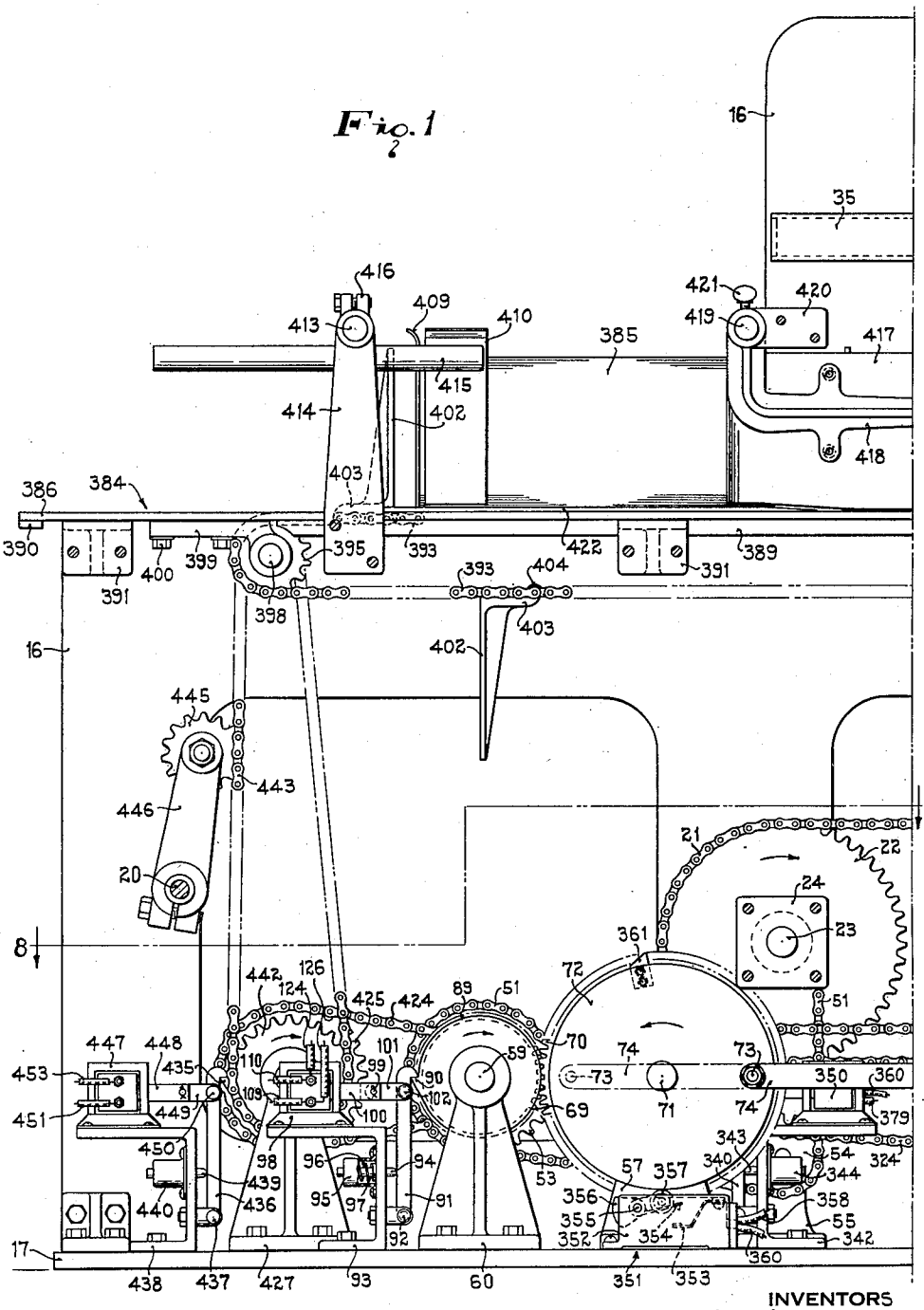
Oct. 6, 1953 L. C. WILLIAMS ET AL 2,654,603

PILE ELEVATOR

Filed Oct. 12, 1946 7 Sheets-Sheet 1

Fig. 1



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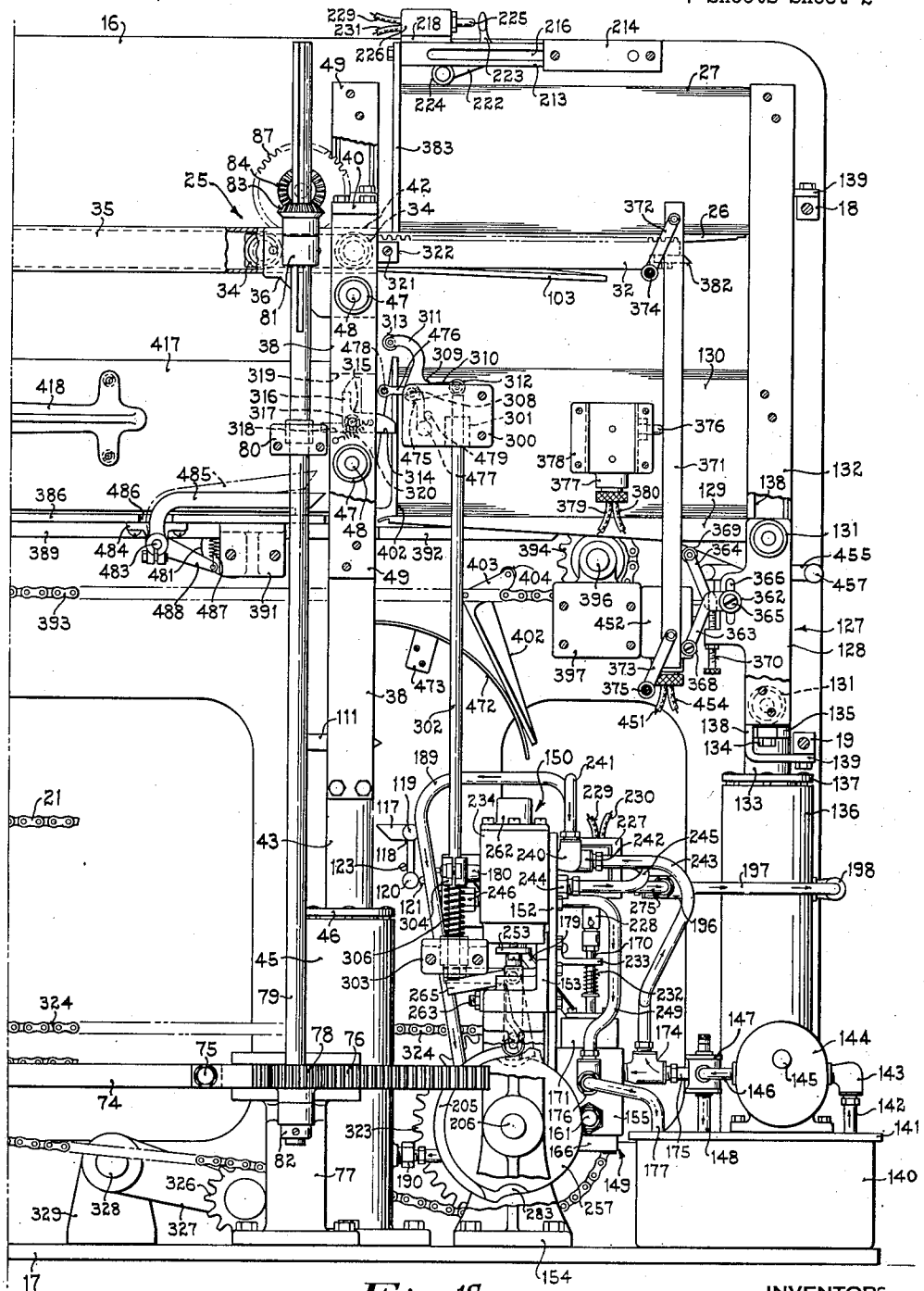


Fig. 1a

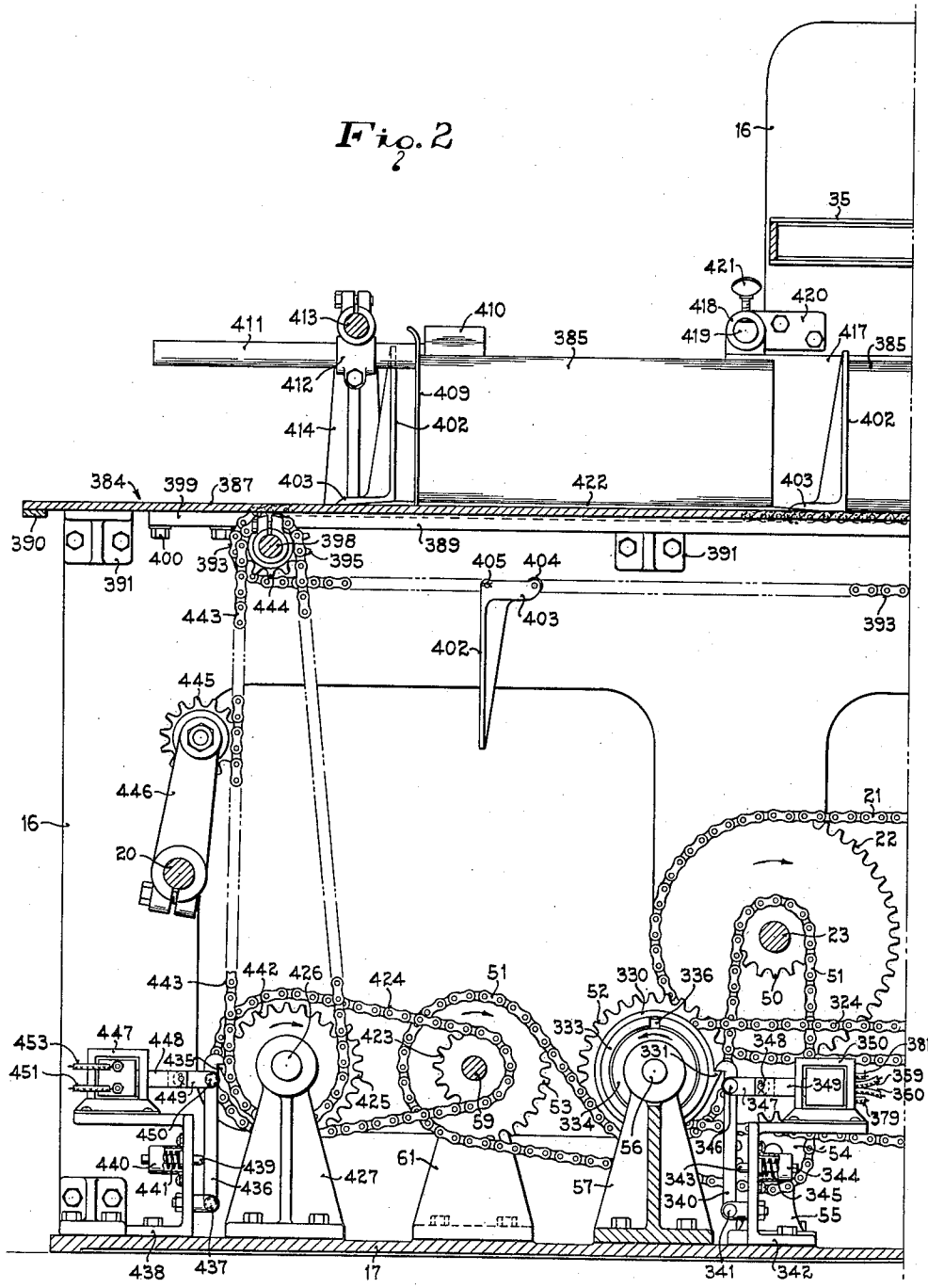
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PILE ELEVATOR

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Fig. 2



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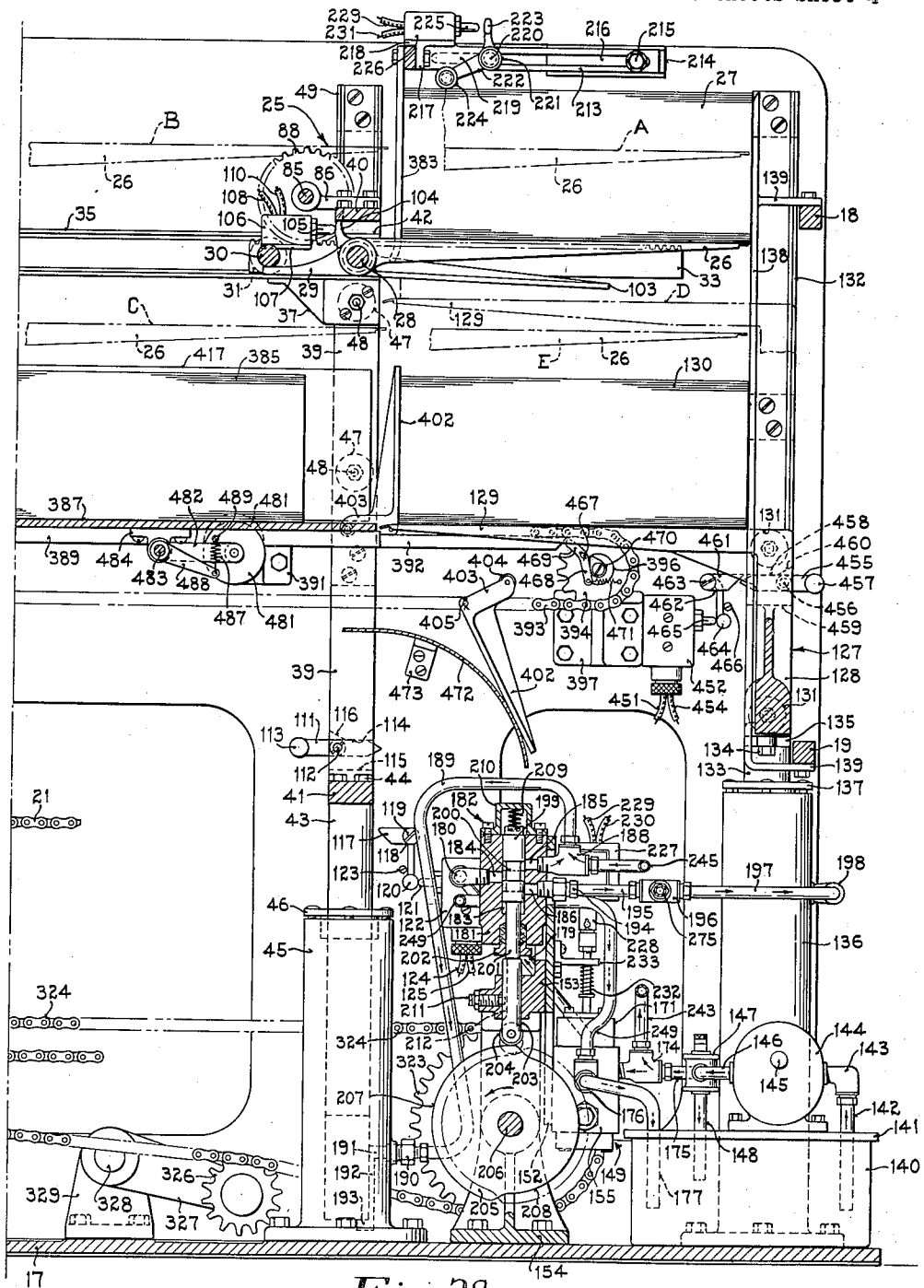


Fig. 2a

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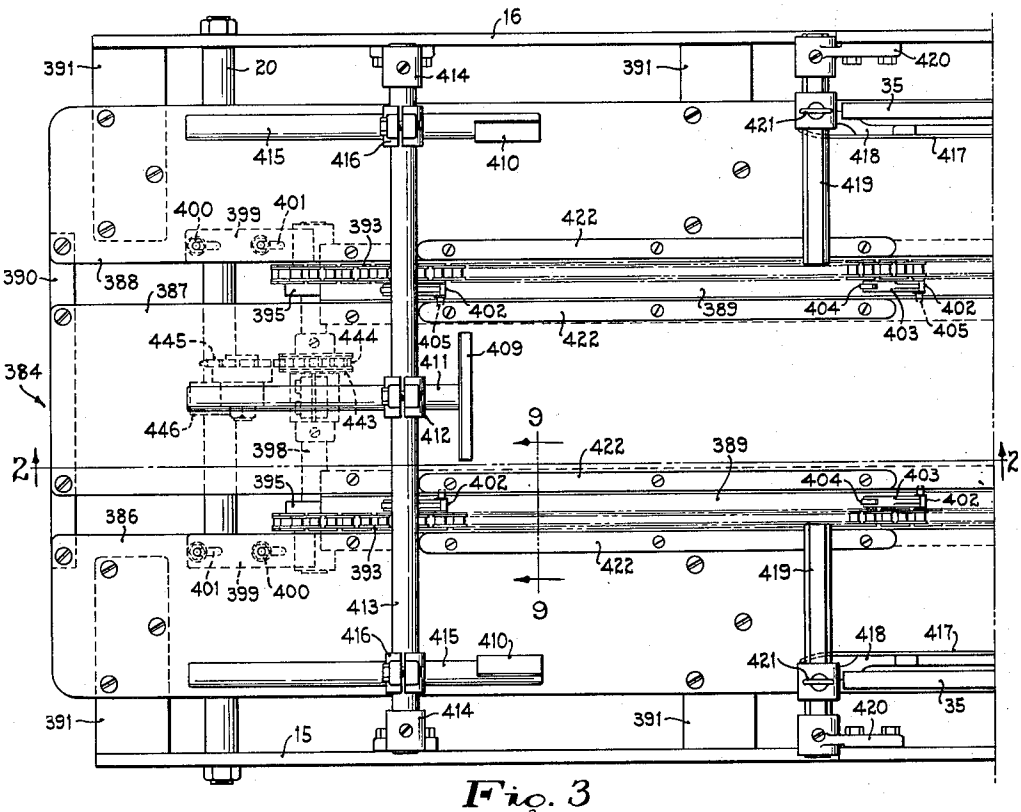


