June 25, 1935. H. C. PIERCE 2,005,906

BOX STACKER

Filed Feb. 7, 1933 3 Sheets-Sheet 1

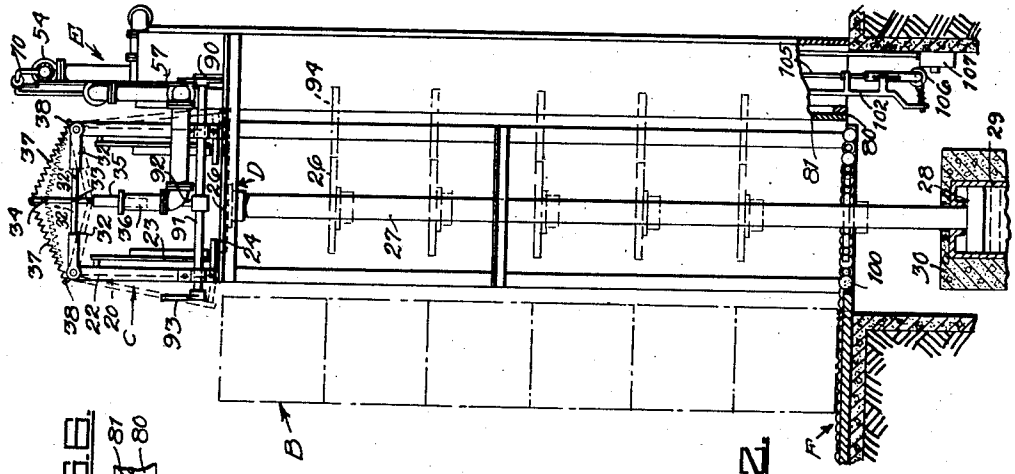


FIG. 2.

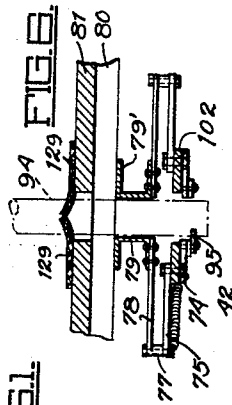


FIG. 6.

FIG. 1.

FIG. 15.

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June 25, 1935. H. C. PIERCE 2,005,906

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FIG. 3.

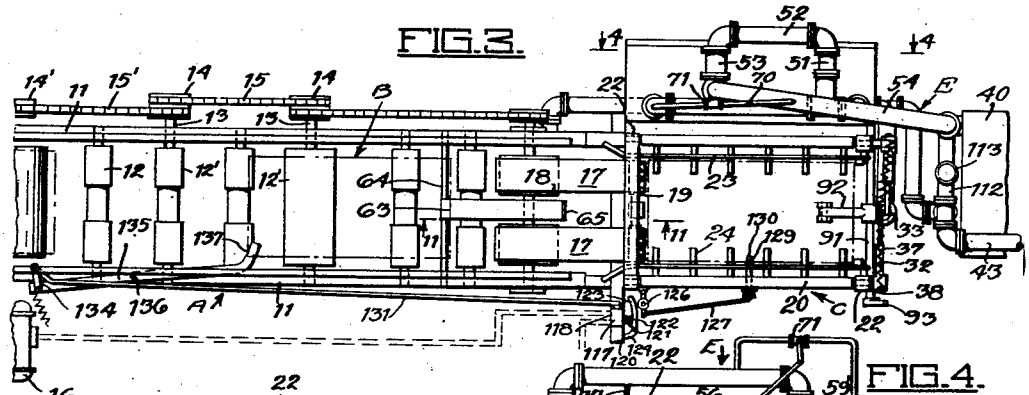


FIG. 4.

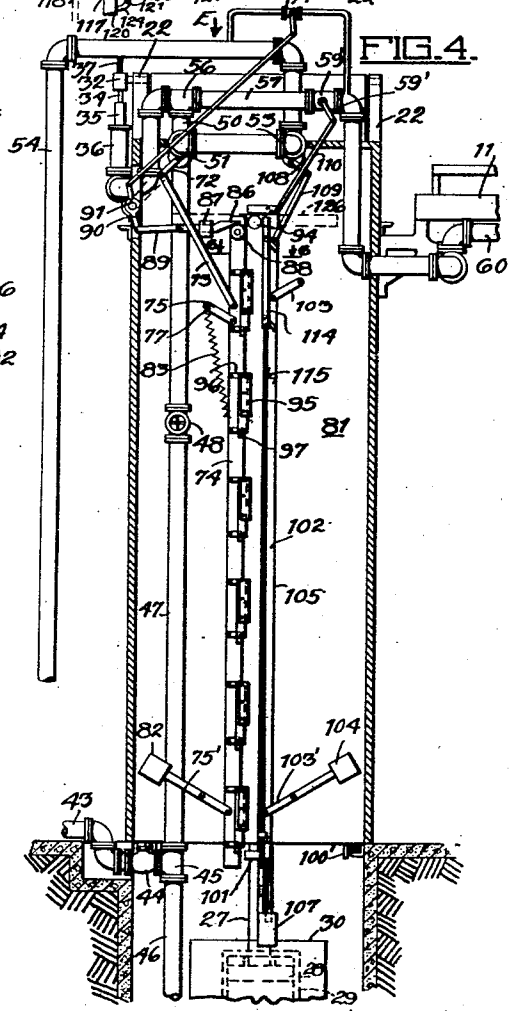


FIG. 5.

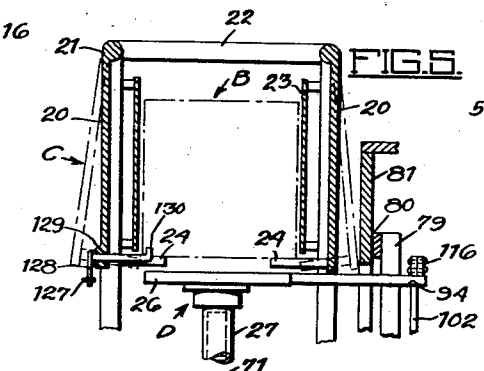


FIG. 12.

