying said fluid into the cylinder; a pile controlled piston valve in the receptacle and submerged in the fluid therein for controlling the delivery of said fluid into the cylinder by said pump; and a fluid chamber below the valve to delay the movement thereof in one direction.

15. A pump and valve assembly for supplying and controlling the delivery of fluid to a cylinder having hydraulically actuated means therein for intermittently imparting upward movement to a pile of sheets and comprising: a receptacle adapted to contain a supply of fluid; a housing in said

receptacle and wholly submerged in the fluid therein, said housing having a fluid inlet port and a fluid outlet port; a plunger pump in the housing and continuously reciprocated to draw fluid from said fluid supply into said housing through the inlet port and force said fluid therefrom through the outlet port into the cylinder; a pile controlled piston valve arranged in the housing between the plunger pump and the fluid inlet port and operated in one direction to connect said fluid inlet port with said pump and operated in the opposite direction to disconnect the fluid inlet port from the pump; and fluid means arranged in the housing and below said valve to delay the movement thereof in said opposite direction.

16. In mechanism for hydraulically imparting intermittent upward movement to a pile of sheets; the combination of a hydraulic cylinder and piston means; a continuously operating fluid pump means connected therewith; a source of motive fluid; valve means interposed between said pump means and said source of motive fluid and movable to connect the latter with and disconnect the same from the pump means; pile engaged means controlling the operation of said valve means; and means to continue a connection between the pump and the source of motive fluid for a short period after the pile engaging means has operated.

17. In mechanism for hydraulically imparting intermittent upward movement to a pile of sheets; the combination of an hydraulic cylinder and piston means; a continuously operating fluid pump means; a source of motive fluid; valve means interposed between said pump means and said source of motive fluid and movable to connect the latter with and disconnect the same from the pump means; pile engaged means controlling the operation of said valve means; and means to retain the valve means in open position for a short period after the pile engaging means has operated to close the valve means.

LEO C. WILLIAMS.

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