Fig. 3

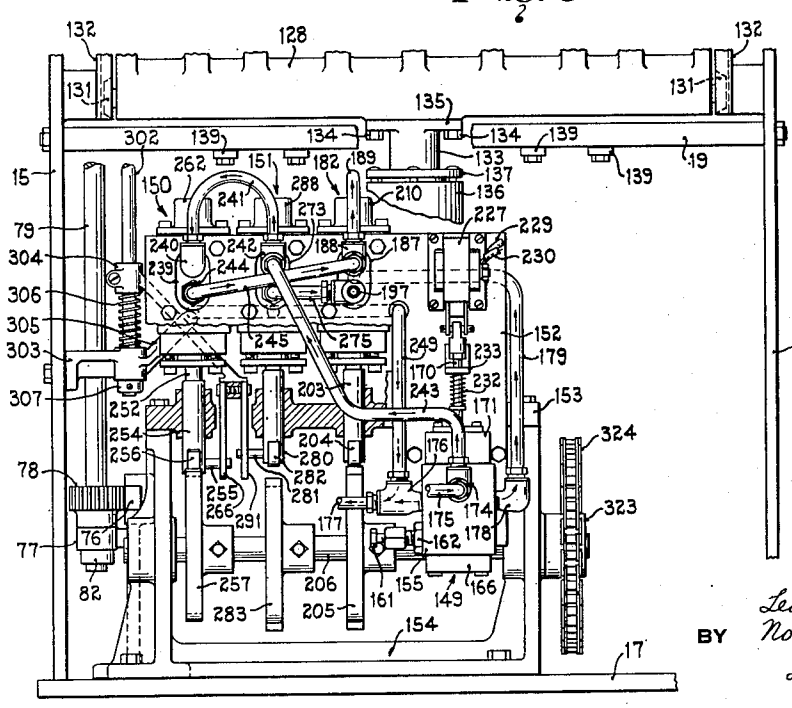


Fig. 4

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PILE ELEVATOR

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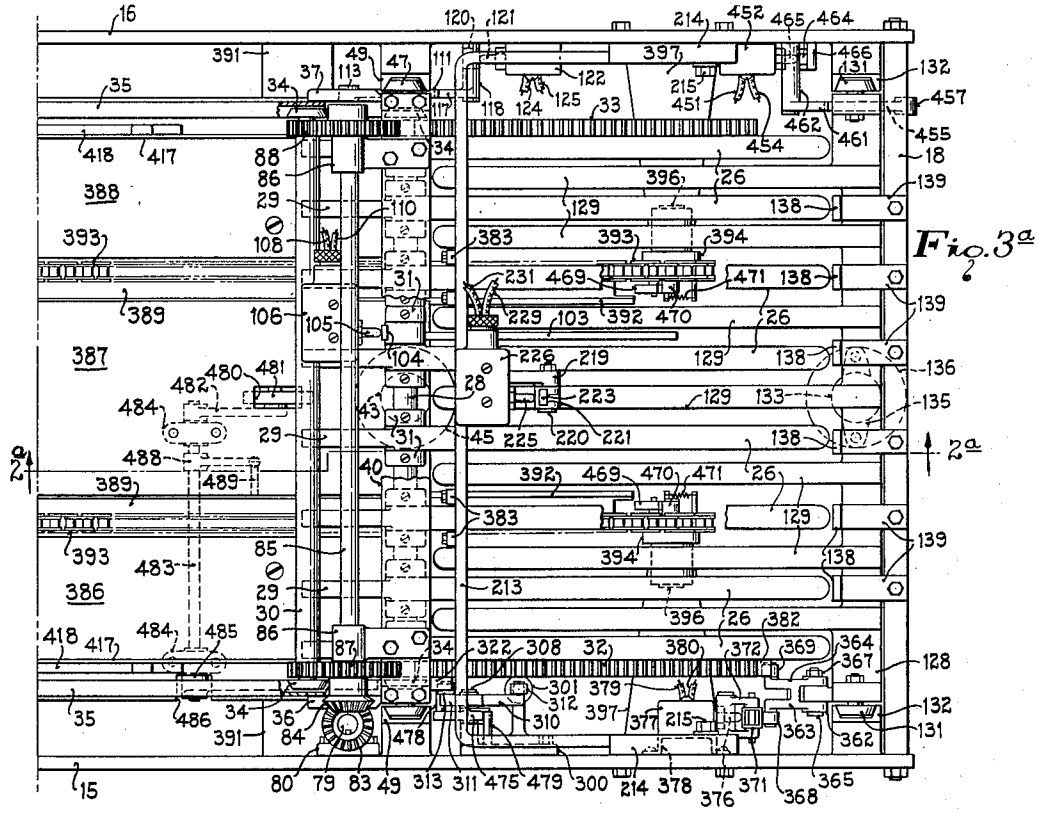


Fig. 3a

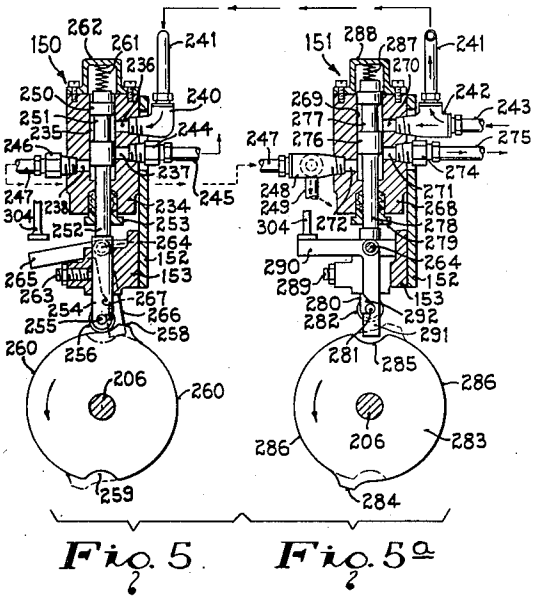


Fig. 5 Fig. 5a

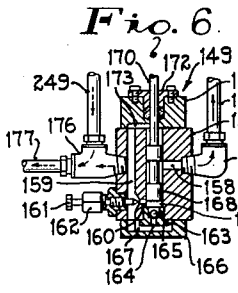


Fig. 6

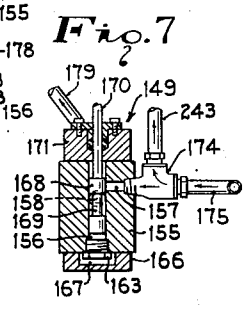


Fig. 7

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PILE ELEVATOR

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Fig. 8

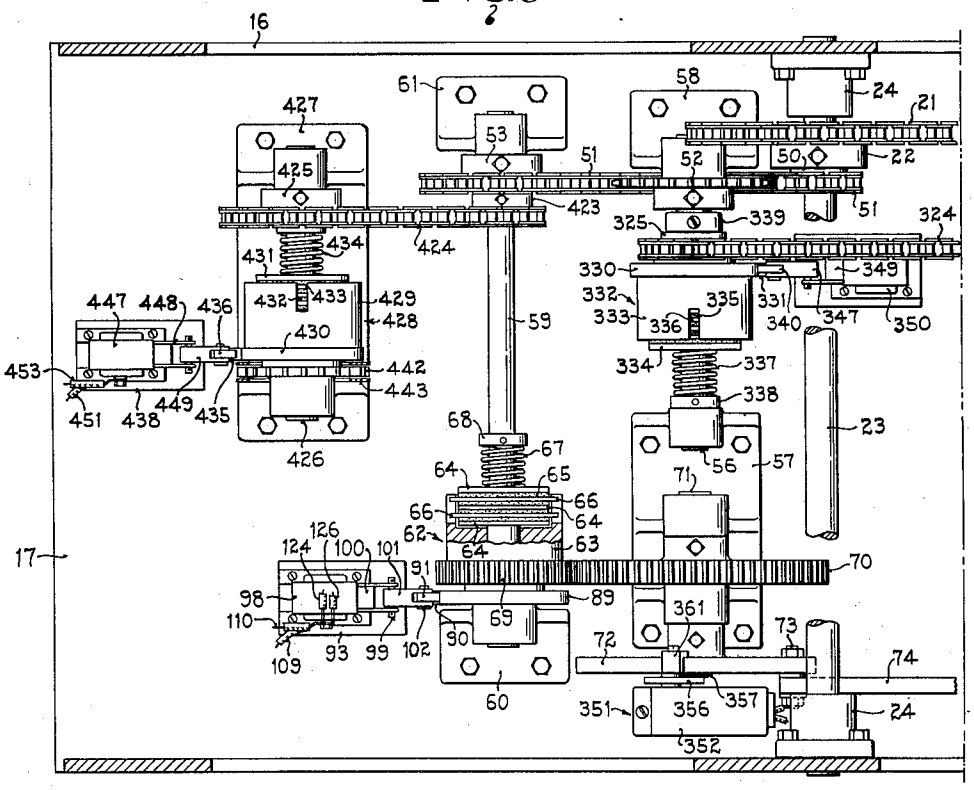
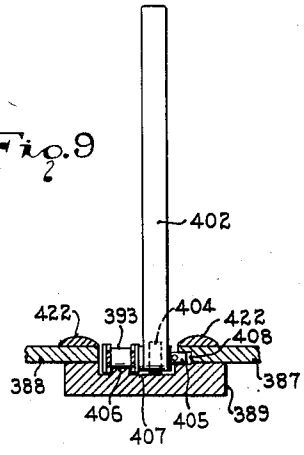


Fig. 9



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2,654,603

UNITED STATES PATENT OFFICE

2,654,603

PILE ELEVATOR

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Application October 12, 1946, Serial No. 703,006

28 Claims. (Cl. 271—62)

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This invention relates generally to sheet feeding apparatus and more particularly to sheet feeders of the type wherein the sheets are fed one after another from the top of an elevated pile thereof.

One of the objects of the present invention is to provide a novel method of maintaining a continuous supply of sheets in a sheet feeder of the pile elevator type to enable the latter to feed sheets at high speed continuously in succession to the machine being fed without interruption for reloading purposes.

Another object of the invention is to provide in a sheet feeder of the pile type a novel method of replenishing a pile of sheets thereon vertically from below while the sheets are being fed one after another at high speed from the top of the pile.

Another object is to provide in a sheet feeder of the pile type novel apparatus for automatically maintaining a continuous supply of sheets thereon.

Another object is to provide novel cooperating automatically controlled main and auxiliary pile elevators for maintaining a continuous supply of sheets on a sheet feeder.

A further object is to provide in a sheet feeder main and auxiliary pile elevators of novel construction, arrangement and operation for maintaining a continuous pile of sheets on said feeder so that sheets can be fed continuously in succession from the top of the pile without having to stop the feeder to reload it.

A still further object is to provide novel cooperating main and auxiliary pile elevators which are dependent on each other in the operations thereof to maintain a continuous supply of sheets on a sheet feeder.

Another object is to provide in a sheet feeder novel cooperating hydraulically operated main and auxiliary pile elevators for maintaining a continuous supply of sheets thereon.

Another object is to provide novel hydraulically operated main and auxiliary pile elevators which are electrically controlled and dependent upon each other in the operations thereof to maintain a continuous supply of sheets on a sheet feeder.

Still another object is to maintain a continuous supply of sheets on a sheet feeder through the provision of novel cooperating main and auxiliary pile elevators and pile loading means.

A still further object is to maintain a continuous supply of sheets on a sheet feeder through the provision of novel cooperating main and auxiliary pile elevators which are dependent upon each other in the operations thereof, in combination with a novel pile loading conveyor which is associated with the auxiliary pile elevator and dependent upon the latter in its operation, thus requiring no attention on the part of the operator and relieving the latter for performance of other duties.

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The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended to define the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Figs. 1 and 1*a* are complementary side elevations of a sheet feeder embodying the present invention, with the near side frame of said feeder removed and portions of certain parts broken away for purposes of clearer illustration;

Figs. 2 and 2*a* are complementary vertical longitudinal sectional views of said feeder, said views being taken substantially on the lines 2—2 and 2*a*—2*a* of Figs. 3 and 3*a*, respectively;

Figs. 3 and 3*a* are complementary top plan views of the feeder, with the piles of sheets omitted and portions of the main pile elevator broken away for purposes of clearer illustration;

Fig. 4 is a fragmentary end view, partly in section and looking from the right of Figs. 1*a* and 2*a*, showing the complete control valve assembly for the hydraulically operated main and auxiliary pile elevators;

Figs. 5 and 5*a* are vertical longitudinal central sections of certain of the valve units shown in Fig. 4 for controlling the rapid raising and lowering movements of the main and auxiliary pile elevators, respectively, the valves proper of said units being shown in the positions they occupy when the main and auxiliary pile elevators are in the full line positions shown in Figs. 1*a* and 2*a*, and said views being combined for purposes of clearer illustration;

Figs. 6 and 7 are vertical longitudinal and transverse central sections, respectively, of the pile controlled valve unit shown in Fig. 4 for controlling the intermittent or step by step elevation of the main and auxiliary pile elevators, the valve proper of said unit being shown in the po-

sition it occupies when the top of the pile from which the sheets are fed is at the proper feeding level as shown in Figs. 1*a* and 2*a*;

Fig. 8 is a horizontal section on the line 8—8 of Fig. 1; and

Fig. 9 is a fragmentary vertical transverse section on the line 9—9 of Fig. 3.

Referring to the drawings, the present invention is shown as embodied in a sheet feeder having plate-like side frame members 15 and 16 on which are mounted the sheet separating, forwarding and conveying devices (not shown) of the feeder. These devices which may be of any known design form no part of the present invention and it is therefore unnecessary to illustrate and describe the same in detail. Suffice to say that the sheet separating devices act to separate the sheets, which may be sheets of paper, cardboard, tin, or other material, or folded sheets known as signatures, one after another from the top and at the rear of a pile thereof on said feeder, and the sheet forwarding devices act to forward each separated sheet from the front or rear thereof to the sheet conveying devices which, in turn, advance the separated and forwarded sheets in succession to the machine to be fed. The side frame members 15, 16 are bolted or otherwise suitably secured to a base plate 17, and are connected together at the front thereof by two vertically spaced cross bars 18 and 19 suitably secured thereto, and at the rear thereof by a cross shaft 20 suitably secured thereto (Figs. 2 and 2*a*).

The main drive of the feeder preferably comprises a chain 21 (Figs. 1, 2, and 8) passing around a sprocket 22 and driven from any suitable source of power, such as, the machine to which the sheets are fed, to continuously rotate said sprocket at a predetermined speed in the direction of the arrow indicated in Figs. 1 and 2. Sprocket 22 is fixed on and drives a shaft 23 which extends transversely of the feeder and is journalled at opposite ends thereof in suitable bearings in brackets 24 that are bolted to the inner surfaces of the side frame members 15, 16. Shaft 23 is utilized to operate the various parts of the feeder hereinafter described.

In accordance with the present invention the feeder is provided with novel double pile elevators and novel pile loading means which cooperate in a novel manner to maintain a continuous pile of sheets on the feeder and thus enable the latter to feed sheets continuously and at high speed from the top of the pile without having to stop the feeder to reload the same, thereby obtaining a high output of fed sheets. As will appear hereafter, the double elevators which, for the sake of description, may be termed main and auxiliary elevators, and the pile loading means are completely automatic in operation and are dependent upon each other in the operations thereof to continuously maintain an adequate pile of sheets on the feeder by automatically adding new loads or piles of sheets at intervals under a preceding diminished load or pile to replenish the latter while sheets are being fed from the top thereof. In this manner the replenishment of a preceding diminished pile of sheets with a new pile of sheets within a prescribed time is positively assured to maintain the continuous uninterrupted feed of the sheets, and requires no attention on the part of the operator thus relieving the latter for performance of other duties.

Referring now to Figs. 1*a*, 2*a*, and 3*a*, the novel main pile elevator indicated generally at 25 comprises a plurality of transversely spaced, forwardly extending fingers 26 adapted to receive thereon and support a pile of sheets 27 which may be termed the first pile. It is important to note that the relatively close spacing of the fingers 26 affords a substantially continuous pile supporting surface and, hence, the pile of sheets can rest directly on and will be properly supported by said fingers, and no pile board or other platform is required between the same and said pile. Fingers 26 are loosely mounted for upward pivotal movement on a transversely extending shaft 28 for a purpose to appear hereafter, and are formed with portions 29 that extend rearwardly beyond said shaft under and into engagement with a second transversely extending shaft 30. Engagement of the portions 29 of fingers 26 with shaft 30 holds said fingers in horizontal pile supporting position and against downward pivotal movement beyond said position to sustain the pile of sheets thereon. Fingers 26 are held in their respective positions on shaft 28 and against axial relative displacement by two collars 31 disposed on opposite sides of each finger and secured to said shaft.

Shafts 28 and 30 have bolted or otherwise suitably secured to opposite ends thereof horizontally disposed rack bars 32 and 33 which extend forwardly beyond shaft 28 adjacent the endmost pile supporting fingers 26 and for a major portion of the length of the latter (Figs. 1*a*, 2*a*, and 3*a*). Each of the rack bars 32, 33 has journalled thereon coaxially with shafts 28, 30 conical anti-friction rollers 34, 34 which project laterally from said bars into horizontal, rearwardly extending channel track members 35, 35. It will thus appear that the rack bars 32, 33, together with the shafts 28, 30, form a carriage which is supported and guided by the rollers 34 and track members 35 for straight line horizontal movement so that the pile supporting fingers 26 thereon may be moved horizontally out of and into pile supporting position for purposes hereinafter described. When the carriage is moved rearwardly or to the left, as viewed in Fig. 2*a*, by mechanism to be hereinafter described, corresponding movement will be imparted to the pile supporting fingers 26, thus retracting said fingers from normal pile supporting position. When the carriage is thereafter moved forwardly, the pile supporting fingers 26 will be advanced from retracted position and returned to pile supporting position.

As shown in Figs. 1*a*, 2*a*, and 3*a*, the track members 35, 35 are bolted adjacent their forward ends to brackets 36 and 37 which, in turn, are bolted to the vertical side bars 38 and 39, respectively, of an upright, transversely extending, rectangular frame including upper and lower cross bars 40 and 41, respectively, said side bars and cross bars being bolted or otherwise suitably secured together at their ends to form said frame. The track members 35, 35 extend to the front surfaces of the side bars 38, 39, and are fitted into grooves 42 (Figs. 1*a* and 2*a*) milled in the inner surfaces of said bars to further rigidly support said track members.

The main pile elevator 25 comprising the upright frame, the track members 35, 35, the carriage, and the pile supporting fingers 26, is supported by the upper projecting end of a hydraulically operated piston 43 (Figs. 1*a* and 2*a*), and is secured to the latter in a suitable manner, as by bolts 44 which pass through suitable openings

in the lower cross bar 41 of said frame and are threaded into said piston. The piston 43 extends into a vertically disposed hydraulic cylinder 45 which is located centrally between the side frame members 15, 16 and is bolted to the base plate 17. Cylinder 45 is provided with a suitable packing gland 46 which is adjustably secured to the upper end thereof. It will thus appear that when the piston 43 is raised, as hereinafter described, corresponding upward movement will be imparted to the main pile elevator 25, and when said piston is lowered, said elevator will likewise be lowered.

The main pile elevator 25 is guided for straight line vertical movement by vertically spaced, conical anti-friction rollers 47, 47 which are journalled at 48, 48 on each of the side bars 38, 39 of the upright rectangular frame and project laterally therefrom into vertically extending channel track members 49, 49 that are bolted or otherwise suitably secured to the adjacent side frame members 15, 16 of the feeder. It will be apparent that with the construction hereinbefore described, the pile supporting fingers 26 are not only raised and lowered, but are also capable of straight line horizontal retracting and advancing movements.

In accordance with another aspect of the present invention, the pile supporting fingers 26 are automatically retracted from and advanced into pile supporting position, the retracting movement of said fingers occurring at one level in the upward movement of the main elevator 25 and the pile of sheets thereon, and the advancing movement of said fingers occurring at another level in the downward movement of said elevator with said fingers in retracted position. As herein shown, this automatic operation of the pile supporting fingers 26 is accomplished by mechanism preferably constructed, mounted, operated, and controlled as follows.

Secured to or formed integrally with the driven sprocket 22 on the feeder drive shaft 23 is a small sprocket 50 (Figs. 2 and 8) around which passes a chain 51 that extends downwardly therefrom, then rearwardly under a sprocket 52 to rotate the latter continuously in the direction of the arrow (Fig. 2) for a purpose hereinafter described, and then around a sprocket 53 to rotate the latter continuously in the direction of the arrow (Fig. 2). One reach of chain 51 also passes around an idler chain tightening sprocket 54 which is rotatably mounted on and adjustably secured to a bracket 55 bolted to the base plate 17. Sprockets 52 and 53 are of the same size but larger than the sprocket 50 for speed reduction purposes. Sprocket 52 is fixed on a transversely extending short shaft 56 which is journalled at opposite ends thereof in suitable bearings provided by brackets 57 and 58 bolted to the base plate 17. Sprocket 53 is fixed on a transversely extending shaft 59 which is journalled at opposite ends thereof in suitable bearings provided by brackets 60 and 61 bolted to the base plate 17 (Fig. 8).

Mounted on shaft 59 adjacent bracket 60 is a friction slip-clutch 62 (Fig. 8) of a well-known design and comprising a cup-shaped member 63 that is loosely mounted on said shaft. Disposed within clutch member 63 and suitably connected with shaft 59 for rotation thereby and axial movement relative thereto is a series of metal disks 64 which, through the medium of axially movable leather disks 65, frictionally drive similar axially movable metal disks 66 that are suitably connected with said clutch member. The leather disks 65 are disposed between the metal disks 64 and 66, and all said disks are retained in frictional driving contact with each other by a coil compression spring 67 surrounding shaft 59 and having one end engaging a collar 68 on said shaft, and the opposite end engaging the outermost driving disk 64. Secured to or formed integrally with clutch member 63 is a spur pinion 69 which meshes with a spur gear 70 to rotate the latter in the direction of the arrow indicated in Fig. 1. For a purpose to be presently described, the pinion 69 and gear 70 are so proportioned to have a ratio of 2:1, i. e. one revolution of gear 70 to two revolutions of pinion 69, or one-half of a revolution of gear 70 to one revolution of pinion 69.