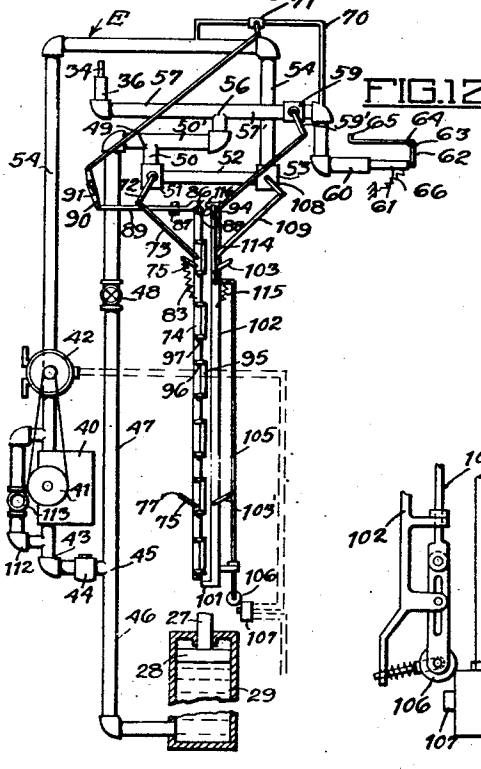


FIG. 10.

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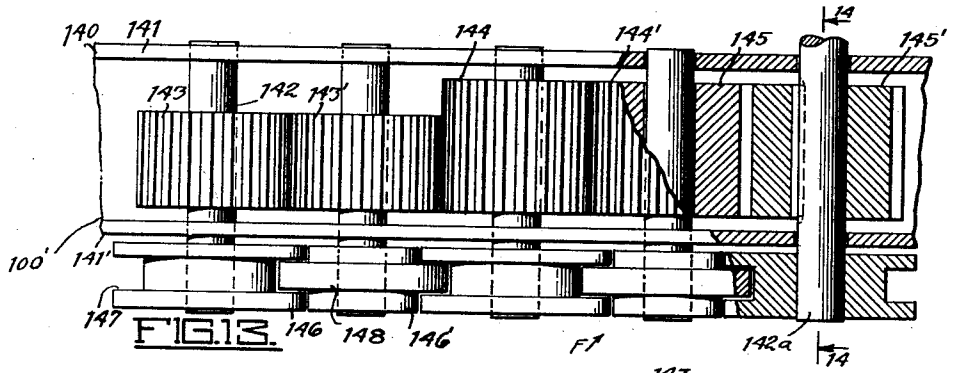


FIG. 13.

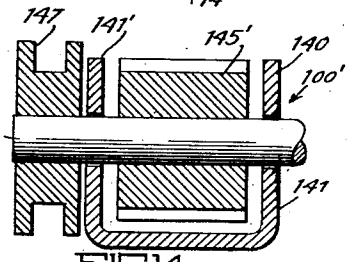
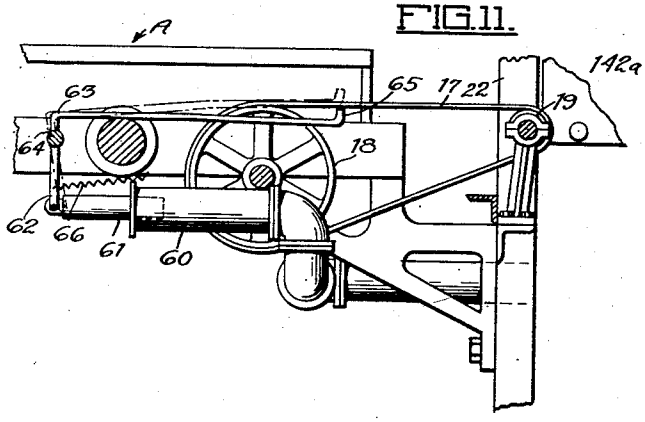


FIG. 14.

FIG. 11.



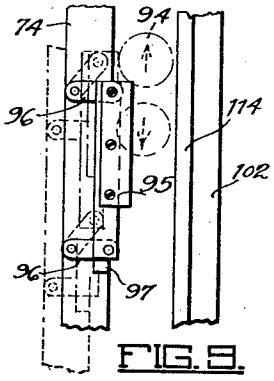
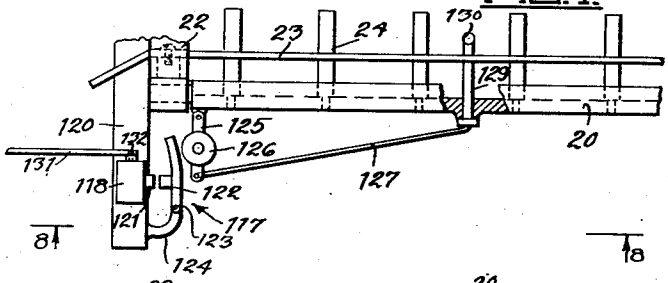


FIG. 9.

FIG. 7.



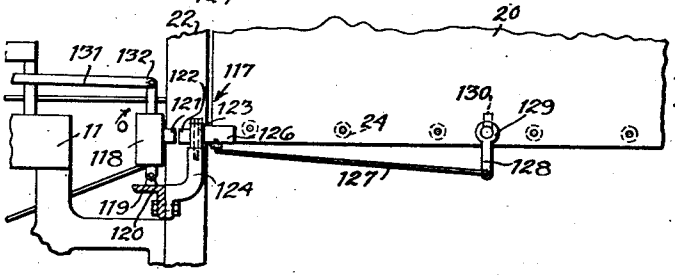


FIG. 8.

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Patented June 25, 1935 2,005,906

UNITED STATES PATENT OFFICE

2,005,906

BOX STACKER

Harold C. Pierce, Anaheim, Calif., assignor, by direct and mesne assignments, to Food Machinery Corporation, a corporation of Delaware

Application February 7, 1933, Serial No. 655,607

21 Claims. (Cl. 214—6)

This invention has to do in a general way with machines for stacking articles, and is more particularly related to improvements in machines for stacking and moving crates or boxes such as are used in fruit packing houses and the like.

It is a primary object of my invention to produce a machine of the class described wherein the boxes or other articles, conveyed by means of a suitable conveyor along one level, are automatically stacked one on top of the other and the stack then conveyed along a lower level.

