June 5, 1962 N. J. SIMPKINS 3,037,645

CRATE STACKER

Filed Dec. 31, 1958 5 Sheets-Sheet 1

Fig. 1

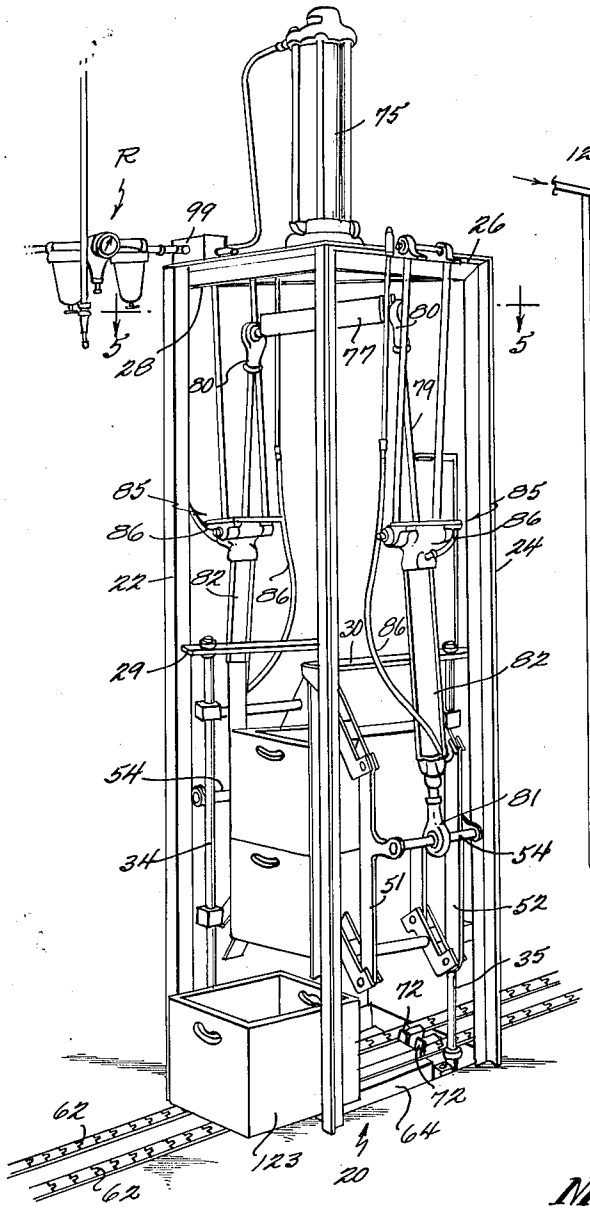
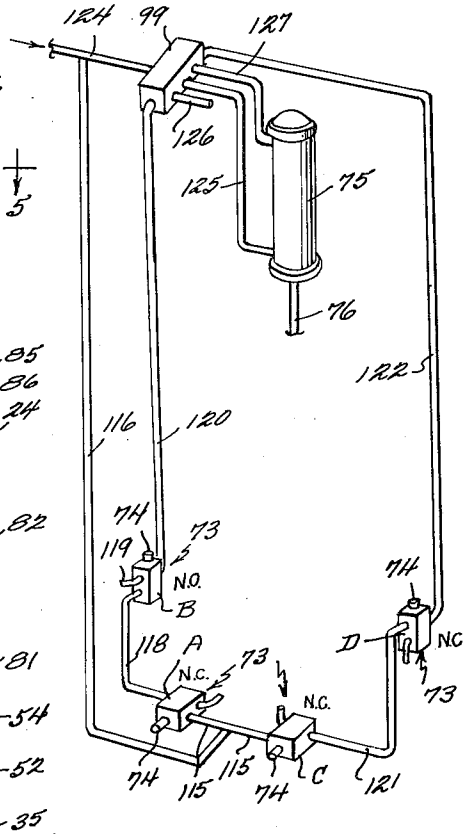