Gear 70 is fixed on a short transversely extending shaft 71 (Figs. 1 and 8) which is journalled in suitable bearings provided on the bracket 57 and projects beyond the latter toward the feeder side frame 15. Fixed on the projecting end of shaft 71 is a crank disk 72, the crank pin 73 of which is pivotally connected with one end of a link 74. The opposite end of link 74 is pivotally connected at 75 (Fig. 1a) with one end of a rack bar 76 that is supported and guided for straight line horizontal reciprocating movement in a bracket 77 bolted to the base plate 17 (Figs. 1a and 4). Meshing with the rack bar 76 is a spur pinion 78 secured to the lower end of a vertical shaft 79 which is located adjacent the feeder side frame member 15 and is journalled in suitable bearings provided on the bracket 77 and by a bracket 80 that is bolted to said frame member and projects inwardly therefrom to receive said shaft. Shaft 79 extends upwardly through and beyond a bearing 81 that is formed on and projects laterally from the bracket 36 which supports one of the track members 35 of the main elevator 25. Axial movement of shaft 79 is prevented in one direction by the pinion 78 and in the opposite direction by a collar 82 which is secured to said shaft and engages the underside of the bearing therefor on bracket 77.

Disposed above the bearing 81 on bracket 36 and keyed to shaft 79 for sliding movement therealong is a bevel gear 83 (Figs. 1a and 3a) which meshes with a similar gear 84. This gear 84 is fixed on one end of a transversely extending shaft 85 which is journalled in suitable bearings provided by brackets 86, 86 that are bolted to the upper cross bar 40 of the upright rectangular frame of main elevator 25 (Figs. 2a and 3a). Secured to and rotated by shaft 85 are two spur gears 87 and 88 which mesh with the rack bars 32 and 33, respectively, of the main elevator carriage carrying the pile supporting fingers 26. It will be noted that the bevel gears 83, 84, shaft 85, and spur gears 87, 88, due to the described mounting therefor, are capable of vertical movement along with the main elevator 25. When the rack bar 76 is moved toward the left, as viewed in Fig. 1a, through rotation of the crank disk 72 one-half of a revolution in the direction of the arrow (Fig. 1) by the described connections therefor with the continuously rotating shaft 59, the rack bars 32, 33 will be moved rapidly toward the left (Fig. 1a) through clockwise rotation of spur gears 87, 88 by the spur pinion 78, shaft 79 and bevel gears 83, 84, resulting in like rapid movement of the pile supporting fingers 26 toward the left (Fig. 1a) and complete withdrawal of said fingers from pile sup-

porting position. When the rack bar 76 is thereafter moved toward the right, the pile supporting fingers 26 will be rapidly advanced from retracted position and completely returned to pile supporting position through counterclockwise rotation of gears 87, 88 by the described connections therefor with said rack bar.

With the construction thus far described, it is apparent that crank disk 72 will be continuously rotated and, hence, the pile supporting fingers 26 will be moved continuously out of and into pile supporting position upon each complete revolution of said crank disk. Mechanism is, therefore, provided to normally hold the crank disk 72 against rotation with the pile supporting fingers 26 normally disposed in pile supporting position, and to release the crank disk for rotation one-half of a revolution only at different intervals, whereby said fingers will be retracted from pile supporting position at one level in the upward movement of elevator 25, and advanced into pile supporting position at another level in the downward movement of said elevator. As herein shown, said mechanism is preferably constructed, mounted, and operated as follows:

Secured to pinion 69 is a disk 89 (Figs. 1 and 8) which is formed on its periphery with a single tooth 90 that is normally engaged by the upper hooked end of a vertical latch 91. The latter is pivotally mounted at 92 on a bracket 93 bolted to the base plate 17. Latch 91 is biased towards disk 89 by a spring-pressed plunger 94 disposed within a container 95 secured to bracket 93. Plunger 94 projects from container 95 through a suitable opening in bracket 93 into engagement with latch 91. The spring for plunger 94 is indicated at 96 and surrounds said plunger between a flange 97 thereon and container 95.

It will thus appear that engagement of the latch 91 with the tooth 90 on disk 89 normally holds pinion 69, gear 70 and crank disk 72 against rotation by shaft 59, at which time the crank pin 73 on crank disk 72 is disposed in its extreme forward position as shown in full lines in Fig. 1, and the pile supporting fingers 26 are disposed in normal pile supporting position, as shown in Fig. 1*a*. This holding of pinion 69 against rotation will not, however, affect the operation of shafts 23, 56, and 59 due to the slip clutch connection 62 between the latter shaft and said pinion. When latch 91 is disengaged from tooth 90, as hereinafter described, the pinion 69 will be released for rotation by shaft 59 one revolution only, whereupon crank disk 72 will be rotated in the direction of the arrow (Fig. 1) one-half of a revolution to move the crank pin 73 from its full-line forward position, to its broken-line rearward position, shown in Fig. 1, and thereby effect complete retraction of fingers 26 from pile supporting position, at which time said crank disk is again stopped through engagement of latch 91 with the tooth 90 on disk 89. Fingers 26 will then be held in retracted position until latch 91 is again actuated, whereupon crank disk 72 will be further rotated in the same direction one-half of a revolution only to move crank pin 73 from its broken-line rearward position to its full-line forward position and thereby return said fingers into pile supporting position.

The first operation of latch 91 to cause retraction of the pile supporting fingers 26 from pile supporting position, as hereinbefore described, is effected automatically under the control of the pile of sheets on the second or auxiliary elevator to be hereinafter described, and while various ways and means may be employed for this purpose, said operation, as herein shown, is preferably effected electrically and by means comprising a solenoid 98 which is bolted to bracket 93 (Figs. 1 and 8). Pivotally connected at 99 with the movable core 100 of solenoid 98 is one end of a link 101 the opposite end of which is pivotally connected at 102 with latch 91. When solenoid 98 is energized, as hereinafter described, core 100 will be drawn rearwardly or toward the left (Fig. 1) and, hence, latch 91 through the described connections therefor with said core will be swung about its pivot 92 out of engagement with the tooth 90 on disk 89, whereupon the latter and pinion 69 will be released for rotation by shaft 59, as and for the purposes hereinbefore described. When solenoid 98 is deenergized, core 100 and latch 91 will be returned to their original positions by the spring-pressed plunger 94 so that said latch will be disposed in the path of rotation of the tooth 90 on disk 89 to again engage said tooth and stop said disk and the pinion 69 after one complete revolution thereof.

Pivotally mounted on shaft 28 of main elevator 25 is a control member in the form of an elongated arm 103 (Figs. 2*a* and 3*a*) which extends forwardly from said shaft in the space between two of the pile supporting fingers 26, and downwardly at an angle so that the forward free end thereof will normally be disposed beneath and in spaced relation with said fingers for engagement by the top of the pile of sheets on the second or auxiliary elevator upon upward movement thereof, as hereinafter described. Arm 103 is formed with an upwardly projecting short arm 104 which engages the plunger 105 of a normally open micro-switch 106 that is secured to a plate 107 which, in turn, is secured to shaft 30. Micro-switch 106 is of well-known design and is of the general type disclosed in the United States Patent No. 1,960,020, granted May 22, 1934, to P. R. McGall, therefore needing no detail description herein. Switch 106 and solenoid 98 have connected therewith lead wires 108 and 109, respectively, which are connected with a suitable source of electrical current, and said switch and said solenoid are connected together by a lead wire 110. It will be noted that by virtue of the described mounting of control member 103, 104, and switch 106 on the shafts 28 and 30, respectively, said member and switch will be moved along with the pile supporting fingers 26 when the latter are retracted from and advanced into pile supporting position.

It will thus appear that when the arm 103 of control member 103, 104 is raised by the pile of sheets on the auxiliary elevator, as hereinafter described, the arm 104 will actuate plunger 105, whereupon the contacts of switch 106 will be closed and the electrical circuit to solenoid 98 will be completed through lead wire 110. Solenoid 98 will then be energized to effect disengagement of latch 91 from the tooth 90 on disk 89 and rotation of crank disk 72 one-half of a revolution resulting in retraction of the pile supporting fingers 26 from pile supporting position, and corresponding movement of control arm 103 out of contact with the top of the pile of sheets on the auxiliary elevator. Control arm 103 will then drop by gravity, whereupon the pressure of arm 104 on plunger 105 will be relieved and the contacts of switch 106 will automatically open to break the electrical circuit to solenoid 98. Solenoid 98 will then be de-energized to enable

latch 91 to re-engage the tooth 90 on disk 89 upon one complete revolution thereof and stop rotation of the crank disk 72, as hereinbefore described. The length of time switch 106 is closed varies with the length of the sheets handled in the feeder, but at no time is said switch held closed long enough to permit more than one complete revolution of pinion 69. Downward pivotal movement of control arm 103 is limited through engagement of arm 104 with the upper cross bar 40 of the upright frame of main elevator 25. It is known that micro-switch 106 is so constructed that the plunger 105 thereof may be moved a reasonable amount beyond contact closing position. Hence, this overtravel of plunger 105 provides for additional upward movement of control arm 103 beyond contact closing position without damaging switch 106 or breaking said arm.

The second operation of latch 91 to cause return movement of the pile supporting fingers 26 from retracted position into pile supporting position is also effected automatically but under the control of main elevator 25. For this purpose, main elevator 25 is provided with a second control member in the form of an arm 111 (Figs. 2*a* and 3*a*) which is pivotally mounted intermediate its ends on a stud 112 that is secured in the side bar 39 of the vertically movable rectangular frame adjacent the lower end thereof. Arm 111 projects forwardly beyond the front surface of side bar 39, and is formed at the rear end thereof with a weight 113 to overbalance said arm and normally hold the latter in engagement with the upper shoulder 114 of a wide recess 115 milled in the outer surface of said side bar. Shoulder 114 is bevelled, as indicated at 116, and recess 115 is of a width sufficient to permit pivotal movement of arm 111 in a clockwise direction, as viewed in Fig. 2*a*, relative to side bar 39.

Disposed in the path of vertical movement of control arm 111 with main elevtor 25 is one arm 117 of a bell crank trip lever 118 (Figs. 2*a* and 3*a*) which is pivotally mounted at 119 on the feeder side frame member 16. The other arm 120 of bell crank 118 extends downwardly and has its lower end weighted and normally engaged with the plunger 121 of a normally open micro-switch 122 which is bolted to the side frame member 16. A pin 123 is secured in side frame member 16 and projects inwardly therefrom across the rear of bell-crank arm 120 to limit pivotal movement of bell crank 118 in a clockwise direction, as viewed in Fig. 2*a*, under the weight of said arm so that the free rear end of arm 117 will be located in proper position for engagement by the free forward end of control arm 111. Switch 122 is electrically connected with solenoid 98 by a lead wire 124, and said switch and said solenoid are electrically connected with a suitable source of electrical current by lead wires 125 and 126, respectively.

It will thus appear than when the main elevator 25, with the pile supporting fingers 26 in retracted position, is lowered to its lowermost position determined through engagement of the lower end of piston 43 with the bottom of the well therefor in cylinder 45, the control arm 111 will engage bell-crank arm 117 for a short interval, swing bell crank 118 in a counter-clockwise direction, as viewed in Fig. 2*a*, and then release said bell crank just before piston 43 engages the bottom of cylinder 45. Under these conditions, the plunger 121 will be actuated by bell-crank arm 120 to close the contacts of switch 122, and then released to permit said contacts to open automatically and return said plunger to its original position. When the contacts of switch 122 are closed, the circuit to solenoid 98 will be completed through lead wire 124 and, hence, said solenoid will be energized long enough to effect disengagement of the latch 91 from the tooth 90 on disk 89 and release gear 69 for rotation by shaft 59, and then de-energized through opening of said contacts to permit said latch to return to its original position and re-engage said tooth after one complete revolution of said disk. Thus, as the main elevator 25 approaches its lowermost position and just before piston 43 contacts the bottom of cylinder 45, the crank disk 72 is further rotated one-half of a revolution in the direction of the arrow (Fig. 1) to move the crank pin 73 from its hereinbefore described rearmost broken-line position to its foremost full-line position, shown in Fig. 1, and thereby fully advance the pile supporting fingers 26 from retracted position into pile supporting position, and return control member 103, 104 to operative position, substantially at the lowermost position of the main elevator.

Delivery of fluid under pressure into cylinder 45 to raise piston 43 and the main pile elevator 25 intermittently or rapidly and continuously, and the release of said fluid from said cylinder to rapidly lower said piston and said elevator, is effected and controlled by mechanism which is also utilized to effect and control the same operations with respect to the second or auxiliary pile elevator. Accordingly, the construction and arrangement of the auxiliary pile elevator will first be described so that a clear and complete understanding of the operations of said fluid control mechanism will be obtained.

Referring now to Figs. 1*a*, 2*a*, and 3*a*, the novel auxiliary pile elevator indicated generally at 127 is normally arranged beneath the main pile elevator 25 for cooperation therewith and is in the form of an angle casting comprising a vertical transversely extending bar 128 which is spaced forwardly of the track members 49, 49 for elevator 25 a distance substantially equal to the length of the pile supporting fingers 26, and a plurality of transversely spaced fingers 129 which extend rearwardly from said bar at the top thereof substantially to the track members 49, 49 and are adapted to receive thereon and support a second pile of sheets 130 which may be termed the new pile. The pile supporting fingers 129 of auxiliary elevator 127 are located in vertical alignment with the spaces between the pile supporting fingers 26 of main elevator 25, and, like the fingers 26, the fingers 129 will properly support a pile of sheets thereon without employing the usual pile board or other platform between said pile and said fingers. The ends of the pile supporting fingers 129 are slightly curved downwardly to facilitate loading of the pile of sheets 130 and subsequent new loads or piles of sheets thereon, as hereinafter described.

The auxiliary elevator 127 is guided for straight line vertical movement by vertically spaced, conical anti-friction rollers 131, 131 (Figs. 1*a*, 2*a*, and 3*a*) which are journalled on the elevator bar 128 at opposite ends thereof and project laterally from said bar into vertically extending channel track members 132, 132 that are bolted or otherwise suitably secured to the side frame members 15, 16 of the feeder.

Auxiliary elevator 127 is supported by the up-

per projecting end of a hydraulically operated piston 133, and is secured to the latter in a suitable manner, as by bolts 134 which pass through suitable openings in a flange 135 and are threaded into the elevator bar 128, said flange being secured to or formed integrally with said piston. The piston 133 extends into a vertically disposed hydraulic cylinder 136 which is centrally located between the feeder side frame members 15, 16 and is bolted to the base plate 17. Cylinder 136 is provided with a suitable packing gland 137 which is adjustably secured to the upper end thereof. It will thus appear that when piston 133 is raised, as hereinafter described, corresponding upward movement will be imparted to the auxiliary pile elevator 127 and the new pile of sheets thereon, and when said piston is lowered, said elevator will likewise be lowered.

Located in close proximity to the forward ends of the pile supporting fingers 26 of main elevator 25 and extending downwardly between and beyond the pile supporting fingers 129 of auxiliary elevator 127 is a plurality of vertically extending, transversely spaced pile guides 138 against which the front edges of the sheets of the piles on said elevators bear during elevation of the same, said pile guides also serving to locate the piles of sheets of different lengths capable of being handled in the feeder, in proper forward positions on said pile supporting fingers. The pile guides 138 are bolted at the upper and lower ends thereof to the tie bars 18 and 19 through the medium of horizontal, forwardly extending portions 139, 139.

Delivery of fluid under pressure into the hydraulic cylinders 45 and 136 to raise the respective pistons 43 and 133 and the main and auxiliary elevators 25 and 127, respectively, and the release of said fluid from cylinders to lower said elevators, is effected and controlled in a novel manner by mechanism preferably constructed, mounted, and operated as follows.

Secured in any suitable manner to the base plate 17 at the front thereof is a tank 140 adapted to contain a supply of oil, water, or other suitable motive fluid (Figs. 1*a* and 2*a*). Tank 140 is closed at the top thereof by a cover 141 bolted or otherwise suitably secured thereto. Extending into tank 140 through cover 141 is one end of a conduit 142 the opposite end of which is connected, as by a fitting 143, with the inlet side of a rotary fluid pump 144 that is bolted to cover 141. Pump 144 is of the constant displacement, low pressure type and is driven continuously and at constant speed by an electric motor (not shown) which is bolted to cover 141 and is coupled with the shaft 145 of said pump.

Upon rotation of pump 144 fluid is drawn from tank 140 through conduit 142 and fitting 143 and forced out through a conduit 146 having one end connected with the exhaust side of said pump. The opposite end of conduit 146 is connected with the inlet side of a pressure relief valve 147 which is supported by and connected with a bypass conduit 148 that is secured to cover 141 and extends therethrough into tank 140. This pressure relief valve 147 is of well-known design needing no detail description herein, except to say that its purpose is to open and permit the fluid to flow from pump 144 back to tank 140 through conduit 148 when the fluid pressure, for any reason, exceeds a predetermined amount, thus preventing damage to the hydraulic system.

Under normal operating conditions, the fluid drawn from tank 140 by pump 144 flows through relief valve 147 and is directed, in a manner to be hereinafter described, to a pile controlled valve unit indicated generally at 149, and to two other valve units indicated generally at 150 and 151 (Figs. 1*a*, and 4 to 7). The pile controlled valve unit 149 is utilized to control the intermittent or step by step elevation of the main and auxiliary pile elevators 25 and 127, respectively, and the valve units 150 and 151 are utilized to control the rapid and continuous raising and lowering movements of the main pile elevator 25 and of the auxiliary pile elevator 127, respectively. The valve units 149, 150, and 151 are supported by a vertically disposed plate 152 which is bolted to a bracket 153 and projects upwardly and downwardly from said bracket. This bracket 153 is bolted to and extends across the top of a transversely extending U-shaped bracket 154 which is located at the front and to one side of the feeder between the hydraulic cylinders 45 and 136, and is bolted to the base plate 17.

As shown in Figs. 1*a*, 2*a*, 4, 6, and 7, the pile controlled valve unit 149 comprises a body 155 which is bolted to the front surface of plate 152 at one side and adjacent the lower end thereof. Body 155 is provided centrally thereof with a cylindrical bore 156 (Figs. 6 and 7) which extends vertically therethrough and is in communication with two axially spaced ports or passages 157 and 158 that are formed in said body and open outwardly through the front and one side, respectively, thereof. Body 155 is further provided with an axially extending passage 159 which opens outwardly through the upper and lower ends thereof and communicates with the lower end of the bore 156 therein through a restricted port 160. Associated with the restricted port 160 is an adjustable needle valve 161 for a purpose to be hereinafter described. Valve 161 is threaded in an adapter 162 secured in a suitable manner to body 155, and projects through the wall of said body, through the passage 159, and into cooperation with the adjacent end of the restricted port 160.

The lower end of bore 156 in body 155 is closed by a plug 163 (Figs. 6 and 7) which is threaded into said body and is provided with a central open ended port 164 communicating with said bore. Port 164 is normally closed by an upwardly opening check valve in the form of a ball 165 loosely retained by plug 163. Bolted to the lower end of body 155 is a cap 166 provided with an annular well 167 which is in communication with the passage 159 in said body and with the port 164 in plug 163. Well 167 is normally filled with fluid and is maintained full of fluid in a manner to be hereinafter described.

Slidably mounted in the bore 156 of body 155 is a valve 168 (Figs. 6 and 7) which is formed with a reduced portion 169 for establishing communication at certain intervals between the ports 157 and 158 in said body. Valve 168 has secured thereto or formed integrally therewith a stem 170 which projects upwardly beyond the body 155 through a guide cap 171 that is bolted to the upper end of said body and is provided with a suitable packing gland 172 bolted thereto and surrounding said stem. Cap 171 is further provided with a passage 173 which connects the upper end of the bore 156 with the upper end of the passage 159 in body 155 to provide a drain for any leakage of fluid around the valve 168 which will be directed by passage 159 into the well 167 in cap 166 and thereby serve to maintain a sufficient supply of fluid in said well.