I am aware of the fact that machines contemplating the same general result just mentioned have been produced. These machines consist in a general way of an upper conveyor which delivers the boxes into what is termed a gate, such gate being associated with a motor driven mechanism for mechanically opening the same to deposit the articles onto a mechanically operated elevator. The elevator is moved downwardly in a step by step manner as the boxes are released from the gate so that the articles are stacked one on top of the other. This downward movement of the elevator is controlled by means of clutches which are thrown into engagement and disengagement by mechanically operated trip mechanisms. As the elevator reaches its lower level, the boxes are deposited upon a lower conveyor which carries them away from the elevator platform, and as the boxes clear the elevator platform they engage a trip lever which actuates another clutch mechanism operating through the medium of gears and cables to raise the elevator platform to a position below the gate.

The operation of a mechanically operated machine of this nature, the movements of which are controlled by grab clutches, is obviously noisy and jerky so that the articles are subjected to more or less rough handling which is liable to damage delicate fruit, and which decreases, to a certain extent the life of the boxes or crates. Furthermore, since the material in the boxes or crates in many instances is quite dirty, the dirt accumulates over the entire machine, grinding on the gears and wearing surfaces greatly decreasing the life of the machines and necessitating frequent overhauling and replacement of parts.

It therefore, becomes a primary object of this invention to eliminate all of these difficulties by producing a machine for stacking boxes and the like wherein the moving parts are operated hydraulically or through the medium of a pressure fluid. This not only provides a machine which operates smoothly and quietly, but it provides one in which the moving means is entirely enclosed, and the wear is therefore negligible. Furthermore, my invention contemplates a machine in which the speed of operation may be easily and conveniently controlled merely by the adjustment of a valve. The hydraulic operating means also provides a machine wherein all of the operating parts are controlled through a single medium (the pressure fluid) so that there is no danger of one element, for example the trap, continuing to operate when the other element, the elevator for example, may cease functioning. This is not true of a mechanically operated machine wherein one of the clutches or operating mechanisms may become broken or ineffective while the other remains operative.

As was mentioned above, in the mechanically operated machine the upward movement of the elevator is controlled by a trip lever adapted to be engaged by the bottom article in a stack as the stack is traversed along the lower conveyor. It frequently happens in actual operation of these machines that a piece of fruit or other article may lodge on the floor of the bottom conveyor in front of the trip lever. When this happens the bottom box engages the fruit which throws the trip before the stack has cleared the elevator platform. This immediately brings into action the elevator raising means which raises the elevator platform into engagement with the rear edge of the bottom box tipping the stack over, and, since, in operation there are a number of stacks or boxes lined up in spaced relation with each other along the bottom conveyor, the tipping of the first stack knocks the next stack over and so on, spilling all of the boxes on the bottom conveyor, thereby damaging the fruit and necessitating a shut-down for a substantial period before the device can again be put into operation.

In the device contemplated by this invention, the upward movement of the elevator is controlled by a pressure relief by-pass valve which carries the pressure fluid away from the elevator as long as there is any weight on the platform. In other words, the by-pass valve is adjusted so that the source of pressure fluid will lift the weight of the platform only. Any additional weight on the platform is effective to open the relief valve and by-pass the pressure fluid. In this maner the possibility of tipping over the stacks of boxes in the manner just described, is completely eliminated.

It is a further object of my invention to provide a stacking machine of the class described wherein a safety stop is positioned in the top conveyor,

such stop being hydraulically operated by the means which control the movement of the elevator and the article releasing mechanism so as to prevent the delivery of articles or boxes into the trap or gate at any time when the elevator is moving.

It is a further feature of this invention that another safety device is provided in connection with the top conveyor driving mechanism which is effective to stop the top conveyor in the event a broken box or other article is lodged in the trap and does not fall therethrough.

The general construction of the device contemplated by this invention comprises a top conveyor and a bottom conveyor which are preferably disposed in planes at right angles to each other, and which are associated with suitable means for driving the same. The top conveyor is adapted to deliver the articles to be stacked into a trap designed to support one of the articles, and an elevator having a platform on its upper end is positioned below the trap for receiving the articles released therefrom.

The elevator is adapted to be raised and held in elevated positions by means of a pressure fluid coming from a suitable source such as a pump, and the pressure fluid system is designed so that when the elevator has been raised to its upper position the pump may be stopped and the elevator is held in this position by means of a suitable check valve associated with the pump and an automatically operated by-pass valve, the operation of which is controlled by a trip lever adapted to be engaged by an article received in the trap.

Hydraulic means tied in with the pressure fluid system are provided for holding the trap closed and additional means are provided for opening the trap. The last mentioned means are constructed so that when the by-pass valve is opened to release the pressure fluid and permit the downward movement of the elevator, the trap opening means become effective to swing the trap open and release an article onto the elevator platform.

Means associated with the elevator are provided for holding the by-pass valve open until the elevator reaches a predetermined point at which other means become effective to close the by-pass valve, thereby stopping the elevator and closing the gate.

The details in the construction of a preferred form of my invention, together with other objects attending its production, will be best understood from the following description of the accompanying drawings which are chosen for illustrative purposes only, and in which—

Fig. 1 is an elevational view partly broken away showing a preferred form of the invention and illustrating an article such as a box or crate as being delivered into the trap by means of the top conveyor;

Fig. 2 is an elevational view which may be considered as having been taken in a plane represented by the line 2—2 in Fig. 1;

Fig. 3 is a plan view of the device shown in Figs. 1 and 2.

Fig. 4 is a sectional elevation taken in a plane represented by the line 4—4 in Fig. 3;

Fig. 5 is a fragmentary sectional elevation taken in a plane represented by the line 5—5 in Fig. 1;

Fig. 6 is a plan section taken in a plane represented by the line 6—6 in Fig. 4;

Fig. 7 is a fragmentary plan view showing one side of the trap and illustrating the construction of a safety switch which controls the operation of the delivery conveyor;

Fig. 8 is an elevational view partly in section which may be considered as having been taken in a plane represented by the line 8—8 in Fig. 7;

Fig. 9 is an enlarged fragmentary elevation illustrating the details in the construction of the valve and switch control release which are associated with and operated by the elevator;

Fig. 10 is an enlarged fragmentary elevational view showing the details in the construction of the lower end of the switch control rail;

Fig. 11 is an enlarged sectional elevation taken in a plane represented by the line 11—11 in Fig. 3;

Fig. 12 is a diagrammatic view showing the arrangement of the pressure system and the valve and switch operating mechanism;

Fig. 13 is an enlarged plan view illustrating the details in the construction of a preferred form of conveyor mechanism which is especially adapted for use in a stacking machine contemplated by this invention;

Fig. 14 is a sectional elevation taken in a plane represented by the line 14—14 in Fig. 13; and

Fig. 15 is a sectional elevation on line 15—15 of Fig. 1.