Fig. 16



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CRATE STACKER

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Fig. 2

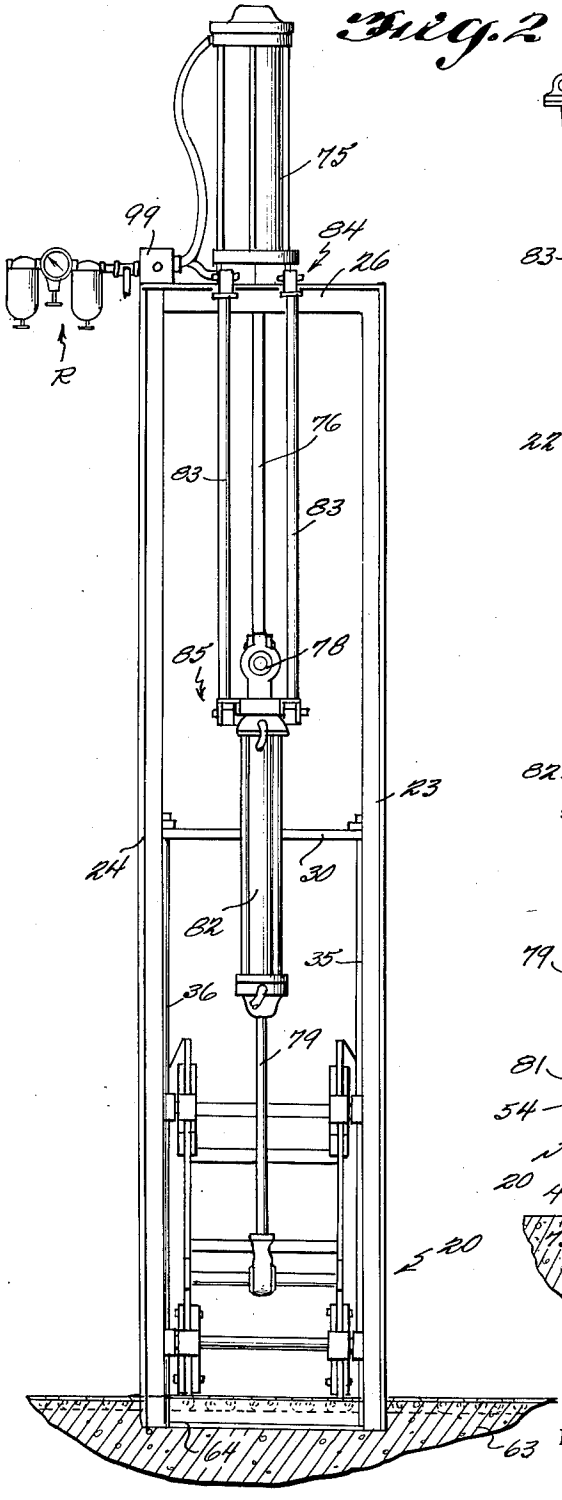
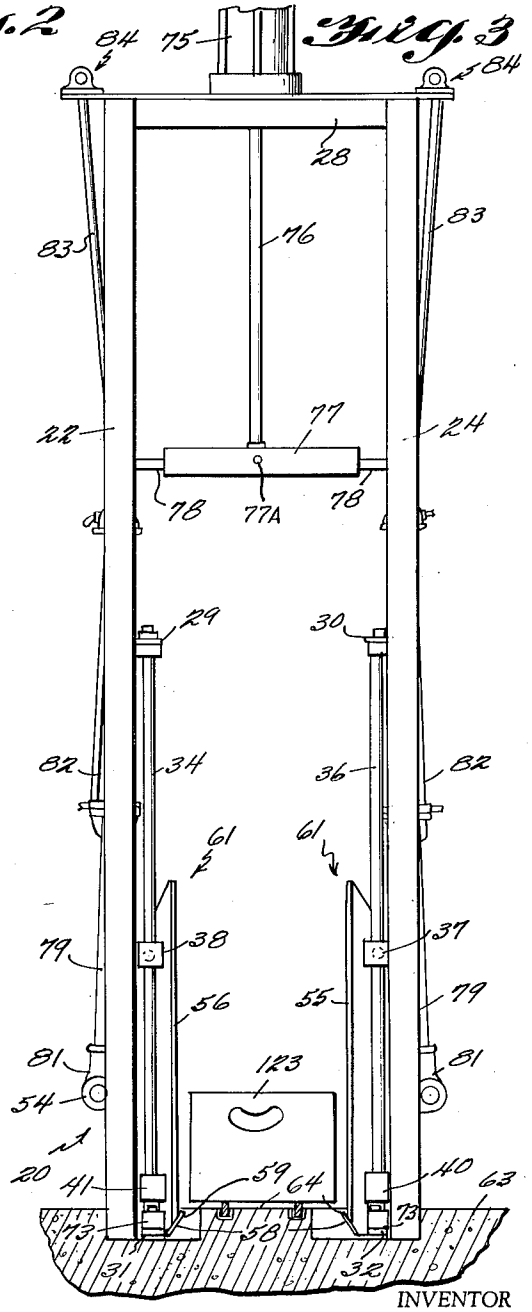


Fig. 3



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CRATE STACKER

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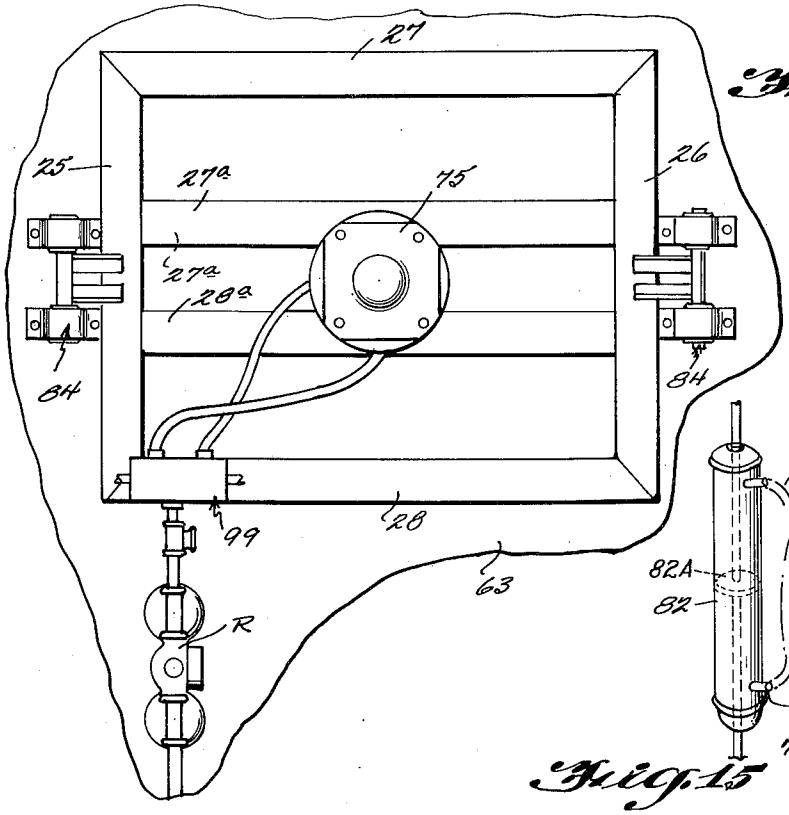