Threaded into body 155 and communicating with the port 157 therein is a T-fitting 174 (Figs. 1a, 2a, 4, and 7) having connected therewith one end of a conduit 175 the opposite end of which is connected with the pressure relief valve 147 to direct the fluid under pressure drawn from tank 140 by pump 144 to said body. Threaded into body 155 and communicating with the passage 159 therein is a T-fitting 176 (Figs. 1a, 2a, 4, and 6) having connected therewith one end of a conduit 177 the opposite end of which extends through the cover 141 of tank 140 and into the latter to return the excess fluid leaking from around the valve 168 and in said passage to said tank. Connected with body 155, as by a fitting 178 (Figs. 4 and 6), and communicating with the port 158 therein is one end of a conduit 179 which extends upwardly along one end of plate 152 and then laterally across the rear surface of said plate. The opposite end of this conduit 179 is connected, as by a fitting 180 (Fig. 2a), with the body 181 of a directional fluid control valve unit indicated generally at 182 (Figs. 2a and 4) which is bolted to the rear surface of plate 152 adjacent the upper end thereof. This valve unit 182 is common to both the main pile elevator 25 and the auxiliary pile elevator 127, and is utilized to automatically control the delivery of fluid under pressure from the pile controlled valve unit 149 to the hydraulic cylinder 45 to effect raising of elevator 25, or to the hydraulic cylinder 136 to effect raising of elevator 127.

As shown in Fig. 2a, the body 181 of valve unit 182 is provided centrally thereof with a vertically extending cylindrical bore 183 which is in communication with the conduit 179 through a port 184 formed in said body. Bore 183 also communicates with two axially spaced ports 185 and 186 that are formed in body 181 and open outwardly through the front side thereof, the port 185 being located at a level above the port 184 and the port 186 being located at a level below the port 184. Threaded into body 181 through a suitable elongated opening 187 in plate 152 (Fig. 4) and communicating with the port 185 in said body is a T-fitting 188. Connected with fitting 188 is one end of a conduit 189 the opposite end of which is connected, as by a fitting 190, with the hydraulic cylinder 45 and communicates with the lower end of the piston well in said cylinder through a port 191 and an axially extending passage 192 communicating with said port and terminating in a passage 193 opening upwardly through the lower wall of said well. Threaded into body 181 through the opening 187 in plate 152 and communicating with the port 186 in said body is a fitting 194 having connected therewith one end of a conduit 195 the opposite end of which is connected with a T-fitting 196. Connected with fitting 196 is one end of a conduit 197 the opposite end of which is connected, as by a fitting 198, with the hydraulic cylinder 136 and communicates with the lower end of the piston well in said cylinder by a port and passages (not shown) similar to the port 191 and passages 192, 193 in cylinder 45.

Slidably mounted in the bore 183 of body 181 is a valve 199 (Fig. 2a) which is formed with a reduced portion 200 and with a stem 201 that projects downwardly through and beyond a suitable packing gland 202 adjustably secured to said body at the lower end thereof. The projecting end of valve stem 201 engages the upper end of a push rod 203 (Figs. 2a and 4) which is fitted for reciprocation in the bracket 153 and projects above and below the latter. Journalled on the lower projecting end of push rod 203 is a cam roller 204 which engages a normally stationary cam 205 that is fixed on a transversely extending shaft 206 journalled at opposite ends thereof in suitable bearings in the vertical arms of the U-shaped bracket 154. Cam 205 is provided with concentric high and low portions 207 and 208, respectively, which are so proportioned that upon rotation of said cam in the direction of the arrow (Fig. 2a) one-half of a revolution the push rod 203 and valve 199 will be lowered and will remain in lowered position, and upon subsequent rotation of the cam in the same direction one-half of a revolution said push rod and said valve will be raised and will remain in raised position. Valve 199 and push rod 203 are yieldingly urged downwardly by a coil compression spring 209 to maintain the stem 201 of said valve in contact with said push rod and the roller 204 on the latter in contact with cam 205. Spring 209 is disposed within a hollow flanged cap 210 bolted to the upper end of body 181, and has one end engaging against the upper wall of said cap and the opposite end engaging against the upper end of valve 199. Rotation of push rod 203 relative to cam 205 is prevented by suitable means, such as by a screw 211 which is threaded into bracket 153 and has a reduced end that projects into an axially extending groove or keyway 212 formed in said push rod.

It will thus appear that when cam 205 is disposed in its normal full line position shown in Fig. 2a, the roller 204 on push rod 203 is engaged by the high part 207 of said cam and valve 199 is raised to the full line position shown in said figure. In this position of valve 199 it will be noted that the fluid outlet port 186 in body 181 is closed by said valve, and that the fluid inlet port 184 is in communication with the fluid outlet port 185 through the reduced portion 200 of the valve. Under these conditions fluid under pressure forced into body 181 under the control of the pile controlled valve 168 of valve unit 149 can only enter the conduit 189 resulting in actuation of the piston 43 in hydraulic cylinder 45 and raising of main elevator 25 and the pile of sheets thereon.

When cam 205 is rotated one-half of a revolution in the direction of the arrow from the full-line position shown n Fig. 2a, by mechanism to be hereinafter described, roller 204 on push rod 203 will ride off the high part 207 of said cam and into the low part 208 thereof and consequently push rod 203 and valve 199 will be lowered by the expanding action of spring 209. Valve 199 and cam 205 will then be disposed in the broken line positions shown in Fig. 2a. In this broken line position of valve 199 it will be noted that the fluid outlet port 185 in body 181 is closed by said valve, and that the fluid inlet port 184 is in communication with the fluid outlet port 186 through the reduced portion 200 of the valve. Under these conditions fluid under pressure forced into body 181 under the control of the pile controlled valve 168 of unit 149 can only enter the conduit 195 resulting in actuation of piston 133 in cylinder 136 and raising of auxiliary elevator 127 and the pile of sheets thereon.

During operation of the feeder the main elevator 25 and auxiliary elevator 127 cooperate to continuously maintain and support an adequate pile of sheets in feeding position, and when the top of said pile is at the proper feeding level, the valve 168 of the pile controlled valve unit 149 will

be positioned as shown in Figs. 6 and 7 wherein it will be noted that the fluid inlet port 157 (Fig. 7) in body 155 is closed by said valve. Under these conditions fluid under pressure forced into body 155 by pump 144 cannot pass through said body and, hence, no fluid will be delivered to the directional control valve unit 182 to effect raising of the main elevator 25 or the auxiliary elevator 127, as hereinbefore described. Closing of port 157 by valve 168 will not affect the operation of pump 144 since the relief valve 147 will open and return the fluid to tank 140 through conduit 148 when the pressure of said fluid exceeds a predetermined amount.

However, as sheets are fed off the top of the pile by the sheet separating and forwarding devices, the height of the pile decreases and it becomes necessary to actuate the valve 168 and thereby effect raising of the elevator supporting said pile in order to keep the top of the latter at a predetermined level for the operation of said devices. This actuation of valve 168 and resultant raising of the main elevator 25 or the auxiliary elevator 127, as the case may be, may be controlled in various ways and by various well-known means for this purpose, but as herein shown, is controlled electrically and by mechanism preferably constructed, mounted, and operated as follows.

Extending transversely of the feeder at the top thereof is a U-shaped bar 213 (Figs. 1*a*, 2*a*, and 3*a*) which is slidably mounted on brackets 214, 214 for adjustment longitudinally of the feeder in accordance with the different lengths of sheets handled in the feeder. Brackets 214, 214 are bolted to the side frame members 15, 15, and bar 213 is secured to said brackets in all positions of longitudinal adjustment thereof as by bolts 215, 215 which extend through slots 216, 216 in said bar and are threaded into said brackets. Bolted to bar 213 substantially at the center thereof is a bracket 217 provided with a shelf 218 and a forwardly extending arm 219 (Figs. 2*a* and 3*a*). Pivotally mounted at 220 on arm 219 is a pile height governed bell crank lever 221 having a rearwardly and downwardly extending arm 222 and an upwardly extending arm 223. Journalled on the free end of bell-crank arm 222 is a pile height testing member or roller 224 which rests on the top of the pile of sheets being fed at the rear and substantially in the center thereof. Bell-crank arm 223 is adapted to engage the plunger 225 of a normally open micro-switch 226 which is bolted to the shelf 218.

Bolted to plate 152 at the top thereof and disposed directly above the pile controlled valve unit 149 is a solenoid 227 (Figs. 1*a*, 2*a*, and 4) having a core 228 with which is pivotally connected the upper end of the stem 170 of valve 168. Solenoid 227 is electrically connected with micro-switch 226 by a lead wire 229, and said solenoid and said switch are, in turn, connected with a suitable source of electrical current by lead wires 230 and 231, respectively. Valve 168 is yieldingly urged downwardly to the normal position shown in Figs. 6 and 7 by a light compression spring 232 surrounding the stem 170 of said valve and having one end engaging against an abutment on said stem and the opposite end engaging against a bracket 233 which is bolted to plate 152 and is provided with a suitable opening to permit stem 170 to project therethrough.

As long as the top of the pile from which the sheets are being fed is at the proper feeding level, the bell crank lever 221 through engagement of roller 224 with said pile will be prevented from moving downwardly to enable arm 223 to engage and actuate plunger 225 of switch 226. Accordingly, the contacts of switch 226 will remain open and no upward movement will be imparted to the elevator supporting said pile because valve 168 will remain in its lowermost position shown in Fig. 7 closing the fluid inlet port 157 in body 155 and preventing delivery of fluid under pressure to the directional control valve unit 182.

As sheets are fed one after another from the top of the pile, however, and with the roller 224 engaged therewith, the bell crank lever 221 will lower by gravity and continue to do so until arm 223 has actuated the plunger 225 to close the contacts of switch 226 and thereby complete the electrical circuit to solenoid 227 through lead wire 229. Solenoid 227 will then be energized, whereupon core 228 is drawn upwardly and raises valve 168 relative to body 155 to a position such that the fluid inlet port 157 is in communication with the fluid outlet port 158 through the reduced portion 169 of said valve. Under these conditions fluid under pressure forced into body 155 by pump 144 will flow through said body, through conduit 179, into and through body 181 of valve unit 182, and then into the hydraulic cylinder 45 of main elevator 25 through conduit 189, or into the hydraulic cylinder 136 of auxiliary elevator 127 through conduits 195, 197 depending on the position of valve 199 of valve unit 182. In the normal full-line position of valve 199 shown in Fig. 2*a*, the fluid will flow into hydraulic cylinder 45 resulting in actuation of piston 43 and raising of main elevator 25 and the pile of sheets thereon, but when said valve is moved to the broken-line position which occurs after a new pile of sheets has been added by auxiliary elevator 127 to and under a preceding diminished pile on main elevator 25 at which time the new pile and the diminished pile will be supported by said auxiliary elevator, as will appear hereafter, the fluid under pressure will then flow from body 181 of valve unit 182 into hydraulic cylinder 136 resulting in actuation of piston 133 and raising of auxiliary elevator 127 with the new and diminished piles of sheets thereon.

As the pile of sheets on main elevator 25 or auxiliary elevator 127, as the case may be, thus raises, the bell-crank lever 221, through engagement of roller 224 with the pile, also raises, whereupon the pressure of arm 223 on plunger 225 is relieved and the contacts of switch 226 automatically open and return said plunger to its original position. Opening of the contacts of switch 226 de-energizes solenoid 227 whereupon valve 168 is lowered to its original position shown in Figs. 6 and 7 by spring 232, thus again closing the fluid inlet port 157 in body 155 and interrupting the flow of fluid under pressure to valve unit 182 to stop further upward movement of main elevator 25 or auxiliary elevator 127 and the pile of sheets thereon until it again becomes necessary to raise said pile at which time the above-described operations of valve 168 are repeated.

Lowering of valve 168 as aforesaid to stop further upward movement of elevator 25 or elevator 127 and the pile of sheets thereon is delayed or retarded so that, upon opening of the contacts of switch 226 following a slight upward movement of the pile, the elevator will not be directly stopped but, on the contrary, will continue to raise and thereby bring the top of the pile beyond switch opening position and an amount sufficient to enable feeding of a number of sheets therefrom be-

fore raising of the elevator and said pile is again necessary. In this manner the pile is raised to the normal feeding level upon a single operation of switch 226, whereas the switch would otherwise operate for each sheet particularly if they are relatively thick, thus eliminating frequent operations of said switch and solenoid 227, preventing rapid and excessive wear of the same and frequent repairs or replacements thereto. As herein shown, this delayed action of valve 168 is accomplished as follows.

When valve 168 is raised, as hereinbefore described, to effect raising of the main elevator 25 or the auxiliary elevator 127, and the pile of sheets thereon, this raising of valve 168 creates vacuum in the lower end of bore 156 in body 155 whereupon the fluid in well 167 of cap 166 raises the ball check valve 165 and flows into said bore through the port 164 in plug 163. When the contacts of switch 226 are opened and the valve 168 begins to drop under the action of spring 232, as hereinbefore described, the ball check valve 165 drops and again closes the port 164 in plug 163, whereupon the fluid previously admitted into bore 156 is trapped therein and must be forced therefrom by valve 168 through the restricted port 160 into passage 159 before said valve can drop to its lowermost position shown in Figs. 6 and 7, thus materially retarding or delaying the lowering movement of valve 168 and closing of the fluid inlet port 157 thereby. The flow of fluid from the bore 156 through port 160 and, hence, the speed at which valve 168 descends and the duration of upward movement of main elevator 25 or auxiliary elevator 127 and the pile of sheets thereon upon each operation of said valve, may be regulated, as desired, by adjusting the needle valve 161 with respect to said port. It will be understood that various other ways and means may be employed in connection with the pile controlled means to delay or retard the operation of any part thereof whereby delay in the lowering movement of valve 168 is effected. It will further be understood that the arm 223 of bell crank lever 221 may be provided with an adjustable screw or the like for contacting and operating the plunger 225 of switch 226, or the latter may be mounted for adjustment toward and away from said arm whereby the feeding level of the pile may be varied, as well understood in the art.

The valve unit 150 (Figs. 1*a*, 4, and 5) which is utilized to control the rapid and continuous lowering and raising movements of main elevator 25 comprises a body 234 that is bolted to the rear surface of plate 152 in spaced relation with the directional fluid control valve unit 182. Body 234 is provided centrally thereof with a vertically extending cylindrical bore 235 (Fig. 5) which communicates with two axially spaced ports 236 and 237 that are formed in said body and open outwardly through the front side thereof. Bore 235 also communicates with a port 238 which is formed in body 234 at a point below the port 237 and opens outwardly through the rear side of said body.

Threaded into body 234 through a suitable elongated opening 239 in plate 152 and communicating with the port 236 in said body is a fitting 240 having connected therewith one end of a conduit 241 (Figs. 1*a*, 4, and 5). The opposite end of this conduit 241 is connected with a T-fitting 242 having connected therewith one end of a conduit 243 the opposite end of which is connected with the T-fitting 174 on body 155 of valve unit 149. The fluid under pressure drawn from tank 140 by pump 144 and entering fitting 174 will thus be directed to body 234 through conduit 243, fitting 242, conduit 241, and fitting 240.

Threaded into body 234 through opening 239 is plate 152 and communicating with the port 237 in said body is a fitting 244 having connected therewith one end of a conduit 245 (Figs. 4 and 5). The opposite end of this conduit 245 is connected with the T-fitting 188 on body 181 of valve unit 182 whereby the fluid under pressure forced into body 234 will be directed from said body to the hydraulic cylinder 45 through said conduit, said fitting and conduit 189. Threaded into body 234 and communicating with the port 238 therein is a fitting 246 (Figs. 1*a* and 5) having connected therewith one end of a conduit 247. The opposite end of this conduit 247 is connected with a T-fitting 248 (Fig. 5*a*) having connected therewith one end of a conduit 249. The opposite end of this conduit 249 is connected with the T-fitting 176 on body 155 of valve unit 149 (Figs. 1*a*, 2*a*, and 4) whereby the return flow of fluid from hydraulic cylinder 45 will be directed to the fluid supply tank 140 through fitting 246, conduit 247, fitting 248, conduit 249, fitting 176, and conduit 177.

Slidably mounted in the bore 235 of body 234 is a valve 250 (Fig. 5) which is formed with a reduced portion 251 and with a stem 252 that projects downwardly through and beyond a suitable packing gland 253 adjustably secured to said body at the lower end thereof. The projecting end of valve stem 252 engages the upper end of a push rod 254 (Figs. 4 and 5) which is fitted for reciprocation in the bracket 153 and projects above and below the latter. Journalled on a pin 255 which is secured in and projects laterally from push rod 254 is a cam roller 256 which is adapted to engage a normally stationary cam 257 that is fixed on shaft 206. Cam 257 is formed to provide an abbreviated high part 258, an abbreviated low part 259, and a concentric intermediate low part 260 whereby valve 250 will occupy three axial positions with respect to body 234 upon rotation of said cam.

Valve 250 and push rod 254 are yieldingly urged downwardly by a coil compression spring 261 (Fig. 5) which is disposed within a hollow flanged cap 262 bolted to the upper end of body 234, one end of said spring engaging against the upper wall of said cap and the opposite end engaging against the upper end of said valve. Rotation of push rod 254 relative to cam 257 is prevented by a screw 263 which is threaded into bracket 153 and has a reduced end that projects into an axially extending groove (not shown) formed in said push rod.

Pivotally mounted at 264 on bracket 153 and associated with push rod 254 is a bell crank latch consisting of a rearwardly extending arm 265 and a downwardly extending arm 266 provided at one edge and adjacent the lower end thereof with a notch 267 (Figs. 4 and 5). As shown in Fig. 5, latch arm 266 normally rests adjacent its lower end against the projecting end of cam roller pin 255. When push rod 254 is raised through rotation of cam 257 and engagement of the high part 258 thereof with roller 256, the pin 255 will register with the notch 267 in latch arm 266, whereupon the latter will swing under its own weight in a clockwise direction, as viewed in Fig. 5, and receive said pin in said notch, thus holding valve 250 and push rod 254 in their raised uppermost positions and preventing said push

rod from immediately lowering and following the low parts 260 and 259 of cam 257.

Cam 257 is shown in full lines in Figs. 1a and 5 in the position it normally occupies, i.e. when the sheets are being fed from the pile on main elevator 25, and intermittent raising of said elevator and pile is effected under the control of the pile controlled valve unit 149. In this position of cam 257 it will be noted that the roller 256 on push rod 254 is engaged with the intermediate low part 260 of said cam at a point adjacent the high part 258 and diametrically opposite the low part 259 thereof. Under these conditions, valve 250 is disposed in its intermediate position shown in Fig. 5 wherein it will be noted that the port 237 in body 234 is closed to the ports 236 and 238 by said valve. Thus, no fluid under pressure can enter hydraulic cylinder 45 through port 237 and conduits 245, 189 to raise main elevator 25 and the pile of sheets thereon, and the fluid previously admitted into said cylinder is trapped therein and cannot flow therefrom through said conduits and said port thereby holding main elevator 25 and the pile of sheets thereon in raised position and against dropping.

When cam 257 is rotated one-half of a revolution in the direction of the arrow from the full line position to the broken line position shown in Fig. 5, push rod 254 will immediately be raised by the high part 258 of said cam and consequently valve 250 will be raised by said push rod to its uppermost position and held in said position through engagement of latch arm 266 with pin 255, as hereinbefore described, and the low part 259 of said cam will be disposed directly beneath the raised and latched push rod 254. In this raised position of valve 250 the fluid inlet port 236 will be closed to the port 237 by said valve, but said latter port and the port 238 will be in communication through bore 235 and valve stem 252. Under these conditions, the fluid previously admitted into the lower end of hydraulic cylinder 45 will be released, whereupon main elevator 25, due to its own weight, will drop rapidly and force piston 43 downwardly until the lower end of the latter contacts the bottom of the well in said cylinder. As piston 43 thus descends, the fluid in cylinder 45 will be forced therefrom by said piston back into the fluid supply tank 140 through passage 193, 192, port 191, conduits 189, 245, port 237, bore 235 and port 238 in valve body 234, and conduits 247, 249, and 177, the resistance created by the fluid in so passing through said passage, ports, bore and conduits controlling the rapidity of the downward movement of main elevator 25.