More particularly describing the invention as herein illustrated, reference letter A indicates a delivery or elevated conveyor adapted to deliver articles such as crates or boxes B into a trap generally indicated by reference letter C.

An elevator, generally indicated at D, is positioned below the trap adapted to receive the articles released therefrom, such elevator being raised and held in an elevated position by hydraulic means which include a pressure fluid system generally indicated by reference letter E.

When the elevator reaches its lowermost position, the stack of boxes carried thereby is removed from the elevator platform by means of a removing or lower conveyor indicated generally by reference letter F.

The upper conveyor A, which may be of any conventional type of conveyor, is shown as comprising a pair of spaced frame members 11 which are supported in any suitable manner such as by means of standards, not shown, such frame members being provided with bearings for supporting conveyor rolls, generally indicated by reference numerals 12 and 12'.

The alternate rolls in the series are provided with projecting shafts 13 which in turn are keyed to sprockets or pulleys 14 and are interconnected by means of belts or chains indicated at 15.

Reference numeral 16 indicates a suitable source of power, such as an electric motor, the shaft of which, not shown, extends through the shaft on one of the rollers, such shaft being provided at its opposite end with a sprocket or pulley member 14' which is engaged by one of the belts or chains 15'. In this manner the driven rolls in the series are all operated from the one source of power and are effective, through their rotation, to move the article B along the conveyor.

The article B is delivered from the roll series into the trap C by means of a pair of belts indicated at 17 such belts being mounted upon driven pulleys 18 and idle pulleys 19. The idle pulleys are positioned partially within the trap C.

The trap C, in this form of my invention, comprises a pair of doors or panels 20 which are pivotally mounted at their upper edges as indicated at 21 in a trap frame 22.

The trap frame 22 is provided with fixed side

panels 23 adapted to form lateral guides for the articles received in the trap, and the swinging side panels 20 are provided at their lower edges with inwardly extending roll fingers 24 which are adapted to support an article received in the trap and are of a length such that when the swinging side panels 20 are swung outwardly into the dot and dash lines shown in Fig. 5 they release the article held in the trap and permit the same to fall upon a platform 26, which forms a part of the elevator D, or upon a box or article which is supported by the platform.

The elevator D, in addition to the platform 26, comprises a vertical rod or standard 27 which is secured at its lower end portion to a piston member 28 slidably mounted in a hydraulic or pressure fluid cylinder 29 shown as being enclosed within a block 30.

The upper edges of the swinging panels 20 are provided at their forward ends with rigidly mounted socket arms 32 which contain slidable bars 32' that extend inwardly equal distances to a central point at which the bars 32' are pivoted, as indicated at 33, to a vertical reciprocating rod 34 which is mounted on the upper end of a plunger 35 slidably received in a pressure fluid cylinder 36. The rod 34 extends a substantial distance above the pivot point 33, and a pair of tension springs 37 are secured to the top of the rod and extend downwardly to projections 38 on the pivoted ends of the arms 32.

From this construction it will be seen that as long as there is a substantial pressure in the pressure fluid cylinder 36, the plunger 35 will be forced into its upper position shown in full lines in Fig. 2, thereby maintaining the trap panels in their closed position, and when the pressure behind the piston 35 is released, the action of the tension springs 37 will be effective to draw the rod 34 downwardly, swinging the trap panels outwardly into the broken line position shown in Fig. 2.

The pressure fluid system E, which is employed to actuate the mechanism embodied in the stacking machine, may be best described with reference to Fig. 12 where it is shown as comprising a fluid storage reservoir and pump generally indicated at 40, such pump having a heavy flywheel 41 actuated by a motor 42.

The pump 40 has an outlet or pressure conduit 43 which leads through a check valve 44 to a T-section 45, one leg 46 of which constitutes a conduit which leads to the bottom of the pressure cylinder 29, and the other leg 47 of which leads through a speed adjusting valve 48 to another T-section 49.

One leg 50, of the T-section 49, is connected through a pressure release valve 51, which is normally closed, and a conduit section 52 to a pressure cylinder control valve 53, which is normally open. The pressure cylinder control valve 53 is in turn connected to a fluid return conduit 54 which leads back to the pump reservoir 40. The other leg 50' of the T-connection 49 leads to a third T-connection 56.

One leg 57, of this last mentioned connection leads to the trap operating cylinder 36. The other leg 57', of the T-connection 56, leads through a stop control valve 59 to a stop cylinder 60. The stop cylinder 60, as shown in Fig. 11, is positioned below the end portion of the conveyor which is adjacent the trap and contains a plunger 61 which is pivotally attached to a leg 62 of a bell crank 63.

The bell crank 63 is pivotally mounted in the conveyor frame on a shaft 64 and its other leg extends along the conveyor and has a stop projection 65 on its end. The bell crank 63 is normally held against the action of a tension spring 66 in a position such that the stop projection 65 is retracted or held below the line of travel of articles in the conveyor. In other words, the upper edge of this stop 65 is normally positioned below the upper surfaces of the belt members 17 for delivering articles into the trap.

When the pressure fluid in the cylinder 60 is released, however, the tension spring 66 is effective to pull the leg 62 forward, thereby raising the projection 65 into a position at which it will be engaged by an article in the conveyor so as to prevent, under such circumstances, the continued movement of the article into the trap. When the trap is closed and the elevator is stationary, the valve 59 is open so that the stop is held in the full line position shown in Fig. 11, the valve 51 under such circumstances being closed. When the valve 51 is opened, however, thereby releasing the pressure fluid from behind the piston 28, this correspondingly releases the pressure from behind the piston 35 and the piston 61.