Fig. 4

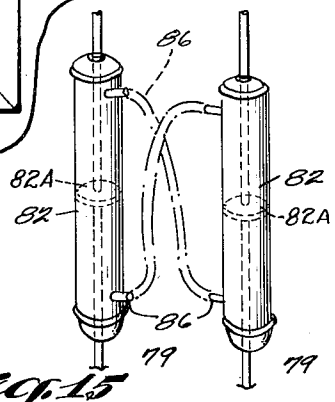


Fig. 15

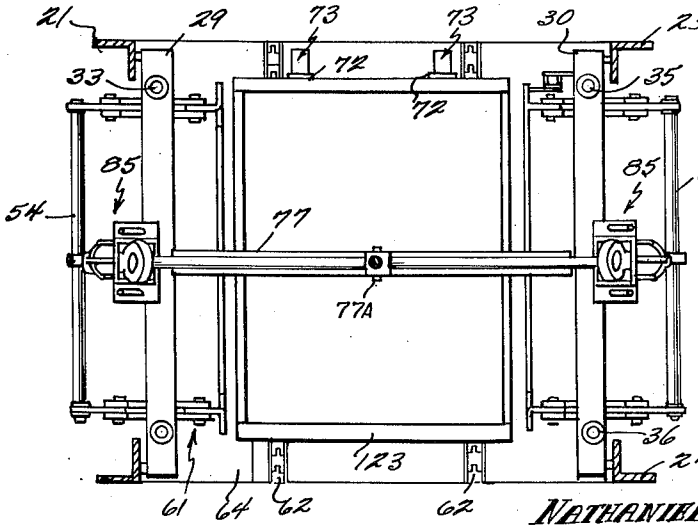


Fig. 5

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CRATE STACKER

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Fig. 6

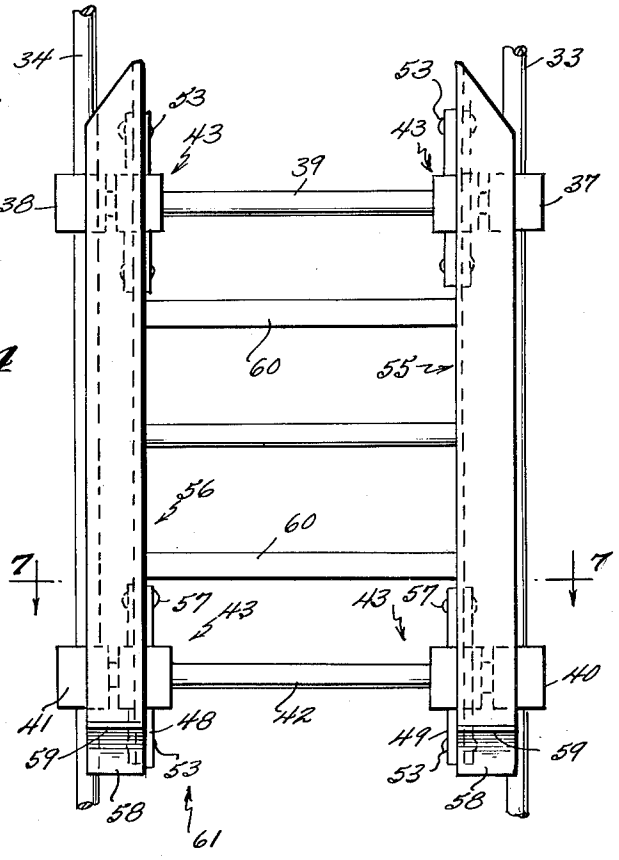


Fig. 13

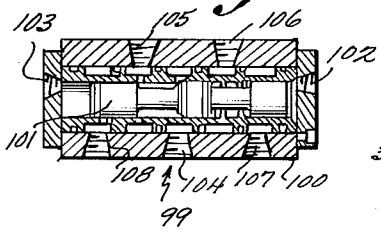


Fig. 14

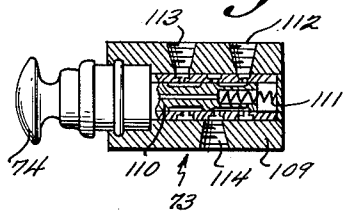


Fig. 8

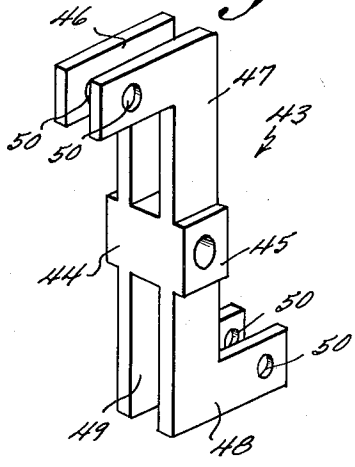
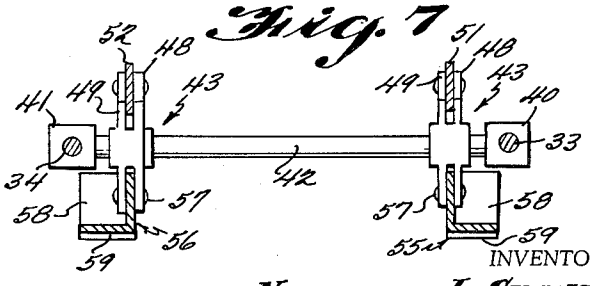