When latch arm 266 releases push rod 254, as hereinafter described, and with the low part 259 of cam 257 disposed directly beneath said push rod, as shown in broken lines in Fig. 5, valve 250 and push rod 254 will be lowered by spring 261 until roller 256 drops into the low part 259 of cam 257. Valve 250 will then be disposed in its lowermost position wherein the port 238 in body 234 will be closed by said valve, and the fluid inlet port 236 will communicate with the port 237 through bore 235 in said body and the reduced portion 251 of valve 250. Under these conditions, the fluid under pressure forced into body 234 by pump 144 will flow continuously from said body through port 237 and into the lower end of hydraulic cylinder 45 through conduits 245, 189, port 191 and passage 192, 193. The fluid under pressure so forced into cylinder 45 acts on the lower end of piston 43 and rapidly raises said piston, whereupon main elevator 25 is rapidly raised thereby. This rapid raising of elevator 25 continues until valve 250 is again shifted to its intermediate position shown in Fig. 5 upon subsequent rotation of cam 257 one-half of a revolution from the broken line position to the full line position shown in said figure and engagement of the intermediate low part 260 thereof with roller 256. Thereupon valve 250 not only interrupts the flow of fluid under pressure into cylinder 45 to stop further upward movement of piston 43 and main elevator 25, but also prevents return flow of fluid from said cylinder and dropping of said elevator, as hereinbefore described.

The valve unit 151 (Figs. 4 and 5a) which is utilized to control the rapid and continuous raising and lowering movements of auxiliary elevator 127 comprises a body 268 that is bolted to the rear surface of plate 152 between the valve units 150 and 182. Body 268 is provided centrally thereof with a vertically extending cylindrical bore 269 (Fig. 5a) which communicates with two axially spaced ports 270 and 271 that are formed in said body and open outwardly through the front side thereof. Bore 269 also communicates with a port 272 which is formed in body 268 at a point below port 271 and opens outwardly through the rear side of said body.

The T-fitting 242 (Fig. 5a) is threaded into body 268 through a suitable elongated opening 273 in plate 152 and communicates with the port 270 in said body whereby the fluid under pressure drawn from tank 140 by pump 144 and entering fitting 174 will also be supplied to body 268 through conduit 243. Threaded into body 268 through opening 273 in plate 152 and communicating with the port 271 in said body is a fitting 274 having connected therewith one end of a conduit 275. The opposite end of this conduit 275 is connected with the T-fitting 196 (Figs. 1a and 2a) whereby the fluid under pressure forced into body 268 will be directed from said body to the hydraulic cylinder 136 for auxiliary elevator 127 through said conduit, said fitting and conduit 197. The T-fitting 248 (Fig. 5a) is threaded into body 268 and communicates with the port 272 in said body whereby the return flow of fluid from hydraulic cylinder 136 will be directed to the fluid supply tank 140 through said fitting, conduit 249, fitting 176, and conduit 177.

Slidably mounted in the bore 269 of body 268 is a valve 276 (Fig. 5a) which is formed with a reduced portion 277 and with a stem 278 that projects downwardly through and beyond a suitable packing gland 279 adustably secured to said body at the lower end thereof. The projecting end of valve stem 278 engages the upper end of a push rod 280 (Figs. 4 and 5a) which is fitted for reciprocation in the bracket 153 and projects above and below the latter. Journalled on a pin 281 which is secured in and projects laterally from push rod 280 at the lower end thereof is a cam roller 282 adapted to engage a normally stationary cam 283 that is fixed on shaft 206. Cam 283 is formed to provide an abbreviated high part 284, an abbreviated low part 285, and a concentric intermediate low part 286 whereby valve 276 will occupy three axial positions with respect to body 268 upon rotation of said cam.

Valve 276 and push rod 280 are yieldingly urged downwardly by a coil compression spring 287 (Fig. 5a) which is disposed within a hollow flanged cap 288 bolted to the upper end of body

268, one end of said spring engaging against the upper wall of said cap and the opposite end engaging against the upper end of said valve. Push rod 280 is held against rotation relative to cam 283 by a screw 289 which is threaded into bracket 153 and has a reduced end that projects into an axially extending groove formed in said push rod.

Pivotally mounted at 264 on bracket 153 (Fig. 5a) and associated with push rod 280 is a bell crank latch consisting of a rearwardly extending arm 290 and a downwardly extending arm 291 provided at one edge and adjacent the lower end thereof with a notch 292. Notch 292 is adapted to receive therein the cam roller pin 281 when push rod 280 is raised through rotation of cam 283 and engagement of the high part 284 thereof with roller 282 and thus hold valve 276 in its raised uppermost position, and prevent said push rod from immediately lowering and following the low parts 285 and 286 of said cam.

In Figs. 1a and 2a, the auxiliary elevator 127 is shown in full lines in its normal lowermost pile loading position determined through engagement of the lower end of piston 133 with the bottom of the well therefor in hydraulic cylinder 136. Accordingly, valve 276 at this time is disposed in its raised uppermost position and held in said position by latch 291, as shown in Fig. 5a, and cam 283 is positioned, as shown in full lines in said figure, wherein it will be noted that the low part 285 thereof is disposed directly beneath the raised and latched push rod 280, and that the high part 284 of said cam is located less than 180° in advance of said low part. In this normal raised position of valve 276 it will be noted that the fluid inlet part 270 in body 268 is closed to the port 271 by said valve, and that the latter port is in communication with the port 272 through the bore 269 in said body and valve stem 278. Hence, fluid under pressure forced into body 268 by pump 144 through port 270 cannot enter conduit 275 to effect actuation of piston 133 in hydraulic cylinder 136, and the fluid previously admitted into said cylinder is permitted to flow therefrom back to the fluid supply tank 140 through conduits 197, 275, body 268, and conduits 249, 177 to enable lowering of auxiliary elevator 127 to loading position.

When push rod 280 is released by latch arm 291, as hereinafter described, and with the low part 285 of cam 283 disposed directly beneath said push rod, as shown in full lines in Fig. 5a, valve 276 and push rod 280 will be lowered by spring 287 until roller 282 drops into the low part 285 of cam 283. Valve 276 will then be disposed in its lowermost position wherein the port 272 in body 268 will be closed by said valve, and the fluid inlet port 270 will communicate with the port 271 through bore 269 and the reduced portion 277 of valve 276. Under these conditions, the fluid under pressure forced into body 268 by pump 144 through port 270 will flow continuously from said body through port 271 and into hydraulic cylinder 136 through conduit 275, fitting 196, and conduit 197. The fluid under pressure so forced into cylinder 136 acts on the lower end of piston 133 and rapidly raises said piston, whereupon auxiliary elevator 127 and the new pile of sheets thereon are rapidly raised thereby.

Raising of the auxiliary elevator 127 with the new pile of sheets thereon, as aforesaid, continues until cam 283 is rotated one-half of a revolution in the direction of the arrow from the full line position to the broken line position shown in Fig. 5a, at which time roller 282 on push rod 280 will immediately ride out of the low part 285 of cam 283 and onto the intermediate low part 286 thereof. Push rod 280 will then be actuated to raise valve 276 to its intermediate position wherein the port 271 in body 268 will be closed by said valve. Thereupon, the flow of fluid under pressure into hydraulic cylinder 136 through conduits 275, 197 will be interrupted to stop further upward movement of piston 133 and auxiliary elevator 127, and the fluid admitted into said cylinder will be trapped therein and cannot flow therefrom through said conduits, thus holding auxiliary elevator 127 with the new pile of sheets thereon in elevated position and against dropping. It will be noted that since the high part 284 of cam 283 is located less than 180° in advance of the low part 285 thereof, said high part will not engage roller 282 on push rod 280 when said cam is rotated one-half of a revolution in the direction of the arrow from the full line position to the broken line position shown in Fig. 5a, but will be disposed in close proximity to said roller, as shown in broken lines in said figure.

Accordingly, upon subsequent rotation of cam 283 one-half of a revolution in the direction of the arrow from the broken line position to the full line position shown in Fig. 5a, the high part 284 of said cam will immediately engage roller 282 and actuate push rod 280 and then move beyond said roller and push rod, whereupon valve 276 will be raised to its uppermost position and push rod 280 will be engaged by latch arm 291, as shown in Fig. 5a, to hold said valve in said position and prevent said push rod from immediately lowering and following the low parts 286 and 285 of cam 283. Communication will then be established between ports 271 and 272 to release the fluid previously admitted into cylinder 136, whereupon auxiliary elevator 127, due to its own weight, will rapidly drop by gravity and force piston 133 downwardly until the lower end of the latter contacts the bottom of the well therefor in said cylinder. As piston 133 thus descends, the fluid in cylinder 136 will be forced therefrom by said piston back into the fluid supply tank 140 through conduit 197, fitting 196, conduit 275, body 268, fitting 248, conduit 249, fitting 176, and conduit 177, the resistance created by the fluid in so passing through said fittings, conduits and body controlling the rapidity of the downward movement of auxiliary elevator 127.

The hereinbefore described operations of valves 199, 250, and 276, and the rotation of control cams 205, 257, and 283 at certain intervals is effected automatically and controlled by mechanism preferably constructed, mounted, and operated as follows. Bolted or otherwise suitably secured to the inner surface of the feeder side frame member 15 is a bracket 300 (Figs. 1a and 3a) provided with a boss 301 having a suitable opening therein to slidably receive the upper end of a rod 302. The lower end of rod 302 is slidably mounted in a bracket 303 (Figs. 1a and 4) which is bolted to the inner surface of the side frame member 15. Fixed on rod 302 adjacent the lower end thereof is an arm 304 which extends inwardly and downwardly at an angle from said rod and is adapted to engage the rearwardly projecting arms 265 and 290 of the bell crank latches associated wtih the push rods 254

and 280, respectively. Arm 304 is held against rotation relative to latch arms 265, 290 by a bifurcated arm 305 (Fig. 4) which is formed integrally with bracket 303 and extends upwardly and inwardly therefrom to receive arm 304. Rod 302 and arm 304 thereon are yieldingly urged upwardly by suitable resilient means, such as a coil compression spring 306 surrounding said rod and having one end engaging against said arm and the opposite end engaging against bracket 303. Upward movement of rod 302 and arm 304 by spring 306 is limited by a stop collar 307 adjustably secured to the lower projecting end of said rod.

Pivotally mounted at 308 on bracket 300 is a bell crank trip lever 309 having a forwardly extending arm 310 and an upwardly and rearwardly curved arm 311 (Figs. 1*a* and 3*a*). Trip arm 310 has journalled thereon a roller 312 engaged with the upper projecting end of rod 302, and trip arm 311 has journalled thereon a roller 313 adapted to be engaged by one arm 314 of a bell crank control lever 315 carried by the main elevator 25 for vertical movement therewith, the other arm of said lever being indicated at 316. Control lever 315 is disposed adjacent the inner surface of the vertical bar 38 of the upright rectangular frame of main elevator 25, and is pivotally mounted at 317 on said bar. Arms 314, 316 of control lever 315 are so proportioned that when said lever is in the normal full line position shown in Fig. 1*a*, arm 314 will project beyond the front edge of bar 38, and when said lever is swung to the broken line position shown in said figure, arm 316 will project beyond the rear edge of said bar for a purpose to appear hereafter. Arm 314 of control lever 315 normally rests against the lower shoulder 318 of a relatively wide recess 319 milled in the inner surface of bar 38. Arm 314 is yieldingly held in engagement with shoulder 318 by a light pull spring 320 having one end connected with said arm and the opposite end connected with bar 38 at a point rearwardly of the pivot 317.

Control lever 315 is so located on bar 38 that the arm 314 thereof, through step by step upward movement of main elevator 25, will engage the roller 313 on trip lever 309 and swing the latter in a clockwise direction, as viewed in Fig. 1*a*, before the pile of sheets on the fingers 26 of said elevator is completely exhausted through feeding of the sheets one after another from the top thereof, as will be hereinafter explained more in detail in connection with the description of the operations of main and auxiliary elevators 25 and 127, respectively. It might be mentioned at this time that this actuation of lever 309 forces rod 302 and arm 304 thereon downwardly and, hence, causes said arm to release latch 291 from push rod 280 and effect rapid raising of auxiliary elevator 127 and the new pile of sheets thereon, as hereinbefore described.

Bolted or otherwise suitably secured at 321 to the outer surface of rack bar 32 of the carriage supporting the fingers 26 of main elevator 25 is a control member in the form of a block 322 (Figs. 1*a* and 3*a*). This control block 322 is also adapted to engage the roller 313 on trip lever 309 and swing the latter in a clockwise direction, as viewed in Fig. 1*a*, to again actuate rod 302 at a time when the pile supporting fingers 26 of main elevator 25 are advanced from retracted position into pile supporting position at the lowermost position of said elevator, as also will be hereinafter explained more in detail in connection with the description of the operations of the main and auxiliary elevators 25 and 127, respectively. It might be mentioned at this time that this actuation of rod 302 causes the arm 304 thereon to release latch 266 from push rod 254 and effect rapid raising of main elevator 25, as hereinbefore described.

The operations of rod 302 by trip lever 309 under the control of the main elevator 25 and the control members 315 and 322 thereon having been described, the mechanism for effecting and controlling the rotation of cam shaft 206 and cams 205, 257, and 283 thereon at certain intervals will now be described.

Fixed on cam shaft 206 is a sprocket 323 (Figs. 1*a*, 2*a*, and 4) around which passes a chain 324 that extends towards the rear of the feeder and passes around a smaller sprocket 325 (Fig. 8). The lower reach of chain 324 passes over an idler chain tightening sprocket 326 (Figs. 1*a* and 2*a*) journalled on an arm 327 which is adjustably secured on a pin 328. The latter is fixed in a bracket 329 bolted to base plate 17. Sprockets 323 and 325 are so proportioned to have a ratio of 2:1, i. e., one revolution of sprocket 323 to two revolutions of sprocket 325, or one-half of a revolution of sprocket 323 to one revolution of sprocket 325.

Sprocket 325 is bolted or otherwise suitably secured to a disk 330 (Figs. 2 and 8) which is provided on its periphery with a single tooth 331. Disk 330 forms a part of a friction slip-clutch 332 that is mounted on the shaft 56 which, as hereinbefore described, is rotated continuously in the direction of the arrow (Fig. 2) by the chain 51 and sprocket 52. Clutch 332 is the same in construction as the clutch 62 on shaft 59, and comprises a cup-shaped member 333 loosely mounted on shaft 56 and having the disk 330 secured thereto or formed as an integral part thereof. Disposed within clutch member 333 and suitably connected with shaft 56 for rotation thereby and axial movement relative thereto is a series of metal disks 334 which, through the medium of axially movable leather disks 335, frictionally drive similar axially movable metal disks 336 that are suitably connected with said clutch member. Disks 334, 335, and 336 are retained in frictional driving contact with each other by a coil compression spring 337 surrounding shaft 56 and having one end engaging a collar 338 secured to said shaft and the opposite end engaging the outermost driving disk 334. A collar 339 secured to shaft 56 between the sprockets 52 and 325 holds clutch member 333 against axial displacement on said shaft. It will thus appear that cam shaft 206 is rotated by the continuously driven shaft 56 through the described connections including the slip-clutch 332.

The tooth 331 on disk 330 is normally engaged by the upper hooked end of a latch 340 (Figs. 2 and 8) to normally hold cam shaft 206 stationary with the cams 205, 257, and 283 thereon in their normal full line positions shown in Figs. 2*a*, 3, and 5*a*. Engagement of latch 340 with disk 330 holds sprocket 325 against rotation by shaft 56, but this does not affect the operation of shafts 23, 56, and 59 due to the slip-clutch connection 332 between said sprocket and shaft 56. Latch 340 is pivotally mounted at 341 on a bracket 342 bolted to base plate 17, and is yieldingly urged towards disk 330 by a spring-pressed plunger 343 disposed within a container 344 secured to said bracket. Plunger 343 projects from

container 344 through a suitable opening in bracket 342 into engagement with latch 340. The spring for plunger 343 is indicated at 345 and surrounds said plunger between a flange thereon and container 344. Bracket 342 has portions thereof removed to provide clearance for the lower reach of chain 324.

Pivotally connected at 346 with latch 340 is one end of a link 347 the opposite end of which is pivotally connected at 348 with the movable core 349 of a solenoid 350 (Figs. 2 and 8). When solenoid 350 is energized, as hereinafter described, core 349 will be drawn forwardly or toward the right (Fig. 2) and, hence, latch 340 through the described connections therefor with said core will be swung about its pivot 341 out of engagement with the tooth 331 on disk 330, whereupon the latter and sprocket 325 will be released to effect rotation of cam shaft 206 in the direction of the arrow indicated in Fig. 2*a*. When solenoid 350 is de-energized which occurs immediately after disk 330 is released, as aforesaid, core 349 and latch 340 will be returned to their original positions by plunger 343 so that said latch will be disposed in the path of rotation of the tooth 331 on disk 330 to engage said tooth and stop said disk and sprocket 325 after one complete revolution thereof resulting in stopping of the cam shaft 206 after it has made one-half of a revolution.

Bolted to the base plate 17 in close proximity to crank disk 72 is a normally open electrical switch 351 (Figs. 1 and 8) of a well-known design and comprising a box 352 provided therein with a pair of laterally spaced stationary contacts 353, one only being shown, and a movable contact 354 which bridges or closes the circuit between said pair of spaced contacts. The movable contact 354 is carried by a pin 355 which is journalled in box 352 and projects outwardly therefrom. Secured to the outwardly projecting end of pin 355 is an overbalanced arm 356 having journalled thereon a roller 357 which rides against the periphery of crank disk 72. Arm 356 tends to swing in a counter-clockwise direction, as viewed in Fig. 1, under the weight thereof and thus maintains roller 357 in engagement with the periphery of crank disk 72, and holds contact 354 out of engagement with contacts 353. One of the stationary contacts 353 and solenoid 350 have connected therewith lead wires 358 and 359, respectively, which are connected with a suitable source of electrical current. The other stationary contact 353 and solenoid 350 are connected together by a lead wire 360 so that when contact 354 is lowered into engagement with both of the spaced stationary contacts 353 the electrical circuit to solenoid 350 will be completed.

Crank disk 72 is provided on its periphery with an abbreviated cam 361 which may be formed integrally with said disk but, as herein shown, is in the form of a block bolted or otherwise suitably secured thereto. Cam 361 is adapted to engage roller 357 and operate switch arm 356 upon rotation of crank disk 72 in the direction of the arrow indicated in Fig. 1, said cam being so located on said disk in advance of the crank pin 73 that said operation of switch arm 356 will occur just prior to completion of one-half of a revolution of crank disk 72.

It will thus appear that when crank disk 72 is rotated one-half of a revolution in the direction of the arrow (Fig. 1) to move crank pin 73 from the full line position to the broken line position thereof shown in said figure and thereby effect retraction of the pile supporting fingers 26 of main elevator 25 from pile supporting position, as hereinbefore described, cam 361 will engage roller 357 for a short interval and move switch arm 356 downwardly, and then move slightly beyond said roller and release the latter and arm 356 just before the crank disk 72 is stopped and the fingers 26 are fully retracted. Under these conditions, the switch contact 354 is lowered by arm 356 into engagement with the stationary contacts 353 to complete the electrical circuit to solenoid 350 through lead wire 360, and then raised by said arm out of engagement with said stationary contacts to break the electrical circuit to said solenoid. Hence, solenoid 350 will be energized long enough to effect disengagement of latch 340 from the tooth 331 on disk 330 and release sprocket 325 for rotation by shaft 56, and then de-energized to permit said latch to return to its original position and re-engage said tooth after one complete revolution of disk 330.

Thus, as the pile supporting fingers 26 approach their rearmost retracted position, switch 351 is closed by cam 361, whereupon cam shaft 206 is rotated one-half of a revolution in the direction of the arrow, indicated in Figs. 2*a*, 5, and 5*a*, to move cams 205, 257, and 283 from their full line positions to their broken line positions shown in said figures and thereby effect lowering of main elevator 25 with the fingers 26 thereof in retracted position, holding of auxiliary elevator 127 with the new pile of sheets thereon, together with the remainder of a preceding pile, in raised position, and transfer of the intermittent or step by step operation under the control of the pile governor 224 from the main elevator 25 to the auxiliary elevator 127, as hereinbefore described and will be further explained hereinafter in connection with the description of the operations of main elevator and auxiliary elevator 25 and 127, respectively.

It will be understood that other ways and means may be employed in connection with the retractible pile supporting fingers 26 or any part of the operating mechanism therefor for effecting disengagement of latch 340 from disk 330 and rotation of cam shaft 206 upon retraction of said fingers.