The release of pressure behind the last mentioned piston permits the tension spring 66 to pull the piston rearwardly and raise the stop 65. Similarly the release of pressure behind the piston 35 permits the tension springs 37 to pull the rod 34 downwardly and open the trap thereby releasing an article contained therein. Also the release of pressure from behind the elevator piston 28, permits the weight of the platform to force the elevator downwardly.

When the elevator is being raised, however, it is desirable that the valve 59, which as pointed out above is normally open, be closed. At the same time, it is desirable under these circumstances that the stop 65 be raised. For this purpose, therefore, I provide a bleeder conduit 70 which leads from a point in the conduit 57' ahead of the valve to a point in the rear conduit 54. This bleeder conduit is provided with a valve 71.

The valve 51, which controls the release of pressure fluid is provided with an actuating arm 72 connected through a suitable link 73 with, what I may term, a rail member 74. This rail member 74 is supported by two or more vertically spaced links 75, such links being connected as illustrated in Fig. 6 to a pivot pin 77 mounted on the outer end of a rigid arm 78, which in turn is secured to a guide channel 79 mounted on the rear face of a frame member 80. The frame member 80 is in turn secured to the bottom portion of a cross member 81. The weight of the rail 74 is counterbalanced by means of a weight 82 which is mounted on the end of an extended lever or link arm 75'. The rail 74 is normally held in its upper position shown in full line in Fig. 4 by means of a tension spring 83. In this manner the pressure releasing valve 51 is normally maintained in its closed position and can be opened only by a downward movement of the rail. In view of the manner in which the rail is pivotally mounted, such downward movement is accompanied by a lateral movement which swings the rail away from its full line position as indicated in broken lines in Fig. 9.

The initial downward and outward movement of the rail 74 is effected by a reciprocating cam member 86 which is slidably mounted in a guide member 87 and has a sloping nose engaging a roller 88 mounted on the upper end of the rail. This cam member 86 has its rear end pivotally at-

tached to a link 89 which in turn is attached to a lever member 90 mounted on a shaft 91 which extends along the lower front edge of the trap compartment and has rigidly mounted on its mid-portion a tongue member 92 which is adapted to be engaged and moved by an article entering the trap. The extending end of the shaft 91 is provided with a handle 93 for manually operating the same.

It will be observed from the broken line position of the trip lever 92 in Fig. 1 that when this lever is moved to a valve opening position its upper end is still off center with respect to the axis of rotation of the lever so that the weight of the lever itself is effective to rotate the valve into a closing position as soon as the lever is cleared by the article moving downwardly through the trap.

It will also be apparent that the lever 92 of itself can be effective to hold the valve open only during such time as it is engaged by an article passing downwardly through the trap. It is necessary, therefore, in order to completely remove the article from the trap and to a point at which the trap can be closed, that the valve must be held open until the elevator reaches a position at which the top of the article lies below the closing plane of the trap finger 24. In other words, it is necessary to hold the pressure release valve 51 open until the elevator platform reaches a predetermined position. This must be done repeatedly throughout the downward movement of the elevator, depending upon the number of articles desired in the stack, and is accomplished through the medium of an extending bar or rod 94 which is formed either on the elevator platform 26 or on the elevator shaft 27.

This bar or rod extends between the guide channels 79 and 79' into a position at which it lies adjacent the rail 74. The rail at the proper points along its length is provided with projecting plates 95 mounted thereon for upward swinging movement by means of links 96 and held against downward swinging movement by means of stops 97. These projecting plates are positioned so as to be engaged by the member 94 prior to the inward movement of the latch finger 92 so that the member 94 is effective through its engagement with the stop members to hold the pressure releasing valve 51 open for a substantial period after the finger 92 drops into its full line position.

When the platform has been lowered to a predetermined point at which the uppermost article is situated with its upper edge below the closing plane of the trap fingers, the projecting members are constructed so as to be cleared by the member 94 whereby the rail 74 is pulled inwardly and upwardly by means of the tension spring 83 to close the pressure releasing valve 51, thereby building up pressure in the pressure fluid system to stop the downward movement of the elevator, close the trap, and retract the stop 65 in the manner described hereinabove. This step by step operation which attends the delivery of each box or article into the trap continues until the elevator platform reaches its lowermost position as shown in broken lines in Fig. 1.

At this point the bottom of the lowermost box, at its ends, rests upon traveling conveyor members indicated at 100 and 100'. At the same time the projecting bar 94 engages a projection 101 which is formed on the end of a switch operating rail 102 pivotally mounted through links 103 and 103' to the guide rail 79'. The rail 102 is counterbalanced by means of a weight 104 mounted on the extended link 103' and as illustrated in Fig. 10, the rail slidably supports a switch-actuating bar 105, the lower end of such bar being provided with a roller 106 which upon the downward movement, effected by engagement of the member 94 with the projection 101, is carried into engagement with an automatic relay switch 107 connected to the pump operating motor 42 which automatically starts the pump.

When the platform just reaches its lowermost position, the pressure release valve 51 is still open and it is necessary in order to make the pump effective to build up a pressure in the fluid system, to provide some means for closing the conduit 47 so that the return of the pressure fluid to the fluid reservoir through the valve 51 is prevented. This is accomplished by means of the control valve 53 which is provided with an actuating lever 108 connected through a link 109 to the rail 102. It is also important that the stop 65 remain in its uppermost position during the raising of the elevator and it is therefore necessary to actuate the valve 59 so as to prevent the application of pressure behind the piston 61 when the pump is started. This valve is accordingly provided with an actuating arm 59' which is also connected to the rail 102 through the medium of a link 110.

It will be seen, therefore, that the downward movement of the rail 102 accomplishes three purposes: it starts the motor 42 so as to provide a source of pressure fluid to raise the elevator; it closes the valve 53 so that such pressure fluid can be effective to raise the elevator and close the trap; and it closes the valve 59 so that the pressure fluid will not be effective to retract the stop 65.