Fig. 7



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Fig. 9

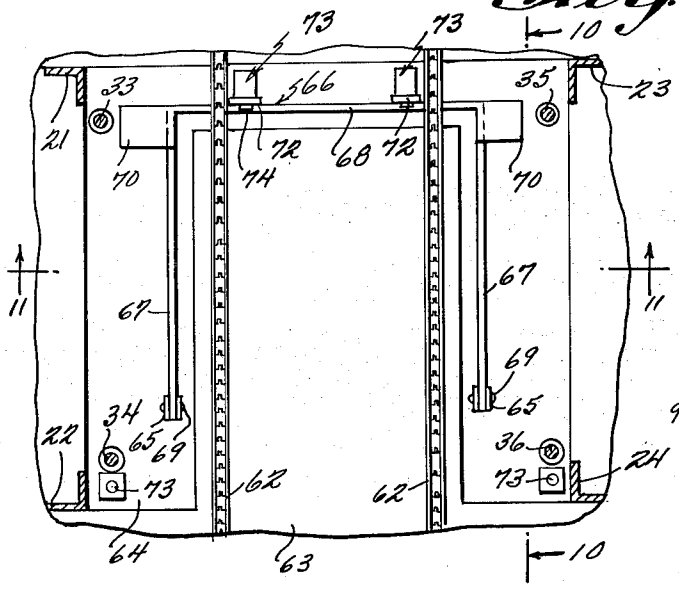


Fig. 12

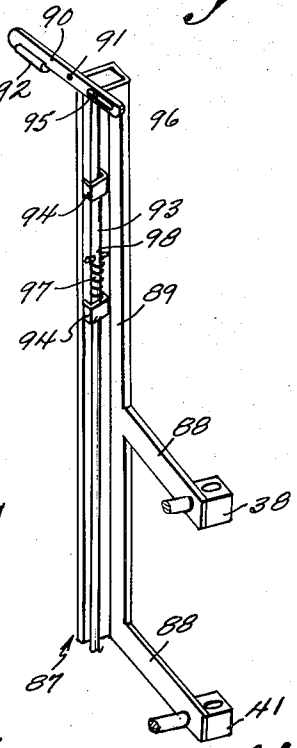


Fig. 10

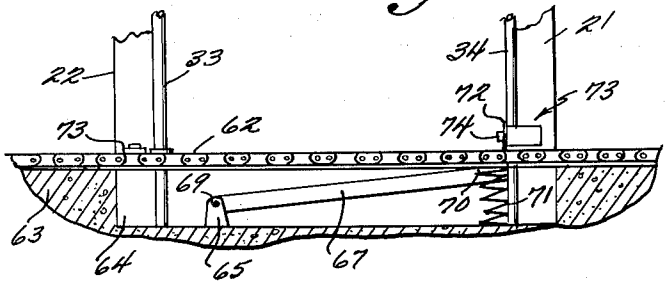
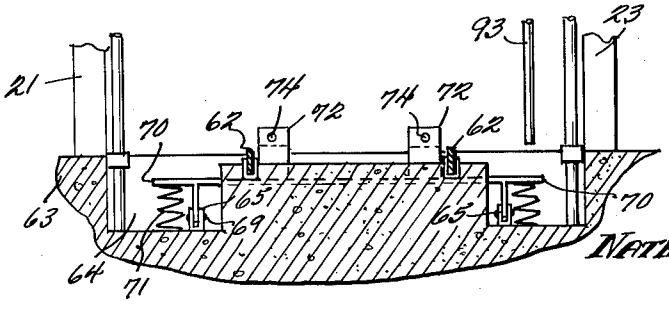


Fig. 11



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United States Patent Office 3,037,645 Patented June 5, 1962

3,037,645

CRATE STACKER

Nathaniel Jeptha Simpkins, Atlanta, Ga., assignor to Miss Georgia Dairies, Inc., Atlanta, Ga.

Filed Dec. 31, 1958, Ser. No. 784,295
6 Claims. (Cl. 214—6)

The present invention relates to crate stackers and particularly to crate stackers which are adapted to automatically stack crates received from a conveyor and discharge the stacked crates on to the same conveyor.

Another object of the present invention is to provide a crate stacker of the class described above which is actuated by a pneumatic cylinder controlled by the flow of crates to the stacker.

A further object of the invention is to provide a crate stacker of the class described above having oppositely disposed lifting members maintained in balanced relation by a hydraulic interconnecting means.

Another object of the invention is to provide a crate stacker constructed in accordance with the invention and having a plurality of pneumatic control valves actuated by movement of the crates into the stacker and movement of the stacker in its stacking operation.