Carried by and movable with auxiliary elevator 127 is a double-armed trip lever 362, one arm 363 of which is inclined downwardly and rearwardly, and the other arm 364 of which is inclined upwardly and rearwardly and also offset laterally from arm 363 (Figs. 1*a* and 3*a*). Lever 362 is pivotally mounted on a stud 365 which projects through a vertical slot 366 formed in the vertical bar 128 of auxiliary elevator 127 at the end thereof facing the feeder side frame member 15. Slot 366 provides for vertical adjustment of lever 362 relative to elevator bar 128, said lever being secured in adjusted positions on said bar by a nut 367 threaded on stud 365. Arms 363, 364 of lever 362 are of the same length and inclination and each have journalled thereon at the free ends thereof rollers 368 and 369, respectively. Threaded into elevator bar 128 is an adjustable screw or stop member 370 which is engaged by lever 362 and holds the latter against pivotal downward movement about stud 365 and in a position such that the rollers 368, 369 are normally disposed in the same vertical plane, as shown in Fig. 1*a*.

Roller 368 on trip arm 363 is engaged with

and adapted to ride along the front surface of a vertically extending square bar 371 upon upward and downward movements of auxiliary elevator 127 (Figs. 1a and 3a). This bar 371 is pivotally connected at the upper and lower ends thereof to the free ends of a pair of upwardly and forwardly inclined, bifurcated parallel arms 372 and 373, respectively, which are pivotally mounted at 374 and 375, respectively, on the feeder side frame member 15. The parallel arm mounting of bar 371 provides for movement of the latter bodily while maintaining the same in vertical position. Engagement of bar 371 with roller 368, and engagement of lever 362 with stop screw 370 holds said bar in proper vertical position and against pivotal downward and forward movement. Bar 371 engages the plunger 376 of a normally open micro-switch 377 disposed rearwardly of said bar intermediate its ends and bolted to a bracket 378 which, in turn, is bolted to the feeder side frame member 15 (Figs. 1a and 3a). This switch 377 is electrically connected with the solenoid 350 by a lead wire 379, and said switch and said solenoid have connected therewith lead wires 380 and 381, respectively, that are connected with a suitable source of electrical current.

Bolted or otherwise suitably secured to the underside and at the forward end of rack bar 32 of the carriage supporting the fingers 26 of main elevator 25 is a control member in the form of a plate 382 which projects forwardly beyond said rack bar and is slightly bevelled at the upper side thereof. This control member or plate 382 is adapted to engage the roller 369 on arm 364 and swing trip lever 362 in a clockwise direction, as viewed in Fig. 1a, about its pivot 365 when the main elevator 25 is rapidly raised from its lowermost position to bring the fingers 26 thereof up under and into contact with the replenished pile on auxiliary elevator 127 and take over the support and elevation of said pile, as will hereinafter be explained more in detail in connection with the description of the operations of the main and auxiliary elevators 25 and 127, respectively. Trip lever 362 is so adjusted on elevator bar 126 that it will be actuated by control plate 382 just as the pile supporting fingers 26 of main elevator 25 contact the replenished pile of sheets on auxiliary elevator 127.

It will thus appear that when trip lever 362 is swung by control member 382 in a clockwise direction (Fig. 1a) as aforesaid, the arm 363 of said lever will move bar 371 rearwardly and thus actuate plunger 376 to close the contacts of switch 377, and when said lever is released, the bar 371 will return to its original position and thus release plunger 376 and permit the contacts of switch 377 to open automatically. Under these conditions, solenoid 350 will be energized to again disengage latch 340 from the tooth 331 on disk 330 and release sprocket 325 for rotation by shaft 56, and then de-energized to permit said latch to re-engage said tooth upon one complete revolution of said sprocket.

Thus, as the pile supporting fingers 26 of main elevator 25 approach the underside of the replenished pile of sheets on the auxiliary elevator 127, cam shaft 206 is again rotated one-half of a revolution in the direction of the arrow, indicated in the drawings, to move the cams 205, 257, and 283 thereon from their broken line positions to their full line positions shown in Figs. 2a, 5, and 5a, and thereby effect stopping and holding of main elevator 25 in raised position and with the fingers 26 thereof in contact with the replenished pile of sheets on auxiliary elevator 127, rapid lowering of auxiliary elevator 127 to reloading position, and transfer of the intermittent or step by step operation under the control of the pile governor 224 from the auxiliary elevator 127 back again to the main elevator 25, as hereinbefore described and will be further explained hereinafter in connection with the description of the operations of the main and auxiliary elevators 25 and 127, respectively.

The operations of the main and auxiliary elevators in maintaining a continuous supply of sheets on the feeder to enable the latter to feed sheets at high speed continuously without interruption for reloading purposes, are as follows. Assuming that the main elevator 25 has been initially loaded with a pile of sheets 27 and raised to the full line position shown in Figs. 1a and 2a to bring the top of said pile to the proper feeding level, and that the auxiliary elevator 127 has been lowered to loading position, as shown in full lines in said figures, and loaded with a second or new pile of sheets 130. At this time, cam 257 and valve 250 associated therewith occupy the full line positions shown in Fig. 5 to hold main elevator 25 and the pile of sheets 27 thereon in raised position and against dropping; cam 283 is positioned as shown in full lines in Fig. 5a, and the valve 276 associated therewith is held in its raised uppermost position by latch 291 to prevent upward movement of auxiliary elevator 127 and the new pile of sheets 130 thereon from loading position; cam 205 and valve 199 associated therewith occupy the full line positions shown in Fig. 2a to provide for intermittent operation of main elevator 25 and step by step raising of the pile of sheets 27 thereon under the control of the pile governor roller 224; and valve 168 is positioned as shown in Figs. 6 and 7 so that no fluid under pressure is supplied to hydraulic cylinder 45 and no motion is imparted to the main elevator 25 and pile of sheets thereon.

The feeder having been started through rotation of sprocket 22 and shaft 23 in the direction of the arrow indicated in Fig 2, and the rotary pump 144 having been started to draw fluid from the supply tank 140, and with the crank disk 72 and cam shaft 206 held against rotation by the latches 91 and 340, respectively, the sheets are fed one after another from the top of the pile 27 on main elevator 25 by the sheet separating and forwarding devices hereinbefore referred to. As the sheets are so fed from pile 27, the governor roller 224 gradually lowers until the arm 223 of governor lever 221 actuates plunger 225 and closes switch 226. Thereupon, solenoid 227 is energized, valve 168 is drawn upwardly, and fluid under pressure drawn from tank 140 by pump 144 is forced into hydraulic cylinder 45, thus raising main elevator 25 and the pile of sheets 27 thereon until the top of said pile is again at the normal feeding level. As the pile 27 thus raises, governor roller 224 also raises, whereupon switch 226 opens and solenoid 227 is de-energized. Valve 168 then drops slowly to its lowermost position shown in Figs. 6 and 7 to delay the stopping of main elevator 25 until the top of pile 27 reaches the normal feeding level at which time the flow of fluid under pressure into cylinder 45 is interrupted by said valve, thus stopping further upward movement of said elevator until elevation of said pile is again nec-

essary at which time the above-described operations are repeated. Since pump 144 is of the low pressure type, this interruption by valve 168 of the flow of fluid into cylinder 45 will have no effect on the operation of said pump, but should the pressure of said fluid exceed a predetermined amount the relief valve 147 will open and by-pass the fluid into the supply tank 140.

When the pile supporting fingers 26 of main elevator 25 reach the broken line position A (Fig. 2a) through continuous feeding of sheets from pile 27 thereon and intermittent raising of said elevator, at which time the pile 27 will have diminished to the last few inches of sheets, approximately two inches in the illustrated embodiment, the control arm 314 through upward movement thereof with main elevator 25 engages the roller 313 on trip lever 309 and swings the latter in a clockwise direction, as viewed in Fig. 1a. Thereupon, rod 302 and arm 304 are forced downwardly by the roller 312 on trip lever 309, and latch 291 is disengaged from the pin 281 on push rod 280 by said arm through downward movement thereof and engagement of the same with the arm 293 of said latch. The released push rod 280 then immediately lowers into the low part 285 of cam 283, whereupon valve 276 is lowered to its lowermost position and fluid under pressure drawn from tank 140 by pump 144 is forced into hydraulic cylinder 136, thus rapidly raising auxiliary elevator 127 and the new pile of sheets 130 thereon toward the elevated pile supporting fingers 26 of main elevator 25 and the diminished pile 27 thereof. It might be mentioned that pump 144 is of such capacity that when fluid is supplied to cylinder 136 to rapidly raise auxiliary elevator 127 as aforesaid, fluid under pressure is also available to effect intermitttent raising of main elevator 25 as the feeding of sheets from the diminished pile thereon continues during this rapid raising of auxiliary elevator 127.

As the auxiliary elevator 127 with the new pile of sheets 130 thereon thus raises while sheets are being fed from the top of the diminished pile 27 on main elevator 25, the top of the new pile 130 on auxiliary elevator 127 engages the control arm 103 on main elevator 25 and swings said arm and arm 104 in a counterclockwise direction, as viewed in Fig. 2a, thereby actuating plunger 105 and closing switch 106. Solenoid 98 is then energized, whereupon latch 91 is disengaged from disk 89, and crank disk 72 is rotated one-half of a revolution in the direction of the arrow, indicated in Fig. 1, thus withdrawing or retracting the pile supporting fingers 26 to the broken line position B (Fig. 2a) and out of supporting relation to the diminished pile 27 which then is neatly and progressively deposited on top of the upwardly moving new pile 130 on auxiliary elevator 127. Rearward displacement of the sheets of diminished pile 27 with fingers 26 is prevented by rear pile guides 303 which are bolted or otherwise suitably secured to the bar 213 and project downwardly therefrom between certain of said fingers. As the fingers 26 are being retracted and the auxiliary elevator 127 continues to move upwardly, said fingers by virtue of their pivotal mounting are free to yield with the new pile 130, thus eliminating all possibility of breaking or bending the same. When the diminished pile 27 is deposited on the new pile 130 the top of the combined piles or the replenished pile is maintained at the normal feeding level through continued upward movement of auxiliary elevator 127 so that there is no interruption in the feed of the sheets.

As the fingers 26 are being retracted, the control arm 103 drops off of the top of the new pile 130 on auxiliary elevator 127, whereupon switch 106 is opened, solenoid 98 is deenergized, and latch 91 returns to its original position to stop rotation of crank disk 72 after one-half of a revolution thereof. As the fingers 26 near the end of their rearward or retracting stroke, the switch 351 is closed for a short interval by cam 361 through rotation of crank disk 72, and then opened by arm 356 at which time said fingers are fully retracted and said crank disk is stopped through engagement of latch 91 with the tooth 90 on disk 89. Upon closing of switch 351 solenoid 350 is energized, thereupon latch 340 is disengaged from the disk 330 and cams 205, 257, and 283 are rotated in unison one-half of a revolution in the direction of the arrow from the full line positions to the broken line positions shown in Figs. 2a, 5, and 5a, respectively, and then stopped through engagement of latch 340 with tooth 331 on disk 330 resulting from opening of switch 351 and de-energizing of solenoid 350 immediately following the disengagement of said latch and release of said disk thereby.

Immediately upon rotation of cams 205, 257, and 283 as aforesaid, the valve 250 is raised to its uppermost position by cam 257, and the latch arm 266 engages pin 255 and thereby holds said valve in said position, whereupon the fluid in hydraulic cylinder 45 is released and the main elevator 25 with the pile supporting fingers 26 thereof in retracted position rapidly drops by gravity to its lowermost position at which time the fingers 26 substantially occupy the broken line position C, shown in Fig. 2a; the valve 276 is raised to its intermediate position by cam 283, whereupon the flow of fluid into hydraulic cylinder 136 through valve body 268 is interrupted and the fluid previously admitted into said cylinder is trapped therein by said valve, thus stopping rapid upward movement of the auxiliary elevator 127 and holding the same with the replenished pile of sheets thereon in raised position and against dropping; and the valve 199 is lowered by spring 209, whereupon the intermittent or step by step elevator control is transferred from the main elevator 25 to the auxiliary elevator 127. At this time the fingers 129 of auxiliary elevator 127 substantially occupy the broken line position D, shown in Fig. 2a. Auxiliary elevator 127 is now under the control of the pile engaged governor roller 224 and valve 168 so that said elevator is intermittently raised to keep the top of the replenished pile thereon at the proper feeding level as the sheets are fed therefrom and as long as said pile is supported by said elevator.

As the main elevator 25 with the fingers 26 thereof in retracted position drops by gravity to its lowermost position, the control arm 314 moves out of engagement with the roller 313 on trip lever 309, thereupon spring 306 returns said lever, rod 302, and arm 304 to their original positions for subsequent operation. As the main elevator 25 approaches its lowermost position, the control arm 111 on said elevator engages the arm 117 of trip lever 118 and swings the latter in a counterclockwise direction, as viewed in Fig. 2a, thus actuating plunger 121 to close switch 122. Solenoid 98 is then energized whereupon latch 91 is again disengaged from disk 89, and crank disk 72 is further rotated one-half of a revolution in the direction of the arrow (Fig. 1), thus moving crank pin 73 from its broken line position to its full line position and advancing the pile supporting fin-

gers 26 from retracted position into pile supporting position beneath the fingers 129 of auxiliary elevator 127 and the replenished pile of sheets thereon, as shown in broken lines at E in Fig. 2a. Crank disk 72 is then stopped through engagement of latch 91 with the tooth 90 on disk 89 resulting from opening of switch 122 and de-energizing of solenoid 93 through continued downward movement of control arm 111 beyond trip arm 117 and return movement of trip lever 118 shortly after closing of said switch thereby.

As the pile supporting fingers 26 near the end of their forward or advancing stroke, the control member or block 322 on the rack bar 32 through forward movement thereof with said rack bar engages the roller 313 on trip lever 309 and swings the latter in a clockwise direction, as viewed in Fig. 1a. Thereupon, rod 302 and the arm 304 thereon are again forced downwardly by the roller 312 on trip lever 309 just as the fingers 26 are fully advanced, but this time the latch 266 is disengaged from the pin 255 on push rod 254 by arm 304 through downward movement thereof and engagement of the same with the arm 265 of said latch. Push rod 254 then immediately drops into the low part 259 of cam 257 which, as previously described, is now in the broken line position shown in Fig. 5, whereupon valve 250 is lowered to its lowermost position and fluid under pressure drawn from tank 140 by pump 144 is forced into hydraulic cylinder 45, thus rapidly raising main elevator 25 until the fingers 26 thereof move in between the fingers 129 of auxiliary elevator 127 and contact the underside of the replenished pile of sheets on said auxiliary elevator. While the fingers 26 of main elevator 25 are being retracted, lowered, advanced and raised, the sheets are being fed continuously from the top of the replenished pile on auxiliary elevator 127.

As the main elevator 25 thus raises, the control arm 111 engages trip arm 117 and swings downwardly to enable the same to pass by said trip arm after which it returns to its original position. Just as the fingers 26 of main elevator 25 are about to contact the underside of the pile on auxiliary elevator 127 as aforesaid, the control member or plate 382 on rack bar 32 through upward movement thereof with main elevator 25 engages the roller 369 on trip lever 362 and swings the latter in a clockwise direction, as viewed in Fig. 1a, whereupon bar 371 is moved rearwardly by the roller 368 on said lever and plunger 376 is actuated by said bar to close switch 377. Solenoid 350 is then energized, whereupon latch 340 is again disengaged from disk 330 and cams 205, 257, and 283 are further rotated one-half of a revolution in the direction of the arrow from the broken line positions to the full line positions shown in Figs. 2a, 5, and 5a, respectively, and then stopped.

Immediately upon this rotation of cams 205, 257, and 283, the valve 250 is raised to its intermediate position, shown in Fig. 5, by cam 257, whereupon the flow of fluid into hydraulic cylinder 45 through valve body 234 is interrupted and the fluid previously admitted into said cylinder is trapped therein, thus stopping rapid upward movement of the main elevator 25 and holding the same in raised position and against dropping and with the fingers 26 thereof in contact with the underside of the replenished pile on auxiliary elevator 127; the valve 276 is raised to its uppermost position by cam 283, and the latch 291 engages pin 281 and thereby holds said valve in said position, as shown in Fig. 5a, whereupon the fluid previously admitted into hydraulic cylinder 136 is released and the auxiliary elevator 127 rapidly drops by gravity away from the replenished pile to its lowermost loading position; and the valve 199 is raised by cam 205 to the full line position, shown in Fig. 5, whereupon the intermittent or step by step elevator operation under the control of the pile engaged governor roller 224 and the valve 168 is transferred from the auxiliary elevator 127 back again to the main elevator 25 to effect intermittent operation of the latter and thereby maintain the top of the replenished pile thereon at the proper feeding level as the feeding of sheets therefrom continues. Thus, the replenished pile of sheets previously supported in feeding position by the auxiliary elevator 127 is transferred to the main elevator 25, said transfer being made without disturbing the feeding level of said pile and without interrupting the feed of sheets therefrom, and said auxiliary elevator is lowered to loading position to receive thereon a new pile of sheets in readiness to be raised and added to the replenished pile now on said main elevator when said latter pile has diminished to the last few inches of sheets, at which time the above-described operations are repeated and the preceding diminished pile is again replenished.

Upon lowering of auxiliary elevator 127 to loading position as aforesaid, the roller 369 on trip lever 362 immediately moves out of engagement with the control member or plate 382. Thereupon trip lever 362 is released and bar 371 returns by gravity to its original position. Switch 377 then opens, solenoid 350 is de-energized, and the latch 340 engages the tooth 331 on disk 330 and stops cams 205, 257, and 283 in their normal full line positions shown in Figs. 2a, 5, and 5a.

It is to be noted that by means of the novel construction, arrangement, and operation of the double elevators 25, 127, and control means therefor herein illustrated and described, the pile replenishing operations are effected so rapidly that not only is the feeder enabled to feed sheets continuously at high speed, but that the replenishing of a preceding pile with a new pile of sheets may be delayed until an increased number of sheets have been so fed with a correspondingly greater reduction of the active pile and yet will be effective before the latter pile is completely exhausted.

The feeder is provided with novel pile conveying and loading means which is associated with the auxiliary elevator 127 and is adapted to support several new loads or piles of sheets thereon in readiness to be automatically loaded thereby on said elevator each time it is lowered to loading position. Said pile conveying and loading means has the advantages in that it, like the double elevators 25 and 127, is fully automatic in operation and thus requires no attention on the part of the operator, except for maintaining a supply of piles thereon which may simply be performed by a loader boy; it reduces to an absolute minimum auxiliary elevator loading time; it assures loading of a pile of sheets on the auxiliary elevator quickly and within the required time; and it eliminates manual loading which is not only fatiguing but is impossible to perform within the required time. As herein shown, the novel pile conveying and loading means is preferably constructed, mounted, and operated as follows.

Extending rearwardly of the path of vertical

movement of the fingers 129 of auxiliary elevator 127 through the upright rectangular frame of main elevator 25 and arranged to lie in the same horizontal plane as the upper surfaces of said fingers when said auxiliary elevator is in its lowermost loading position, is a table 384 which is adapted to support in tandem relation two reserve loads or piles of sheets 385, 385 (Figs. 2 and 2a). It will be understood that table 384 may be of any desired length to support any desired number of reserve piles of sheets, and may be of any suitable construction. In the illustrated embodiment, table 384 comprises three transversely spaced elongated plates 386, 387, 388 (Figs. 3 and 3a) which are secured together by longitudinally extending track members 389, 389 that bridge the spaces between said plates and are bolted to the undersides thereof, and by a rear cross bar 390 disposed beneath the same and bolted thereto (Figs. 2, 2a, 3, and 3a). Table 384 is supported at longitudinally spaced points by brackets 391 which are bolted to the plates 386, 388 and to the adjacent side frame members 15 and 16, respectively.

Track members 389, 389 have end portions 392, 392 (Figs. 2a and 3a) reduced in width and which extend beyond the front end of table 384 between certain of the fingers 129 of auxiliary elevator 127 for approximately one-half the length of said fingers when said elevator is in pile loading position, as shown in full lines in Fig. 2a. Extending along the upper surface of each track member 389 is the upper reach of an endless roller type chain 393 which passes around sprockets 394 and 395 located adjacent the front and rear ends, respectively, of said track members (Figs. 1, 1a, 2, 2a, 3, and 3a). Sprockets 394 are journalled on headed stud shafts 396 which are fixed in brackets 397 bolted to and projecting inwardly from the feeder side frame members 15 and 16. Sprockets 395 are fixed on a transversely extending shaft 398 journalled at opposite ends thereof in suitable bearings in brackets 399 which are adjustably secured to the plates 386 and 388 at the undersides thereof, as by bolts 400 that extend through slots 401 in said brackets and are threaded into said plates. The bolt and slot mounting of brackets 399 provides for tightening of chains 393.