It will be seen that if the elevator started to move upwardly as soon as it reached the bottom of its travel the conveyor units 100 and 100' would not have an opportunity to completely remove the stack of boxes or other articles from the platform. It is necessary, therefore, to provide some means for by-passing the pressure fluid until the articles have been completely removed. This is accomplished by providing a by-pass conduit 112 in the pump system, such conduit, which connects the outlet of the pump with the inlet of the reservoir, being provided with a pressure relief by-pass valve 113 which is set so as to open under any back pressure which may be created by a weight on the elevator in excess of the empty platform.

From this it will be seen that as long as any portion of the stack of boxes remains on the elevator, the pressure fluid coming from the pump is simply by-passed around the pump and back into the reservoir. As soon as the elevator is cleared, however, the pressure relief by-pass valve 113 automatically closes and the pressure of the pump is thereby effective to raise the elevator.

The pressure relief by-pass valve 113 may be of any conventional type of so-called adjustable pressure relief valve. For the purpose of illustration, however, I show, in Fig. 15, one form of valve which may be employed to accomplish the desired result. This valve is shown as comprising a housing 213 provided with an apertured seat diaphragm 214 upon which a valve 215 is pressed into seating engagement. The valve 215 has a stem 216 which extends through a packing gland 217 and has a cup plate 218 on its upper end which receives a compression spring 219, the top of the compression spring in turn being received

in a cup 219' which is mounted on the lower end of an adjustable screw 220. The screw 220 is threadedly mounted in a collar member 221 supported by a suitable bracket 222.

As the elevator approaches its uppermost position, the bar 94 engages a plate member 114 mounted on the rail 102 and attached to the upper end of the rod 105. Upon such engagement the rod 105 is drawn upwardly against the action of a tension spring 115 so as to permit the automatic relay switch 107 to open whereby the motor is stopped. The heavy flywheel on the pump, however, by its centrifugal force, provides sufficient pressure fluid to raise the elevator to its top position where the bar 94 engages a stop or projection 116 on the top of the rail 102, swinging the rail upwardly to a point at which the valves 53 and 59 are opened.

The valve 51 having been closed in the meantime after the final downward movement of the elevator, the opening of the valve 59 permits the fluid pressure in the system to retract the stop 65 and the trap having been closed by the plunger 35 when the valve 51 was closed, the machine is now ready to again stack the boxes traveling over the conveyor A.

As has been previously pointed out, one of the important features of this invention resides in the provision of means for automatically stopping the upper or delivery conveyor in the event the trap becomes stuck or jammed which might occur when a broken box was delivered thereto. This is accomplished by providing an automatic release switch 117 which controls the delivery conveyor motor 16.

The switch 117 comprises a switch box 118 pivoted to a bracket 119 mounted on an extension 120 of the trap frame. This switch box has a switch button 121 which is adapted to engage and be actuated by a projection 122 on a horizontal swinging finger 123, the finger being pivoted to a rigid arm 124.

Reference numeral 125 indicates a lever member which carries a roller 126 adapted to engage the forward face of the finger 123. This lever is adapted to be moved back into a position at which it will engage the finger and hold the same in a switch operating position by means of a rod 127 which is connected at its forward end to a lever member 128 mounted on a pin 129 which in turn is pivotally mounted in the lower edge of the trap panel 20. The pivot pin 129 extends inwardly to a position at which an upturned end 130 thereon will be engaged by a box or article entering the trap. In other words, as long as there is a box or other article resting on the finger in the trap, the pin 129 has been rotated so as to move the lever 125 rearwardly where the roller 126 engages the finger 123. When in this position any forward swinging movement of the switch box in the direction of the arrow O in Fig. 8 will bring the switch button 121 into engagement with the projection 122, thereby throwing the switch to open the motor circuit.

This last mentioned movement of the switch box is effected by a bar or rod 131 which has its forward end pivotally attached to a projection on top of the switch box as indicated at 132. The rear end portion of the bar or rod 131 is connected, as illustrated in Fig. 3, to a finger 134 which is mounted on a lever member 135 pivotally mounted in the conveyor frame as indicated at 136. This lever member has an inturned end portion 137 which projects into the path of the articles traversing the conveyor so that an article, which is passed along the conveyor to a point at which it will be entering the trap, is effective to swing the switch box forward, and in the event a box is stuck in the trap holding the finger 123 in the manner just described the moving box will, through its engagement with the inturned end 137 of the lever 135, throw the switch and stop the conveyor.

The conveyor F which I have described as comprising the two elements 100 and 100' may take various forms. I prefer, however, to employ a construction such as is shown in Figs. 13 and 14 in which the conveyor unit 100', for example, is shown as comprising a channel member 140 having side rails 141 and 141' between which a plurality of pins 142 are rotatably mounted. These pins are provided with gears 143, 143'; 144, 144'; 145, 145', etc., such gears being alternately idle and keyed to the respective pins as indicated in the gears 145 and 145' respectively.

The inner extending ends of all of the pins are provided with rollers indicated at 146 and 146', the rollers 146 being channeled as indicated at 147 and the rollers 146' being provided with kerfs 148 which run in the respective channels. One of the keyed pins or shafts in the series, for example the shaft indicated at 142a, is connected to a suitable source of power, not shown, so that the whole series is driven and all of the driven rollers are rotated in the same direction.

It will be understood that a conveyor unit made up in the manner just described, may be of considerable length and with boxes or articles transversing its entire length, it is apparent that the gears at the driven end will carry a much greater load than the gears at the other end. For the purpose of economy in manufacture, therefore, I propose to graduate the gears from one end of the conveyor to the other, and the view shown illustrates the manner in which such graduations are made. It will be understood, of course, that the next smaller set of gears would be a much greater distance from the driven shaft 142a than illustrated, but this will be immediately apparent to those familiar with the art.

For the purpose of protecting the operating part including the two movable rails 102 and 74 and their associated link members, etc., I enclose these parts in a case or box which may be perfectly tight excepting for the slot through which the projecting bar 94 travels, and the sides of this slot, for the purpose of added protection, may be provided with a pair of yieldable flaps formed of rubber or the like, such flaps being indicated by reference numerals 129.

It will be apparent from the foregoing description that the machine contemplated by this invention avoids all of the difficulties encountered in a mechanically operated machine in that the noise and wear are practically eliminated; its smooth operation avoids rough handling of the articles; and actual operation of the machine has demonstrated that the articles can be stacked much more rapidly without danger of spilling than they can in a similar machine of the mechanical type.