A further object of the invention is to provide a crate stacker of the class described above which is combined with a conventional crate moving chain conveyor to move the crates into the stacker individually and to move the stacked crates out of the stacker upon completion of the stacking operation.

A still further object of the invention is to provide a crate stacker of the class described above which is inexpensive to manufacture, positive in its action and which automatically stacks the crates with a minimum of personal attention from the operator.

Other objects and advantages will become apparent in the following specification when considered in light of the attached drawings, in which:

FIGURE 1 is a perspective view of the invention showing crates being stacked therein;

FIGURE 2 is a side elevation of the invention;

FIGURE 3 is a front elevation of the invention shown partially broken away and in section for convenience of illustration;

FIGURE 4 is a top plan view of the invention;

FIGURE 5 is a horizontal section taken along the line 5—5 of FIGURE 1, looking in the direction of the arrows;

FIGURE 6 is a fragmentary elevational view of one of the crate lifting carriages;

FIGURE 7 is a horizontal section taken along the line 7—7 of FIGURE 6, looking in the direction of the arrows;

FIGURE 8 is a perspective view of one of the connecting links;

FIGURE 9 is a horizontal sectional view similar to FIGURE 5 with the crate removed, illustrating the stop and conveyor chain relationship to the stacker;

FIGURE 10 is a fragmentary vertical sectional view taken along the line 10—10 of FIGURE 9, looking in the direction of the arrows;

FIGURE 11 is a transverse vertical section taken along the line 11—11 of FIGURE 9, looking in the direction of the arrows;

FIGURE 12 is a fragmentary perspective view of the crate stop release shaft;

FIGURE 13 is a longitudinal sectional view of the pneumatic cylinder control valve;

FIGURE 14 is a longitudinal sectional view of one of the pilot control valves;

FIGURE 15 is a fragmentary perspective view of the hydraulic equalizing cylinders and the connections extending therebetween; and

FIGURE 16 is a semi-diagrammatic view of the pneumatic circuits used in the device.

Referring now the drawings in detail wherein like reference characters indicate like parts throughout the several figures, the reference numeral 20 indicates generally a crate stacker constructed in accordance with the invention.

The crate stacker 20 includes a pair of spaced apart parallel upright angle iron frame members 21, 22 and a second pair of spaced apart parallel upright frame members 23, 24 with the second pair of frame members 23, 24 arranged in spaced parallel relation to the first pair of frame members 21, 22. A horizontal angle iron frame member 25 connects the upper ends of the frame members 21, 22. A horizontal frame member 26 connects the upper ends of the frame members 23, 24. The horizontal frame members 25, 26 are arranged in spaced apart parallel relation and have their opposite ends connected by spaced apart lateral frame members 27, 28. The horizontal frame members 25, 26 are further connected by closely spaced parallel lateral frame members 27a, 28a, which are positioned intermediate the frame members 27, 28.

A transverse bar 29 extends between and is welded to the frame members 21, 22 intermediate the upper and lower ends thereof. The bar 29 extends horizontally and is arranged on the side of the frame members 21, 22 toward the frame members 23, 24. A horizontal bar 30 is secured to the frame members 23, 24 intermediate the upper and lower ends thereof and on the side thereof toward the frame members 21, 22. The bars 29, 30 are arranged in the same horizontal plane. A horizontally extending bar 31 extends between and connects the lower ends of the frame members 21, 22 underlying the bar 29 and another horizontally extending bar 32 extends between and connects the frame members 23, 24 underlying the bar 30.

A pair of spaced apart parallel cylindrical guide rails 33, 34 are arranged in upright relation and have their respective upper and lower ends secured to the bars 29, 31. A second pair of upright spaced apart parallel guide rails 35, 36 have their respective upper and lower ends supported in the bars 30, 32. A pair of generally rectangular guide blocks 37, 38 are slidably supported respectively on the guide rails 33, 34 and are connected together by a horizontally extending shaft 39. A second pair of generally rectangular guide blocks 40, 41 are similarly supported on the guide rails 33, 34 in vertically spaced relation to the guide blocks 37, 38 and are connected by a horizontally extending shaft 42. A pair of supports, indicated generally at 43, are journalled on each of the shafts 39, 42 adjacent the blocks 37, 38 and 40, 41. The supports 43 include a generally rectangular body 44 having a transversely extending bore 45 formed therein through which the shafts 39, 42 extend. A pair of spaced apart parallel L-shaped links 46, 47 extend upwardly from the body 44 and a second pair of spaced apart parallel L-shaped links 48, 49 extend oppositely from the body 44. The outer end portions of the links 46, 47, 48, 49 are each provided with a transversely extending bore 50.

A pair of spaced apart parallel vertically extending bars 51, 52 have their opposite upper and lower ends respectively secured to the links 48, 49 by means of pivot pins 53. The bars 51, 52 are arranged in transversely spaced relation and are connected by a horizontally extending yoke shaft 54.

A pair of spaced apart parallel angle iron uprights, indicated generally at 55, 56, are positioned to engage between the links 46, 47 at the upper and lower ends thereof and are secured thereto by pivot pins 57. The uprights 55, 56 are each provided with a downwardly and

outwardly sloping cam plate 58 secured to the lower ends thereof. The cam plates 58 each project inwardly beyond the uprights 55, 56 to provide a hook 59 on the lower inner edge of each of the uprights 55, 56.