Chains 393 are provided at one side thereof with a plurality of vertically extending pile pushers 402 (Figs. 1, 1a, 2, 2a, 3, and 9) which are equally spaced along said chains in transverse alignment and receive therebetween the piles of sheets of different lengths capable of being handled in the feeder and piled on table 384 at the rear thereof. Pushers 402 are each formed with a rearwardly extending right angle portion 403 having journalled thereon a roller 404. Pushers 402 are pivotally connected with chains 393 by extending certain of the pins of the latter, as indicated at 405 (Fig. 9), laterally beyond the links at one side thereof to receive said pushers. Track members 389 support and guide the chains 393 and pushers 402 during movement of the same along the upper surface of table 384, and for this purpose, said members are formed with rail portions 406 (Fig. 9) to receive the rollers of said chains, and with ways 407 to receive the rollers 404 of said pushers. As shown in Fig. 9, the pins 405 for pushers 402 project into grooves 408 formed in and extending along opposite side edges of plate 387 so that the upper reaches of chains 393 are held against bowing upwardly and said pushers are held in upright position and against backward tilting movement upon engagement thereof with a stationary reserve pile of sheets on table 384 and forward movement of said pile thereby along said table and onto the fingers 129 of auxiliary elevator 127.

In the illustrated embodiment, the sheets forming each reserve pile are manually piled on the table 384 from either side of the feeder. The pile thus formed is then advanced by two transversely aligned pushers 402 from piling position to a point adjacent the front end of table 384 in one operation of chains 393, at which time a second reserve pile is formed on table 384 at the rear of the first pile and between the preceding and succeeding pairs of aligned pushers 402. When chains 393 are again actuated, and with the auxiliary elevator 127 in loading position, the first or leading reserve pile of sheets is moved by the pushers 402 in one operation from table 384 onto and along the fingers 129 of said elevator until the front side of said pile engages the pile guides 138, and the second reserve pile of sheets is moved by the succeeding pair of pushers 402 from piling position to the position vacated by said first reserve pile. A third reserve pile of sheets is then piled on table 384 at the rear of the second reserve pile and in front of the next pair of pushers 402, and thereafter as each leading reserve pile is loaded on auxiliary elevator 127. Thus, as shown in Figs. 2 and 2a, there are always at least two reserve piles of sheets 385 on table 384 in readiness to be advanced and loaded on auxiliary elevator 127.

To facilitate proper piling of the sheets on table 384 and location of the pile thus formed in advance of the next following pair of aligned pushers 402, rear and side pile guides 409 and 410, respectively, are provided (Figs. 1, 2, and 3). The rear pile guide 409 is welded or otherwise suitably secured to a rod 411 which is releasably clamped in an arm 412 to enable adjustment of said guide longitudinally of table 384 for piles of different lengths. Arm 412 is clamped on a transversely extending shaft or bar 413 which is fixed at one or both ends in brackets 414 that are bolted to the feeder side frame members 15, 16 and project upwardly therefrom to receive said bar. Each side pile guide 410 is welded or otherwise suitably secured to a rod 415 which is clamped in an arm 416 that is, in turn, releasably clamped to bar 413 to enable lateral adjustment of said guide for piles of different widths.

The reserve piles of sheets 385 are guided during forward movement thereof along table 384 and onto the fingers 129 of auxiliary elevator 127 by relatively long pile guides 417 which are disposed at opposite sides of said piles. Guides 417 are bolted or otherwise suitably secured to arms 418 which are mounted on and adjustable along short transversely extending shafts or rods 419 to accommodate piles of different widths. Rods 419 are fixed at one end thereof in brackets 420 which are bolted to the feeder side frame members 15, 16. Arms 418 and guides 417 are held in adjusted positions by thumb screws 421 or the like threaded in said arms and engaging rods 419. Table 384 is provided on the upper side thereof and at sheet piling position with pairs of oval-shaped strips 422 (Figs. 1, 2, 3, and 9) which are located on opposite sides of chains 393 and pushers 402 and bolted to the plates 386, 387, and 388. These strips 422 serve to hold the rearmost reserve pile 385 out of contact with the chains 393 during movement of the latter relatively to said pile to bring the succeeding pair of pushers 402

into engagement therewith, thus eliminating displacement, tearing, marking, or otherwise disfiguring of the bottom sheet or sheets by said chains.

As previously stated, the leading reserve pile of sheets 385 on table 384 is moved in one operation of chains 393 and pushers 402 from said table onto and along the fingers 129 of auxiliary elevator 127 and into engagement with the pile guides 138. The location of pushers 402 longitudinally of table 384 and fingers 129 prior to the piling of sheets on said table is thus important to insure proper loading of the reserve pile on said fingers as aforesaid. This setting of pushers 402 for the piles of sheets of different lengths capable of being handled in the feeder is effected by first placing one or more sheets of the size to be fed by the feeder on the fingers 129 of auxiliary elevator 127 with the front edge thereof contacting the pile guides 138, and then moving the chains until the nearest pushers 402 engage the rear edge of the sheet so placed on fingers 129. The pushers 402 will then be in proper position for piling of the sheets on table 384 and accurate loading of the pile on auxiliary elevator 127 upon subsequent operations of chains 393.

Chains 393 and pushers 402 thereon are operated each time the auxiliary elevator 127 is lowered to loading position, said operation being effected automatically under the control of said elevator by mechanism preferably constructed, mounted, operated, and controlled as follows. Fixed on and continuously rotated by shaft 59 is a small sprocket 423 (Figs. 2 and 8) around which passes a chain 424 that extends rearwardly from said sprocket and passes around a larger sprocket 425 to continuously rotate the latter in the direction of the arrow, indicated in Fig. 2. Sprocket 425 is fixed on a short transversely extending shaft 426 which is journalled at opposite ends in suitable bearings provided by a bracket 427 bolted to base plate 17.

Mounted on shaft 426 between sprocket 425 and one of the bearings for said shaft is a friction slip clutch 428 (Fig. 8) of the same design as the clutches 62 and 332 hereinbefore described. Clutch 428 comprises a cup-shaped member 429 loosely mounted on shaft 426 and having a disk 430 secured thereto or formed integrally therewith. Disposed within clutch member 429 and suitably connected with shaft 426 for rotation thereby and axial movement relative thereto is a series of metal disks 431 which, through the medium of axially movable leather disks 432, frictionally drive similar axially movable metal disks 433 that are suitably connected with said clutch member. Disks 431, 432, and 433 are retained in frictional driving contact with each other by a coil compression spring 434 surrounding shaft 426 and having one end engaging against the outermost driving disk 431 and the opposite end engaging against the hub of sprocket 425.

Disk 430 on clutch member 429 is provided on its periphery with a single tooth 435 (Figs. 1, 2, and 8) that is normally engaged by the upper hooked end of a vertical latch 436 which is pivotally mounted at 437 on a bracket 438 bolted to base plate 17. Latch 436 is urged towards disk 430 by a spring-pressed plunger 439 disposed within a container 440 bolted to bracket 438. Plunger 439 projects from container 440 through a suitable opening in bracket 438 into engagement with latch 436. The spring for plunger 439 is indicated at 441 and surrounds said plunger between a flange thereon and container 440.

Engagement of latch 436 with the tooth 435 on disk 430 normally holds the latter and a sprocket 442 bolted thereto against rotation by shaft 426. This holding of disk 430 against rotation does not, however, affect the operation of shafts 23, 56, 59 and 426 due to the slip clutch connection 428 between the latter shaft and said disk. Passing around sprocket 442 is a chain 443 which extends upwardly from said sprocket and passes around a smaller sprocket 444 (Figs. 2 and 3) that is releasably clamped to shaft 398 to rotate the latter and the sprockets 395 thereon and thereby actuate the pusher chains 393, and to enable setting of the pushers 402 in proper position, as hereinbefore described, without disturbing the driving connections for said pusher chains. One reach of chain 443 passes over an idler chain tightening sprocket 445 journalled on an arm 446 adjustably secured to the tie shaft 20.

It will thus appear that the pusher chains 393 and pushers 402 thereon are operated by the shaft 426 through the described driving connections therefor with said shaft including the friction slip-clutch 428, and are normally held against operation through engagement of latch 436 with the tooth 435 on disk 430. Sprockets 423, 425, 442, and 444 are so proportioned that upon disengagement of latch 436 from disk 430 and rotation of sprocket 442 one complete revolution only, the pusher chains 393 and pushers 402 will be moved a distance sufficient to advance the leading reserve pile of sheets 385 from table 384 onto the fingers 129 of auxiliary elevator 127, along said fingers and into engagement with the pile guides 138, as illustrated in Fig. 2*a* in connection with the new or second pile of sheets 130. It will be understood that when handling sheets of less length than those of the maximum size shown in the drawings, the pushers 402 will move in between the fingers 129 of auxiliary elevator 127.

Although various ways and means may be employed for effecting disengagement of latch 436 from disk 430, this operation, as herein shown, is effected electrically and by means comprising a solenoid 447 bolted to bracket 438 (Figs. 1, 2, and 8). Pivotally connected with the movable core 448 of solenoid 447 is one end of a link 449 the opposite end of which is pivotally connected at 450 with latch 436. Solenoid 447 is electrically connected by a lead wire 451 with a normally open micro-switch 452 located adjacent the front of the feeder and bolted to the feeder side frame member 16 (Figs. 1*a*, 2*a*, and 3*a*). Solenoid 447 and switch 452 are connected with a suitable source of electrical current by lead wires 453 and 454, respectively.

Carried by and movable with the auxiliary elevator 127 is a control member in the form of an arm 455 (Figs. 2*a* and 3*a*) which is pivotally mounted intermediate its ends at 456 on the vertical bar 128 of said elevator at the end thereof facing the feeder side frame member 16. Arm 455 projects rearwardly beyond the elevator bar 128 and is formed at the front end thereof with a weight 457 to overbalance said arm and normally hold the latter in engagement with the upper shoulder 458 of a wide recess 459 milled in the end of said elevator bar. Shoulder 458 is bevelled as indicated at 460 to permit pivotal movement of arm 455 in a counter-clockwise direction, as viewed in Fig. 2*a*, relative to elevator bar 128.

Disposed in the path of vertical movement of control arm 455 is one arm 461 of a bell crank trip lever 462 (Figs. 2*a* and 3*a*) which is pivotally

mounted at 463 on the feeder side frame member 16. The other arm 464 of bell crank 462 extends downwardly and has its lower end weighted and normally engaged with the plunger 465 of switch 452. A pin 466 is secured in side frame member 16 and projects inwardly therefrom across the front of arm 464 to limit pivotal movement of bell crank 462 in a counter-clockwise direction, as viewed in Fig. 2a, so that the free forward end of arm 461 will be located in proper position for engagement by the free rear end of control arm 455.

Assuming now that the diminished pile 27 on main elevator 25 has been replenished with the new pile 130 on auxiliary elevator 127 and that the latter is being lowered to loading position to receive another new pile of sheets, all as hereinbefore described. As the auxiliary elevator 127 thus lowers, and with the reserve piles of sheets 385 positioned on table 384 as shown in Figs. 2 and 2a, the control arm 455 on said elevator engages the arm 461 of trip lever 462 and moves past said arm just before the auxiliary elevator 127 reaches loading position, and in so doing swings lever 462 in a clockwise direction, as viewed in Fig. 2a, to actuate the plunger 465 and close switch 452, and then releases said lever to relieve the pressure on said plunger and permit opening of said switch. Under these conditions, solenoid 447 is energized just as the auxiliary elevator 127 reaches loading position, whereupon latch 436 is disengaged from disk 430, sprocket 442 is rotated one revolution by shaft 426, and the pusher chains 393 and pushers 402 are advanced along table 384 an extent such that the leading reserve pile of sheets 385 is moved from said table, onto and along the fingers 129 of auxiliary elevator 127 up to the pile guides 138, and the next or succeeding reserve pile is moved to the position vacated by said leading reserve pile. The chains 393 and pushers 402 are then stopped from further movement through engagement of latch 436 with the tooth 435 on disk 430 resulting from opening of switch 452 and de-energizing of solenoid 447 immediately following the release of said disk by said latch. Thus, auxiliary elevator 127 is quickly and properly loaded with a new pile of sheets in readiness for the next pile replenishing operation, and when this is effected and said elevator is again lowered to loading position, the above-described pile loading operations are repeated, and thereafter each time the auxiliary elevator is lowered to loading position as long as the table 384 is supplied with reserve piles of sheets. When the auxiliary elevator 127 with the new pile of sheets thereon is raised to add said pile to a preceding diminished pile, as hereinbefore described, the control arm 455 will engage trip arm 461 and swing downwardly, thereby enabling the latter to pass said trip arm after which it returns to its original position.

Means are provided for tilting each pair of aligned pushers 402 forwardly as they reach the front sprockets 394 and before they pass around said sprockets in the return movement thereof, thus quickly removing the pushers from the path of the oncoming reserve pile of sheets 385 and preventing said pushers from fouling on the auxiliary elevator 127. As herein shown, said tilting means comprises a bell crank lever pivotally mounted at 467 on each of the front sprockets 394 and consisting of a downwardly extending arm 468 and an upwardly and rearwardly inclined arm 469 (Figs. 2a and 3a). The arm 468 of each bell crank engages a fixed cam 470 which is secured to or formed integrally with the head of each stub shaft 396, and each arm 468 is held in engagement with its respective cam 470 by a light pull spring 471 having one end connected to the lower end of said arm and the opposite end connected with the sprocket 394.

It will thus be apparent that when sprockets 394 are rotated, the arms 469, through engagement of the arms 468 with the fixed cams 470, will be swung in a clockwise direction, as viewed in Fig. 2a, relatively to said sprockets across the inner sides of the pusher chains 393 once during each revolution of sprockets 394. In the illustrated embodiment, the sprockets 394 make two revolutions for each pile loading stroke of chains 393. Hence, the operation of arms 469 is so timed that it occurs at the beginning of the pile loading stroke of chains 393 and again at the completion of one-half of said pile loading stroke. Under these conditions, upon actuation of the pusher chains 393 to load the leading reserve pile of sheets 385 onto auxiliary elevator 127, the pair of aligned pushers 402 in advance of said pile are engaged at the right angle portions 403 thereof by the arms 469 as said portions move past the sprockets 394 either at the beginning or during said loading operation and tilted forwardly about their pivot pins 405, thus causing said pushers to drop by gravity and project below the upper reaches of chains 393 before they pass around sprockets 394. Thus, each pair of aligned pushers 402 after loading of a new pile of sheets thereby on auxiliary elevator 127 and upon subsequent operation of chains 393 are quickly removed from the path of the next or succeeding new pile of sheets and are prevented from fouling on said elevator.

A transversely extending downwardly curved guard plate 472 (Figs. 1a and 2a) is provided for holding the pushers 402 clear of the fluid control valve mechanism and the upright rectangular frame of main elevator 25 during return movement of said pushers beneath table 384. Plate 472 is supported at opposite ends thereof by brackets 473 bolted thereto and to the feeder side frame members 15, 16.

Control means are provided for discontinuing the operation of auxiliary elevator 127 when the supply of reserve piles of sheets is exhausted and the final reserve pile has been loaded on said elevator and added thereby to a diminished preceding pile on main elevator 25, as hereinbefore described, and for maintaining said main elevator in operation until the last or substantially the last sheet is fed from the final replenished pile thereon, said control means being also effective to discontinue the operation of auxiliary elevator 127 if the loader boy, for some reason, fails to keep the table 384 supplied with piles of sheets resulting in the absence of a pile at elevator loading position on said table. As herein shown, said control means comprises the following elements constructed, mounted, and operated as follows.

Pivotally mounted on the pivot pin 308 in bracket 300 for the trip lever 309 and disposed between said lever and said bracket is a second bell crank trip lever 475 having a forwardly extending arm 476 and a downwardly extending arm 477 (Figs. 1a and 3a). Secured in the free end of arm 476 is a pin 478 which projects inwardly from said arm into the path of vertical movement of the arm 314 of control member 315 on main elevator 25. A stop pin 479 is secured in bracket 300 and projects inwardly therefrom across the front of arm 477 to limit pivotal move-

ment of trip lever 475 in a counter-clockwise direction, as viewed in Fig. 1a, so that the pin 478 on arm 476 will be in proper position for engagement by the arm 314 of control member 315.

It will thus appear that as the main elevator 25 is lowered from raised position with the fingers 26 thereof in retracted position, as hereinbefore described, the control member 315 on said elevator, through engagement of the arm 314 thereof with the pin 478 on trip lever 475, will be swung from the full-line position to the broken-line position, shown in Fig. 1a, aided by the spring 320, at which time the arm 316 of said control member will engage the shoulder 318 on elevator bar 38 and the free end of said arm will project rearwardly beyond said bar, and the arm 314 will be wholly disposed within the recess 319.

The plate 387 of table 384 is provided adjacent the forward end thereof with an elongated opening 480 (Fig. 3a), and projecting upwardly from beneath said table through said opening is a roller 481 that is journalled on an arm 482 (Figs. 2a and 3a). Arm 482 is secured to one end of a rod 483 that extends transversely of table 384 beneath the latter towards the feeder side frame member 15 and is journalled in suitable bearings in brackets 484 bolted to the plates 387 and 386 of said table. Secured to the opposite end of rod 483 is a trip arm 485 (Figs. 1a and 3) which projects upwardly from said rod through a suitable opening 486 formed in plate 386 at the side edge thereof, and then forwardly along the top of said plate adjacent said edge substantially to the vertical bar 38 of main elevator 25. Roller 481 and trip arm 485 are yieldingly urged upwardly by a pull spring 487 having one end connected to an arm 488 secured to rod 483, and the opposite end connected to an inwardly projecting pin 489 secured in the adjacent track member 389.

During normal operation of the feeder and with a reserve pile of sheets 385 in elevator loading position on table 384, the roller 481 is prevented by said pile from moving upwardly through the opening 480 in plate 387, and, hence, the trip arm 485 at this time is positioned as shown in full lines in Fig. 1a. Under these conditions, as the main elevator 25 is lowered with the fingers 26 thereof in retracted position and with the control member 315 swung to the broken-line position shown in Fig. 1a through engagement of the arm 314 thereof with the pin 478 on trip lever 475, as hereinbefore described, the free end of the arm 316 of said control member will engage the free end of the trip arm 485 and, hence, the control member 315, through continued downward movement of main elevator 25 will be swung in a clockwise direction, as viewed in Fig. 1a, and returned to its normal full-line position shown in said figure aided by the spring 320.

With the control member 315 thus returned to its normal position as aforesaid, the operation of auxiliary elevator 127, the replenishing of a preceding diminished pile, and the reloading of said elevator, as hereinbefore described, will proceed as usual. The control member 315 is moved out of operative position by trip pin 478, and into operative position by trip arm 485 each time the main elevator 25 is lowered as long as a reserve pile of sheets 385 is present in loading position on table 384. It will be noted that upon engagement of the arm 314 of control member 315 with the pin 478 on trip lever 475 during intermittent upward movement of main elevator 25, said trip lever will yield in a clockwise direction, as viewed in Fig. 1a, and thus enable said arm to pass beyond said pin after which said trip lever returns to its original positon.

Assuming now that the final reserve pile of sheets 385 has been moved from loading position on table 384 onto the fingers 129 of auxiliary elevator 127. Thereupon, with no reserve pile of sheets present in loading position on table 384, the roller 481 will move upwardly through the opening 480 in plate 387 under the action of spring 487, as shown in broken lines in Fig. 2a, resulting in raising of trip arm 485 to the broken line position shown in Fig. 1a so that the free end thereof will be disposed out of the path of downward movement of the arm 316 of control member 315 on main elevator 25. Accordingly, when the main elevator 25 is lowered to bring the fingers 26 thereof into supporting relation with the final reserve pile of sheets after the latter has been added by auxiliary elevator 127 to the preceding diminished pile, the arm 316 of control member 315 will not engage the trip arm 485, and, hence, said control member will not be returned to its normal full-line position shown in Fig. 1a.