It is to be understood that, while I have herein described and illustrated one preferred form of my invention, the invention is not limited to the precise construction as described above, but includes within its scope whatever changes fairly come within the spirit of the appended claims.

I claim as my invention:

1. A stacking machine of the class described embodying: a trap adapted to receive and sup-

port one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for opening said trap to release an article supported therein; valve means for releasing said pressure fluid thereby permitting downward movement of said elevator; means operable by an article received in said trap for opening said valve means; and means associated with said elevator for holding said valve means open after said first mentioned valve opening means is disengaged by said article and until said elevator reaches a predetermined position.

2. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for opening said trap to release an article supported therein; valve means for releasing said pressure fluid thereby permitting downward movement of said elevator; means operable by an article received in said trap for opening said valve means; means associated with said elevator for holding said valve means open after said first mentioned valve opening means is disengaged by said article and until said elevator reaches a predetermined position; and means for closing said valve means when said elevator has reached said predetermined position.

3. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for opening said trap to release an article supported therein; valve means operable by an article received in said trap to release said pressure fluid thereby permitting downward movement of said elevator; means associated with said elevator for holding said valve means open until said elevator reaches a predetermined position; means for closing said valve means when said elevator has reached said predetermined position; and hydraulic means for automatically closing said trap when said valve means is closed.

4. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; conveyor means for intermittently delivering said articles into said trap; means for intermittently opening said trap to release an article supported therein; an elevator adapted to be raised and held in elevated positions by a pressure fluid; a platform on said elevator below said trap adapted to intermittently receive articles from said trap; valve means associated with said elevator for intermittently releasing said pressure fluid to permit a predetermined downward movement of said elevator whereby the successive articles released from said trap are stacked one on top of the other; and automatic means operable by said elevator when it reaches the lower limit of its travel for applying fluid pressure to said elevator to raise the same, said last mentioned means including a switch actuated by said elevator and a pump controlled by said switch.

5. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; means for intermittently delivering said articles into said trap; means for intermittently opening said trap to release an article supported therein; an elevator adapted to be raised and held in elevated positions by a pressure fluid; a platform on said elevator below said trap adapted to intermittently receive articles from said trap; valve means associated with said elevator for intermittently releasing said pressure fluid to permit a predetermined downward movement of said elevator whereby the successive articles released from said trap are stacked one on top of the other; automatic means operable by said elevator when it reaches the lower limit of its travel for applying fluid pressure to said elevator to raise the same; and means including an adjustable by-pass valve for by-passing said pressure fluid away from said elevator until said platform has been relieved of all of the weight of said stacked articles.

6. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; conveyor means for intermittently delivering said articles into said trap; means for intermittently opening said trap to release an article supported therein; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap adapted to intermittently receive articles from said trap; valve means associated with said elevator for intermittently releasing said pressure fluid to permit a predetermined downward movement of said elevator whereby the successive articles released from said trap are stacked one on top of the other; conveyor means situated at the lower limit of travel of said platform for removing a stack of articles from said platform; automatic means operable by said elevator when it reaches the lower limit of its travel for applying fluid pressure to said elevator to raise the same; and means including a pressure actuated by-pass valve for by-passing said pressure fluid away from said elevator until the entire weight of said articles has been removed from said platform.

7. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; means for intermittently delivering articles into said trap; means for opening said trap to release an article received therein; an elevator positioned below said trap for receiving released articles; means operated by a pressure fluid for raising said elevator and holding same in a raised position; means operable by each article received in said trap to release said pressure fluid and permit the initiation of downward movement in said elevator; means associated with said elevator for controlling the release of said pressure fluid thereby stopping the downward movements of said elevator at predetermined points; means for delivering pressure fluid to said elevator to raise same; means operable by said elevator when it reaches the bottom of its travel to start said pressure fluid delivering means; means including a pressure relief by-pass valve for by-passing said pressure fluid away from said elevator until said articles have been entirely removed therefrom; and means for removing said articles from said elevator.

8. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; means actuated by a pressure fluid for holding said trap closed; means for intermittently delivering articles to be stacked into said trap; an elevator positioned below said trap for intermittently receiving articles therefrom; means actuated by said pressure fluid for raising

said elevator and holding same in elevated position; and means actuated by an article received in said trap for releasing said pressure fluid thereby permitting said trap opening means to open said trap, releasing said article therefrom, and at the same time permitting downward movement of said elevator.

9. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; means actuated by a pressure fluid for holding said trap closed; means for intermittently delivering articles to be stacked into said trap; an elevator positioned below said trap for intermittently receiving articles therefrom; means actuated by said pressure fluid for raising said elevator and holding same in elevated position; means actuated by an article received in said trap for releasing said pressure fluid thereby permitting said trap opening means to open said trap, releasing said article therefrom and at the same time permitting downward movement of said elevator; and means associated with said elevator for controlling the release of said pressure fluid so as to stop the downward movement of said elevator and close said trap when said elevator reaches a predetermined position.

10. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; a delivery conveyor for delivering articles into said trap; means actuated by a pressure fluid for holding said trap closed; means for opening said trap; an elevator positioned below said trap for receiving articles therefrom; means actuated by said pressure fluid for raising said elevator and holding same in elevated position; a stop member associated with said delivery conveyor; means for swinging said stop member into the path of articles on said delivery conveyor; means actuated by said pressure fluid for retracting and holding said stop member out of the path of said articles; a pressure fluid system for delivering said pressure fluid to said elevator raising and holding means, said stop retracting and holding means and said trap closing and holding means; a valve in said pressure fluid system for maintaining pressure therein; and means actuated by an article received in said trap to open said valve and release the pressure in said pressure fluid system.

11. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; a delivery conveyor for delivering articles into said trap; means actuated by a pressure fluid for holding said trap closed; means for opening said trap; an elevator positioned below said trap for receiving articles therefrom; means actuated by said pressure fluid for raising said elevator and holding same in elevated position; a stop member associated with said delivery conveyor; means for swinging said stop member into the path of articles on said delivery conveyor; means actuated by said pressure fluid for retracting and holding said stop member out of the path of said articles; a pressure fluid system for delivering said pressure fluid to said elevator raising and holding means, said stop retracting and holding means, and said trap closing and holding means; a valve in said pressure fluid system for maintaining pressure therein; means actuated by an article received in said trap to open said valve and release the pressure in said pressure fluid system; and means associated with said elevator for successively holding said valve open until said elevator reaches predetermined points.

12. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; a delivery conveyor for delivering articles into said trap; means actuated by a pressure fluid for holding said trap closed; means for opening said trap; an elevator positioned below said trap for receiving articles therefrom; means actuated by said pressure fluid for raising said elevator and holding same in elevated position; a stop member associated with said delivery conveyor; means for swinging said stop member into the path of articles on said delivery conveyor; means actuated by said pressure fluid for retracting and holding said stop member out of the path of said articles; a pressure fluid system for delivering said pressure fluid to said elevator raising and holding means, said stop retracting and holding means, and said trap closing and holding means; a valve in said pressure fluid system for maintaining pressure therein; means actuated by an article received in said trap to open said valve and release the pressure in said pressure fluid system; means associated with said elevator for successively holding said valve open until said elevator reaches predetermined points; and means for closing said valve when said elevator reaches each of said predetermined points, thereby restoring the pressure in said pressure system so as to stop said elevator, close said trap, and retract said stop.

13. A stacking machine of the class described embodying: a trap adapted to receive articles to be stacked; a delivery conveyor for delivering articles into said trap; means actuated by a pressure fluid for holding said trap closed; means for opening said trap; an elevator positioned below said trap for receiving articles therefrom; means actuated by said pressure fluid for raising said elevator and holding same in elevated position; a stop member associated with said delivery conveyor; means for swinging said stop member into the path of articles on said delivery conveyor; means actuated by said pressure fluid for retracting and holding said stop member out of the path of said articles; a pressure fluid system for delivering said pressure fluid to said elevator raising and holding means, said stop retracting and holding means, and said trap closing and holding means; a valve in said pressure fluid system for maintaining pressure therein; means actuated by an article received in said trap to open said valve and release the pressure in said pressure fluid system; means associated with said elevator for successively holding said valve open until said elevator reaches predetermined points; means for closing said valve when said elevator reaches each of said predetermined points, thereby restoring the pressure in said pressure system so as to stop said elevator, close said trap, and retract said stop; a pump for supplying pressure fluid to said pressure fluid system; switch means actuated by said elevator at the bottom of its travel to start said pump for raising said elevator; and means actuated by said elevator as it approaches said trap to open said pump switch.

14. A machine for stacking articles embodying: a trap adapted to receive one of said articles; hydraulic means for actuating said trap; an elevator below said trap adapted to receive articles released from said trap; hydraulic means for raising said elevator and intermittently lowering same; and valve means actuated by an article received in said trap for simultaneously controlling

both of said hydraulic means during the intermittent downward movement of said elevator.

15. A machine for stacking articles embodying: a trap adapted to receive one of said articles; conveyor means for delivering articles into said trap; hydraulic means for actuating said trap; an elevator below said trap adapted to receive articles released therefrom; hydraulic means for raising said elevator and intermittently lowering same; valve means for controlling said elevator; means for driving said conveyor; a switch for controlling said conveyor driving means; means actuated by an article in said trap for biasing said switch; and means in said conveyor adapted to be engaged by an article therein for cooperating with said switch biasing means to open said switch when it is in a biased position.

16. In a machine for stacking articles: a trap; means for actuating said trap; an elevator below said trap adapted to receive articles released therefrom; a conveyor for delivering articles into said trap; means for driving said conveyor; switch means for stopping said conveyor driving means; and means for actuating said switch means comprising a member in said trap adapted to be actuated by an article in said trap and another member in said conveyor adapted to be actuated by an article in said conveyor for cooperating to open said switch when both of said members are engaged.

17. A machine for stacking articles embodying: a trap adapted to receive one of said articles; hydraulic means for actuating said trap; an elevator below said trap adapted to receive articles released therefrom; hydraulic means for raising said elevator and intermittently lowering same; and valve means actuated by an article received in said trap for simultaneously controlling both of said hydraulic means whereby said trap is opened with each predetermined downward movement of said elevator so as to deposit said article from said trap onto said elevator.

18. A machine for stacking articles embodying: a trap adapted to receive one of said articles; hydraulic means for actuating said trap; an elevator below said trap adapted to receive articles released therefrom; hydraulic means for raising said elevator and intermittently lowering same; and valve means actuated by an article received in said trap for simultaneously controlling both of said hydraulic means whereby said trap is opened with each predetermined downward movement of said elevator and is closed during the upward movement of said elevator.

19. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for opening said trap to release an article received therein; valve means operable by an article received in said trap to release a predetermined amount of said pressure fluid thereby permitting a predetermined downward movement of said elevator; conveyor means situated at the lower limit of travel of said platform for removing a stack of articles from said platform; automatic means operable by said elevator when it reaches the lower limit of its travel for applying fluid pressure to said elevator to raise the same; and means including a pressure actuated by-pass valve for by-passing said pressure fluid away from said elevator until the entire weight of said articles has been removed from said platform.

20. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for opening said trap to release an article received therein; valve means operable by an article received in said trap to release a predetermined amount of said pressure fluid thereby permitting a predetermined downward movement of said elevator; conveyor means situated at the lower limit of travel of said platform for removing a stack of articles from said platform; automatic means operable by said elevator when it reaches the lower limit of its travel for applying fluid pressure to said elevator to raise the same; and means for limiting the elevator lifting force of said pressure fluid so that it is less than the combined weight of said elevator and any portion of the weight of said stack, whereby said elevator will not be raised until the stack of articles has been completely removed from said platform.

21. A stacking machine of the class described embodying: a trap adapted to receive and support one of the articles to be stacked; an elevator adapted to be raised and held in elevated position by a pressure fluid; a platform on said elevator below said trap; means for normally holding said trap closed; means for intermittently releasing said holding means; yieldable means for automatically opening said trap to release an article supported therein upon release of said holding means; and valve means operable by an article received in said trap to release a predetermined amount of said pressure fluid, thereby permitting a predetermined downward movement of said elevator.

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