A pair of vertically spaced parallel transversely extending bars 60 extend between and connect the uprights 55, 56, as can be best seen in FIGURE 6. The guide blocks 37, 38, 40, 41 are mounted for vertical sliding movement on the guide rails 33, 34 and with the structure supported thereon including the uprights 55, 56 form a lifting carriage, indicated generally at 61. The guide rails 35, 36 have an identical lifting carriage 61 mounted thereon in opposed relation to the lifting carriage 61 mounted on the guide rails 33, 34.

A conveyor including a pair of spaced apart parallel conveyor chains 62 is supported in the floor 63 on which the crate stacker 20 is mounted and the spaced apart parallel chains 62 are arranged intermediate the pair of frame members 21, 22 and the pair of frame members 23, 24 and parallel thereto. The chains 62 extend through the stacker 20 and outwardly therefrom, both to the front and to the rear thereof. A pit 64 is formed in the floor 63 intermediate the upright frame members 21, 22, 23, 24 to permit the lower ends of the uprights 55, 56 to be lowered on the guide rails 33, 34, 35, 36 to a point where the hooks 59 are slightly below the upper plane of the conveyor chains 62. The conveyor chains 62 are of conventional design and form a part of the present invention only as the remaining portions of the crate stacker 20 are combined therewith. The chains 62 are provided for moving the crates within the dairy over relatively long distances with the crates arranged individually or stacked.

A pair of spaced apart parallel U-shaped brackets 65 are mounted in the pit 64 on opposite sides thereof. A generally horizontal U-shaped stop support, generally indicated at 66, has a pair of spaced apart parallel legs 67 connected by a bight 68. The legs 67 and the free ends thereof are pivotally secured to the brackets 65 by pivot pins 69. The legs 67 at the ends thereof opposite the brackets 65 are each provided with an outwardly extending generally horizontal spring pad 70. A coil spring 71 is positioned in the bottom of the pit 64 and engages against the underside of each of the spring pads 70 to normally urge the stop support 66 upwardly into contact with the underside of the conveyors 62. A pair of stop plates 72 are secured to the bight 68 in spaced apart parallel upstanding relation adjacent to and intermediate the chains 62. A pilot valve, generally indicated at 73, is supported on each of the stop plates 72 and has the actuator button 74 thereof projecting beyond the stop plate 72.

An upright pneumatic cylinder 75 has its lower end supported on the frame members 27*a*, 28*a* intermediate the opposite ends thereof. The pneumatic cylinder 75 has a piston rod 76 depending therefrom and arranged for vertical reciprocation when air is supplied to opposite ends of the cylinder 75. A horizontal yoke 77 is pivotally mounted as at 77*a* on the lower end of the piston rod 76 and is provided with oppositely extending stub shafts 78 at opposite ends thereof. A generally upright shaft 79 is arranged at each end of the yoke 77 and is pivotally secured thereto by a bearing block 80. The lower ends of the shafts 79 are connected respectively to the shafts 54 by bearing blocks 81. Vertical movement of the yoke is effective to vertically move the shafts 79 and therethrough to vertically reciprocate the carriages 61 on the guide rails 33, 34, 35, 36.

A double-acting hydraulic ram 82 is mounted on each of the shafts 79 and the pistons 82*a* of the hydraulic rams 82 are fixedly secured to the shafts 79. A pair of spaced apart parallel support rods 83 are pivotally mounted at their upper ends in bearing blocks 84 carried respectively by the transverse frame members 25, 26. The lower ends of the rods 83 are pivotally connected to the upper ends of the hydraulic rams 82 by means of bearing blocks, generally indicated at 85. The rods 83 support the hydraulic rams 82 to maintain them against vertical movement as the shafts 79 are reciprocated vertically therethrough by means of the pneumatic cylinder 75. The hydraulic rams 82 are interconnected by means of conduits 86 so that the upper end of each of the rams 82 is connected respectively to the lower end of the opposite hydraulic ram 82. With the hydraulic rams 82 interconnected, as described, they function as an equalizer and the shafts 79 move equally therethrough, maintaining the carriages 61 in horizontally aligned relation to each other as they are moved vertically on the guide rails 33, 34, 35 and 36.

In FIGURE 12 a stop release assembly is indicated generally at 87 and consists of a pair of brackets 88 which extend horizontally inwardly from the blocks 38, 41 adjacent the frame member 24. An upright angle iron member 89 is carried by the inner ends of the brackets 88 and extend substantially thereabove. A lever 90 is pivoted at 91 to the upper end of the angle iron member 89 and is provided with an anti-friction roller 92 in its outer lower edge for engaging the upper edge of the uppermost crate when a sufficient number of crates have been placed in the stack. A push rod 93 is secured to the angle iron 89 by means of bearings 94 and is arranged for vertically sliding movement. The upper end of the push rod 93 is pivotally connected at 95 to a slot 96 in the lever 90 so that upon upward movement of the roller 92 on the lever 90 the push rod 93 will be moved downwardly with respect to the angle iron 89. A coil spring 97 encompasses the push rod 93 engaging at its lower end one of the bearings 94 and its upper end a pin 98 in the push rod 93. The spring 97 normally biases the push rod 93 upwardly in the bearings 94. The lower end of the push rod 93 overlies the spring pad 70 closest to the upright frame member 23 and is arranged to press the stop support 66 downwardly on downward movement of the carriage 61 when the lever 90 engages the upper edge of a crate when the stack becomes sufficiently high. The stop plates 72 and the pilot valves 73 are lowered into the pit 64 when the push rod 93 presses the stop support 66 downwardly so that crates supported on the conveyor chains 62 may move out of the stacker 20 to be conveyed to the desired location.