Under these conditions, during intermittent operation of main elevator 25 after transfer of the final replenished pile thereto from auxiliary elevator 127, the control member 315 will remain in its broken-line inoperative position shown in Fig. 1a and, hence, trip lever 309 will not be actuated to effect raising of auxiliary elevator 127 and all further operations incident to the operation of said auxiliary elevator will not occur. Thus, step by step elevation of main elevator 25 will continue under the control of the pile governor roller 224 until the last or substantially the last sheet is fed from the final or last replenished pile on said elevator at which time the feeder and the fluid pump 144 are stopped.

There is thus provided apparatus comprising cooperating double pile elevators and pile conveying and loading means of novel construction, arrangement, and operation for maintaining a continuous supply of sheets on a sheet feeder of the pile type to enable the latter to feed sheets one after another at high speed continuously without interruption for reloading purposes, thus obtaining a very high output of fed sheets.

A particular advantage of the invention is in automatically effecting the pile conveying, loading, and replenishing operations, thus no attention on the part of the operator is required, and the replenishment of a preceding pile is positively assured before the latter is completely exhausted.

Another advantage of the invention is in the replenishing of a preceding pile through adding a new pile of sheets thereto from below while it is still supported on the main elevator and simultaneously withdrawing the supporting means therefor, thus providing in effect a continuous uninterrupted pile of sheets on the feeder and rendering the latter more efficient and more practical for high speed feeding of sheets.

Another advantage of the invention is in the transfer of the replenished pile from the auxiliary elevator to the main elevator for elevation thereby, thus always maintaining an adequate pile of sheets on the feeder whereby the continuous uninterrupted feed of the sheets at

high speed is assured, and providing for lowering of said auxiliary elevator and loading thereof with a new pile of sheets during feeding of the sheets from the preceding replenished pile in readiness to be added thereto when necessary.

Another advantage of the invention is that the pile replenishing operations are effected so rapidly that the replenishing of a preceding pile may be delayed until an increased number of sheets has been fed from said pile with a corresponding greater reduction in the height thereof, thus increasing the time between successive pile replenishing operations resulting in a reduction in the number of said operations required throughout the entire run of the feeder.

Still another advantage of the invention is in the use of hydraulically actuated pile elevator operating mechanisms and electrical control means which greatly simplifies the design, construction, arrangement, and operation of the various units, and provides for ease and reliability in the operation of said units to maintain a continuous pile of sheets on the feeder.

Another advantage of the invention is that the various units are untimed and depend upon each other in the operation thereof, thus the construction of said units is not only further simplified, but the operations thereof at and only at the required time is positively insured.

Although only one embodiment of the present invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that the invention is not limited to said embodiment. Various changes may be made, particularly in the design, arrangement, and mode of operation of the parts illustrated, without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art. For example, mechanical means may be employed for actuating the pile elevators, and mechanical or pneumatic means may be employed for controlling the operations of said elevators and the pile loading mechanism. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. In apparatus of the character described, means for supporting a pile of sheets in position for removal of the sheets one after another from the top thereof, means mounting said supporting means for horizontal movement out of pile supporting position, actuating means for moving said supporting means out of pile supporting position, normally ineffective power means for operating said actuating means, elevator means for supporting and elevating a new pile of sheets to the bottom of the first pile to replenish the latter as sheets are removed from the top thereof, and means engaged by the top of the elevated new pile when the latter reaches the level of the bottom of the first pile for rendering said power means effective to operate said actuating means and move said first-named supporting means out of pile supporting position whereby the remainder of said first pile is deposited on and combined with said new pile.

2. In apparatus for handling sheets, retractible means for supporting a pile of sheets in position for removal of the sheets one after another from the top thereof, actuating means for moving said retractible means in a horizontal direction from pile supporting position, normally ineffective power means for operating said actuating means, elevator means for supporting and elevating a new pile of sheets to the bottom of the first pile to replenish the latter as sheets are removed from the top thereof, and control means carried by and movable relative to said retractible means and engaged by the top of the elevated new pile for rendering said power means effective to operate said actuating means and move said retractible means from pile supporting position whereby the remainder of said first pile is deposited on and combined with said new pile.

3. In apparatus of the character described, a pile elevator including a retractible support for a pile of sheets, normally inoperative mechanism for retracting said support in a horizontal direction out of pile supporting position, means for raising said elevator during removal of sheets from the top of the pile on said support and until the latter reaches a certain height, a second pile elevator operable auotmatically under the control of said first-named elevator when said support reaches said height for raising a new pile of sheets towards the elevated preceding pile, and means for rendering said mechanism operative to retract said support from pile supporting position as said new pile reaches the level of the bottom of the preceding pile.

4. In apparatus of the character described, a pile elevator including a retractible support for a pile of sheets, normally inoperative mechanism for retracting said support in a horizontal direction out of pile supporting position, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, a second pile elevator operable automatically under the control of said first-named elevator when said support reaches said height for raising a new pile of sheets to the bottom of the elevated diminished pile, means operable automatically under the control of said new pile for rendering said mechanism operative as said new pile reaches the level of the bottom of the diminished pile to retract said support out of supporting relation to said diminished pile, and means for controlling the operation of said second elevator to effect further raising of the pile thereon when said support is retracted and as sheets are removed from the top of said pile.

5. In apparatus of the character described, a first elevator for supporting and raising a pile of sheets until the latter is diminished through removal of sheets from the top thereof, a second elevator disposed below said first elevator for supporting, raising, and adding a new pile of sheets to the bottom of the diminished pile on said first elevator, and means controlled by said first elevator and controlling the operation of said second elevator.

6. In apparatus for handling sheets, a main elevator including a retractible support for a pile of sheets, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, an auxiliary elevator disposed below said main elevator for supporting a new pile of sheets, means controlled by said main elevator when said support reaches said height for raising said auxiliary elevator and said new pile to add the latter to the bottom of the elevated diminished pile, and means for retracting said support out of supporting relation to the diminished pile as said new pile is added to said diminished pile.

7. In apparatus for continuously presenting

sheets for removal one after another from a supply thereof, a main elevator including a retractible support for a pile of sheets, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, an auxiliary elevator disposed below said main elevator for supporting a new pile of sheets, means controlled by said main elevator when said support reaches said height for raising said auxiliary elevator to add said new pile to the bottom of the elevated diminished pile and thereby replenish the latter, means for retracting said support out of supporting relation to the diminished pile as said new pile is added to said diminished pile, and means controlled when said support is retracted for controlling the operation of said auxiliary elevator operating means to effect further raising of said auxiliary elevator as sheets are removed from the top of the replenished pile thereon.

8. In apparatus for continuously presenting sheets for removal one after another from a supply thereof, a main elevator including a relatively movable support for a pile of sheets, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, an auxiliary elevator disposed below said main elevator for supporting a new pile of sheets, means controlled by said main elevator when said support reaches said height for raising said auxiliary elevator to add said new pile to the bottom of the elevated diminished pile and thereby replenish the latter, means for moving said support relative to the diminished pile as said new pile is added to said diminished pile, and means controlled by the operation of said last-named means for rendering said auxiliary elevator operating means effective to further raise said auxiliary elevator as sheets are removed from the top of the replenished pile thereon.

9. In apparatus of the character described, a main elevator including a relatively movable support for a pile of sheets, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, an auxiliary elevator disposed below said main elevator for supporting a new pile of sheets, means controlled by said main elevator when said support reaches said height for raising said auxiliary elevator to add said new pile to the bottom of the elevated diminished pile, and means controlled by the elevated new pile for moving said support out of supporting relation to the diminished pile as said new pile is added to said diminished pile.

10. In apparatus for handling sheets, a main elevator including a retractible support for a pile of sheets, means for raising said elevator until said support reaches a certain height and said pile is diminished through removal of sheets from the top thereof, an auxiliary elevator disposed below said main elevator for supporting a new pile of sheets, means controlled by said main elevator when said support reaches said height for raising said auxiliary elevator to add said new pile to the bottom of the elevated diminished pile and thereby replenish the latter, means controlled by the elevated new pile for retracting said support relative to the diminished pile as said new pile is added to said diminished pile, and means controlled when said support is retracted for rendering said auxiliary elevator operating means effective to further raise said auxiliary elevator as sheets are removed from the top of the replenished pile thereon.

11. In apparatus for supporting, elevating and replenishing piles of sheets, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and directly thereafter downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, means for imparting said upward and downward movements to said main support, means for imparting said lateral movements to said main support, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile, said main and auxiliary pile supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support, and means for imparting said upward and downward movements to said auxiliary support.

12. In apparatus of the character described, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and directly thereafter downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, power means for automatically imparting said upward, downward, and lateral movements to said main support, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile, said main and auxiliary pile supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support, and power means for automatically imparting said upward and downward movements to said auxiliary support.

13. In apparatus for supporting, elevating, and replenishing piles of sheets, a main support for normally supporting a pile of sheets and operable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and directly thereafter downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, power means for imparting said upward, downward, and lateral movements to said main support, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and operable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile, said main and auxiliary pile supports comprising a plurality of transversely spaced portions so arranged to enable the

portions of said main support to move between the portions of said auxiliary support, power means for imparting said upward and downward movements to said auxiliary support, and means for controlling said operations of said main and auxiliary supports so that they occur in the order named and that each succeeding operation is responsive to and dependent upon each preceding operation.

14. In apparatus of the character described, a main support for normally supporting a pile of sheets and operable upwardly step by step until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and directly thereafter downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof step by step until it is diminished, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and operable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support, power means for imparting said upward and downward movements to said main and auxiliary supports and said lateral movements to said main support, means controlled by the first pile through removal of sheets therefrom for controlling the upward movement of said main support, means controlled by said main support through upward movement thereof and through lateral movement thereof into supporting relation with the new or replenished pile for controlling the upward and downward movements, respectively, of said auxiliary support, means controlled by said new pile and by said main support through downward movement thereof for controlling the lateral movements of said main support out of supporting relation with the diminished pile and into supporting relation with the new or replenished pile, respectively, and means controlled when said main support is moved out of supporting relation to the diminished pile and is disposed in supporting relation with the new or replenished pile for controlling the downward movement of said main support and the step by step upward movement of the new or replenished pile thereby, respectively.

15. In apparatus for continuously presenting sheets for removal one after another from a supply thereof, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and directly thereafter downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, means for imparting said upward and downward movements to said main support, means for imparting said lateral movements to said main support, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and continue the elevation of the replenished pile until said main support is disposed in supporting relation therewith, and then downwardly to normal position to receive a succeeding new pile of sheets, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support, and means for imparting said upward and downward movements to said auxiliary support.

16. Apparatus as claimed in claim 14, wherein the auxiliary support is adapted to raise the replenished pile step by step until the main support is disposed in supporting relation therewith, and the pile controlled means is effective to control the step by step upward movement of both main and auxiliary supports independently of each other.

17. Apparatus as claimed in claim 14, wherein the auxiliary support is adapted to raise the replenished pile step by step until the main support is disposed in supporting relation therewith, and the pile controlled means is effective to control the step by step upward movement of both main and auxiliary supports independently of each other, and including means controlled when the main support is moved out of supporting relation to the diminished pile for rendering the pile controlled means effective to control the step by step upward movement of the auxiliary support.

18. In apparatus of the character described, a main elevator, an auxiliary elevator normally disposed below said main elevator, and means for moving said main elevator upwardly, then laterally in one direction, then downwardly and then laterally in the other direction from a position above said auxiliary elevator to a position below the same, and for moving said auxiliary elevator upwardly and then downwardly to normal position below said main elevator.

19. In apparatus of the character described, a main elevator, an auxiliary elevator normally disposed below said main elevator, power means for raising and lowering each of said elevators and for imparting lateral movement to said main elevator, and means for controlling the movements of said elevators to cause the main elevator to move laterally in one direction, then downwardly and then laterally in the other direction from a position above the auxiliary elevator to a position below the same and to cause said auxiliary elevator to then move downwardly to normal position below said main elevator.

20. In apparatus of the class described having a pile elevator, of pile loading means therefor comprising a support disposed laterally of said elevator at loading position and on which a plurality of piles of sheets rest one behind the other with the first or leading pile disposed adjacent said elevator, a pair of endless chains extending along said support beneath said piles, a plurality of upwardly projecting pile engaging pushers pivotally mounted on said chains at corresponding positions thereon and spaced therealong equal distances apart, means for guiding said chains and said pushers during movement thereof along said support, means for driving said chains and said pushers to advance said piles along said support and to advance the first pile from said support and into proper position on said elevator, and automatically operated means

for rapidly moving the pair of pushers in advance of said first pile forwardly and downwardly relative to said chains upon loading of said first pile on said elevator, said last-named means comprising levers operable to engage said pair of pushers and to impart to the latter a thrust relative to and in the direction of movement of said chains, and cam means for operating said levers.

21. In apparatus for supporting, elevating, and replenishing piles of sheets, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and then downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile to receive a succeeding new pile of sheets thereon, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support, means for imparting said upward and downward movements to said main and auxiliary supports and said lateral movements to said main support, a reserve pile support disposed at one side of said auxiliary support in the normal position of the latter and on which a plurality of reserve piles of sheets normally rest one behind the other and with the first or leading reserve pile disposed adjacent said auxiliary support, and means operable when said auxiliary support is disposed in normal position to advance said first reserve pile from said reserve pile support and onto said auxiliary support and to advance the next or succeeding reserve pile into the position vacated by said first reserve pile.

22. In apparatus for supporting, elevating, and replenishing piles of sheets, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and then downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile to receive a succeeding new pile of sheets thereon, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support automatically operated means for imparting said upward and downward movements to said main and auxiliary supports and said lateral movements to said main support, a reserve pile support disposed at one side of said auxiliary support in the normal position of the latter and on which a plurality of reserve piles of sheets normally rest one behind the other and with the first or leading reserve pile disposed adjacent said auxiliary support, and means automatically operated when said auxiliary support reaches normal position for advancing said reserve piles along said reserve pile support and for advancing the first reserve pile therefrom and onto said auxiliary support.

23. In apparatus for supporting, elevating, and replenishing piles of sheets, a main support for normally supporting a pile of sheets and movable upwardly until said pile is diminished through removal of sheets from the top thereof, then laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, and then downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, an auxiliary support normally disposed below said main support for supporting a new pile of sheets and movable upwardly when the first pile is diminished to add said new pile to the bottom thereof and then downwardly to normal position when said main support is disposed in supporting relation with the new or replenished pile to receive a succeeding new pile of sheets thereon, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to enable the portions of said main support to move between the portions of said auxiliary support power means for imparting said upward and downward movements to said main and auxiliary supports and said lateral movements to said main support, a reserve pile support disposed at one side of said auxiliary support in the normal position of the latter and on which a plurality of reserve piles of sheets normally rest one behind the other and with the first or leading reserve pile disposed adjacent said auxiliary support, power operated means for advancing said reserve piles along said reserve pile support and for advancing the first reserve pile therefrom and onto said auxiliary support when the latter is lowered to normal position, and means for controlling the operations of said main and auxiliary supports and of said reserve pile advancing means so that they occur in the order named and that each succeeding operation is responsive to and dependent upon each preceding operation.

24. In apparatus of the character described, a main support for normally supporting and raising a pile of sheets until said pile is diminished through removal of sheets from the top thereof, an auxiliary support normally disposed in loading position below said main support for supporting and raising a new pile of sheets to add said pile to the bottom of the diminished first pile, said main support being movable laterally out of supporting relation to the diminished pile as said new pile is added thereto, then downwardly and laterally into supporting relation with the new or replenished pile to continue the elevation thereof until it is diminished, and said auxiliary support being movable downwardly to normal loading position when said main support is disposed in supporting relation with the new or replenished pile, said main and auxiliary supports comprising a plurality of transversely spaced portions so arranged to permit the portions of said main support to move between the portions of said auxiliary support automatically operated means for raising and lowering said main and auxiliary supports and for imparting

said lateral movements to said main support, a reserve pile support disposed laterally and at the loading position of said auxiliary support and on which a plurality of reserve piles of sheets rest one behind the other and with the first or leading reserve pile disposed adjacent said auxiliary support, means automatically operated when said auxiliary support reaches loading position for advancing said reserve piles along said reserve pile support and for advancing the first reserve pile therefrom and onto said auxiliary support, said operations of said main and auxiliary supports and of said reserve pile advancing means continuing in the order named until the last or final reserve pile is loaded on said auxiliary support, and means controlled by the last or final reserve pile upon loading thereof on said auxiliary support for maintaining said main support in operation after said final pile has been added to the diminished next to last pile and transferred to said main support to enable removal of all or substantially all of the sheets from said final pile.

25. In apparatus of the character described, a pile elevator, a carriage including a pair of parallel shafts mounted on said elevator for relative lateral movement, and means on said carriage and comprising a plurality of horizontally disposed fingers pivotally mounted on one of said shafts in axial spaced relation and engaged with the other of said shafts for supporting a pile of sheets.

26. In apparatus of the character described, a supporting frame, a pile elevator comprising an upright rectangular supplemental frame, vertical trackways on said supporting frame for guiding said supplemental frame for straight line vertical movement, a carriage comprising a pair of parallel shafts, horizontal trackways on said supplemental frame for guiding said carriage for straight line horizontal movement relative to said supplemental frame, and a plurality of horizontally disposed fingers pivotally mounted on one of said shafts in axial spaced relation and engaged with the other of said shafts for supporting a pile of sheets.

27. In apparatus of the character described, a main elevator for supporting and raising a pile of sheets until the latter is diminished through removal of sheets from the top thereof, an auxiliary elevator for raising and adding a new pile of sheets to the bottom of the diminished first pile, a first cylinder, a piston in said cylinder and connected with said main elevator, a second cylinder, a piston in said second cylinder and connected with said auxiliary elevator, pump means for supplying fluid into said first and second cylinders, pile controlled valve means controlling the delivery of fluid into said first and second cylinders by said pump means, valve means disposed between said pile controlled valve means and said first and second cylinders and movable in one direction to enable delivery of fluid into said first cylinder under the control of said pile controlled valve means and prevent delivery of fluid into said second cylinder when the pile is supported on said main elevator and movable in the opposite direction to enable delivery of fluid into said second cylinder under the control of said pile controlled valve means and prevent delivery of fluid into said first cylinder when the new pile has been added to the diminished pile and the combined diminished and the new piles are supported on said auxiliary elevator, and other valve means disposed between said pump means and second cylinder and operable independently of said first and second-named valve means for connecting said pump means with said second cylinder and effect rapid and continuous upward movement of said auxiliary elevator and said new pile thereon when said main elevator reaches a certain height and the pile thereon is diminished.

28. In apparatus of the character described, a main elevator for supporting and raising a pile of sheets until the latter is diminished through removal of sheets from the top thereof and movable laterally out of supporting relation to the diminished pile as the latter is replenished with a new pile of sheets, an auxiliary elevator for raising and adding a new pile of sheets to the bottom of the diminished first pile to replenish the latter, a first cylinder, a piston in said cylinder and connected with said main elevator, a second cylinder, a piston in said second cylinder and connected with said auxiliary elevator, continuously operated pump means for supplying fluid into said first and second cylinders, pile controlled valve means controlling the delivery of fluid into said first and second cylinders by said pump means, directional valve means disposed between said pile controlled valve means and said first and second cylinders and movable in one direction to enable delivery of fluid into said first cylinder under the control of said pile controlled valve means and prevent delivery of fluid to said second cylinder when the pile is supported on said main elevator and movable in the opposite direction to enable delivery of fluid into said second cylinder under the control of said pile controlled valve means and prevent the delivery of fluid into said first cylinder when the new pile has been added to the diminished pile and the combined diminished and new piles are supported on said auxiliary elevator, means controlled by the lateral movement of said main elevator out of supporting relation to the diminished pile for moving said directional valve means in said opposite direction, other valve means disposed between said pump means and second cylinder and operable independently of said first and second-named valve means for connecting said pump means with said second cylinder and effect rapid and continuous upward movement of said auxiliary elevator and new pile thereon, and means controlled by said main elevator for operating said other valve means when said main elevator reaches a certain height and the pile thereon is diminished.

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