In FIGURE 13, a control valve, indicated generally at 99, is illustrated in longitudinal section and comprises a body 100 having a piston type control valve plug 101 mounted for reciprocation therein. Ports 102, 103 are arranged in opposite ends of the body 100 for connection to pilot valves 73 to move the piston plug 101 within the body 100 to control the flow of air to the pneumatic cylinder 75. An air inlet port 104 is connected to an air pressure regulator R and the outlet ports 105, 106 are connected respectively to opposite upper and lower ends of the pneumatic cylinder 75. With the valve plug 101 in the position illustrated in FIGURE 13, the inlet port 104 is connected to the outlet port 105 and an exhaust port 107 is connected to the outlet port 106. With the valve plug 101 at its opposite end, the outlet port 106 is connected with the inlet port 104 and the outlet port 105 is connected with an exhaust port 108.

A pilot valve 73 is mounted on each of the stop plates 72, as described above, and a second pilot valve 73 is secured to each of the guide rails 34, 36 for engagement by the carriages 61 at their lowermost position of travel.

In FIGURE 14 the pilot valve 73 is illustrated in longitudinal section and includes a body 109 having a piston type valve plug 110 positioned therein for reciprocation. A spring 111 normally urges the piston plug 110 toward the left end of the body 109, as viewed in FIGURE 14. The actuator button 74 is connected directly to the piston plug 110 and is effective to move the piston plug

110 against the tension of the spring 111. A pair of convertible inlet and exhaust ports 112, 113 are arranged on one side of the pilot valve 73 and an outlet port 114 is positioned on the opposite side of the body 109 intermediate the convertible inlet and exhaust ports 112, 113.

Referring now to FIGURE 16, the pneumatic circuits for controlling the pneumatic cylinders 75, including the pilot valves 73 and the control valve 99, is diagrammatically illustrated. The four pilot valves 73 are separately indicated by the letters A, B, C and D so that their function may be described below. The valve A is mounted on one of the stop plates 72 and has an inlet pipe 115 connecting the port 113 to a pneumatic pressure line 116. An exhaust pipe 117 is connected to the port 112 and an outlet conduit 118 extends outwardly from the port 114. The pilot valve B is mounted on the guide rod 34 and has the outlet conduit 118 from the valve A extending to the port 112 thereof. An exhaust pipe 119 extends from the port 113 and an outlet conduit 120 is secured to the outlet port 114. The outlet conduit 120 is connected to the port 102 of the control valve 99. The connection of the inlet conduit 115 to the port 112 and the outlet conduit 118 to the port 114 in the valve A creates a normally closed condition so that no flow is established through the valve A except when the actuator button 74 is depressed, moving the piston plug 110 to the right, as viewed in FIGURE 14. When the button 74 is depressed the piston plug 110 connects the outlet conduit 118 to the inlet conduit 115 to permit the passage of air outwardly through the valve A. The valve B is connected oppositely of the valve A to have a normally open condition in which the outlet conduit 120 is normally connected to the outlet conduit 118 of the valve A. When the button 74 thereof is depressed, the piston plug 110 blocks the passage of air from the outlet conduit 118 of the valve A to the outlet conduit 120 of the valve B. When the button 74 is depressed the piston plug 110 connects the outlet conduit 120 to the exhaust pipe 119 to vent the control valve 99. As can be clearly seen from the above, both the valve A and the valve B must be in open position for air to reach the port 102 of the control valve 99 so as to move the piston 101 to the opposite end of the body 100 than that illustrated in FIGURE 13.

The valve C is normally closed and is connected to the inlet conduit 115 through its port 113. An outlet conduit 121 connects the port 114 of the valve C with the port 113 of the valve D. A conduit 122 connects the outlet port 114 of the valve D with the port 103 of the control valve 99. The valve D is normally closed and for air from the supply conduit 115 to reach the port 103 of the control valve 99, both the valve C and the valve D must have the button 74 thereof depressed to open the valves.

The valves A and C are both moved to open position by contact therewith of a crate 123 moving on the conveyor chains 62. The carriages 61 would be in their lowermost position with the valve B closed and the valve D open. With the valves C and D open, pressure flows through the line 122 to the port 103 moving the piston plug 101 to the right, as viewed in FIGURE 13. In this position of the plug 101, air flows from the inlet line 124 through the line 125 to the lower end of the cylinder 75 and the piston rod 76 is moved upwardly. As the piston rod 76 moves upwardly the yoke 77 and the shafts 79 are raised, pulling upwardly on the shafts 54. Initial upward movement of the shafts 54 will raise the bars 51, 52 and pivot the supports 43 on the shaft 42, lowering the lifting members 55, 56 and moving them inwardly so that the hooks 59 may engage under opposite side edges of the crate 123. Continued lifting movement of the piston rod 76 will raise the carriages 61 and the crate 123 to the upper limit of their movement. When the carriages 61 have been raised to the upper limits of their travel, pressure remains on the underside of the pneumatic cylinder 75 to maintain the carriages 61 in their upper position. A second crate 123 then moves inwardly on the conveyor chains 62 and contacts the stops 72 engaging the buttons 74 of the valves A and C, moving them from their normally closed position to open position. The movement of the carriages 61 away from the valves B and D had permitted the valve B to return to its normally open position and the valve D to return to its normally closed position. As soon as the valve A is opened by the succeeding crate 123 air flows to the port 102 of the control valve 99 moving the piston plug 101 to the opposite end to simultaneously connect the conduit 125 to an exhaust pipe 126 and to connect the inlet pressure line 124 to the conduit 127 extending to the upper end of the pneumatic cylinder 75. The reversal of the valve 99 causes the pneumatic cylinder 75 to operate in a reverse direction and the piston rod 76 thereof moves downwardly so that the carriages 61 place the original crate 123 on top of the second crate 123 and then move on downwardly to their original position with the hooks 59 positioned below the top level of the chain 62. As soon as the carriages 61 have reached their lowermost position, the valve D is opened and the valve B is closed to again reverse the valve plug 101 in the control valve 99. The vertical reciprocating movement of the carriages 61 is continued in a like manner until a predetermined number of crates 123 are stacked one on top of the other to create, for instance, a stack of five crates 123. When the fifth crate 123 has been positioned beneath the stack held in the carriages 61, downward movement of the carriages 61 will cause the lever 90 to engage the upper edge of the uppermost crate so as to move the push rod 93 downwardly in a position to contact the spring pad 70, whereupon the stops 72 are depressed and the stack of crates 123 is permitted to move out of the stacker 20 on the conveyor chains 62.

It should be understood that the conveyor chains 62 have a relatively smooth upper surface and the crates 123 may slide thereon whenever the stops 72 are in their raised position, as illustrated in FIGURE 10.

When the stack of crates 123 has been moved out of the crate stacker 20 on the conveyor chains 62, the lever 90 disengages from the top crate 123 and the spring 97 and the spring 71 return the push rod 93 and the stop support 66 to their raised positions for engagement of the next crate 123 moving on the conveyor chains 62.

It can be seen from the description above that crates moving in individual successive positions on the conveyor chains 62 will be individually stopped in position for the carriages 61 to raise them above the conveyor chains 62, permitting the next successive crate 123 to be moved into position at the bottom of the stack.

Having thus described the preferred embodiment of the invention, it should be understood that numerous structural modifications and adaptations may be resorted to without departing from the scope of the appended claims.

What is claimed is:

1. A crate stacker comprising an upright frame, a vertically disposed fluid pressure cylinder mounted on the upper end of said frame, a reciprocable piston rod in said fluid pressure cylinder extending therefrom into said frame, a transverse member pivotally secured intermediate its ends to the free end of said piston rod, vertical oppositely disposed guide means on said frame adjacent the lower end portion thereof, lift carriages operatively connected to each of said guide means and movable relative thereto, a pair of elongated rods each having one of their ends secured to the ends of said transverse member and each pivotally secured at their other ends to said lift carriages, each of said elongated rods extending through one of a pair of hydraulic cylinders mounted in said frame, pistons fixed to said rods and residing in said hydraulic cylinders, each of said hydraulic cylinders having their opposite ends in communication to equalize move-

ment of said lifting carriages, crate engaging means on said lift carriages movable from an inoperative position to a crate engaging position in response to movement of said pair of elongated rods, and means to position crates in said frame to be engaged by the crate engaging means on said lift carriages.

2. A crate stacked as defined in claim 1 wherein said lift carriages include pairs of vertically extending bars secured together intermediate their ends in spaced parallel relation, the lower ends of each of said pairs of bars having interconnected supports pivotally secured thereto, the upper ends of each of said pairs of bars having interconnected supports pivotally secured thereto and said crate engaging means pivotally secured to said support.

3. A crate stacker as defined in claim 1 which includes a control valve having a fluid inlet port and fluid outlet ports in communication with opposite ends of said fluid pressure cylinder, pilot valves having fluid inlet ports and fluid outlet ports in communication with said control valve, certain of said pilot valves actuated by a crate positioned in said frame, other of said pilot valves actuated by said lift carriages to alternately direct a flow of fluid to opposite ends of said fluid pressure cylinder.

4. A crate stacker as defined in claim 1 wherein said means to position crates in said frame includes a crate carrying conveyor extending therethrough, a pivoted stop support having stop means thereon, said stop means normally in crate engaging position in the path of travel thereof to position crates carried by said conveyor for engagement by said crate engaging means on said lift carriages.

5. A crate stacker as defined in claim 4 which further includes means mounted on and movable with one of said lift carriages and engageable with a stacked crate, movement of said means effecting pivotal movement of said stop support to move the stop means carried thereby from the path of travel of crates carried by said conveyor whereby a stack of crates within said frame can be moved therefrom.

6. A crate stacker as defined in claim 5 wherein said means comprises horizontal brackets each secured at one end to said lifting carriage, an upright member secured to the other ends of said brackets, a lever pivotally secured intermediate its ends to said upright member, a roller secured to one end of said lever and engageable with the uppermost of a stack of crates, a vertically movable push rod pivotally secured to the other end of said lever, the free end of said push rod in overlying relation to said stop support.

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