Dec. 11, 1951 E. D. ANDREWS 2,578,277

CONTAINER LOADING MACHINE HAVING AUTOMATIC CARTON EJECTOR

Filed April 26, 1946 4 Sheets-Sheet 1

Fig. 1.

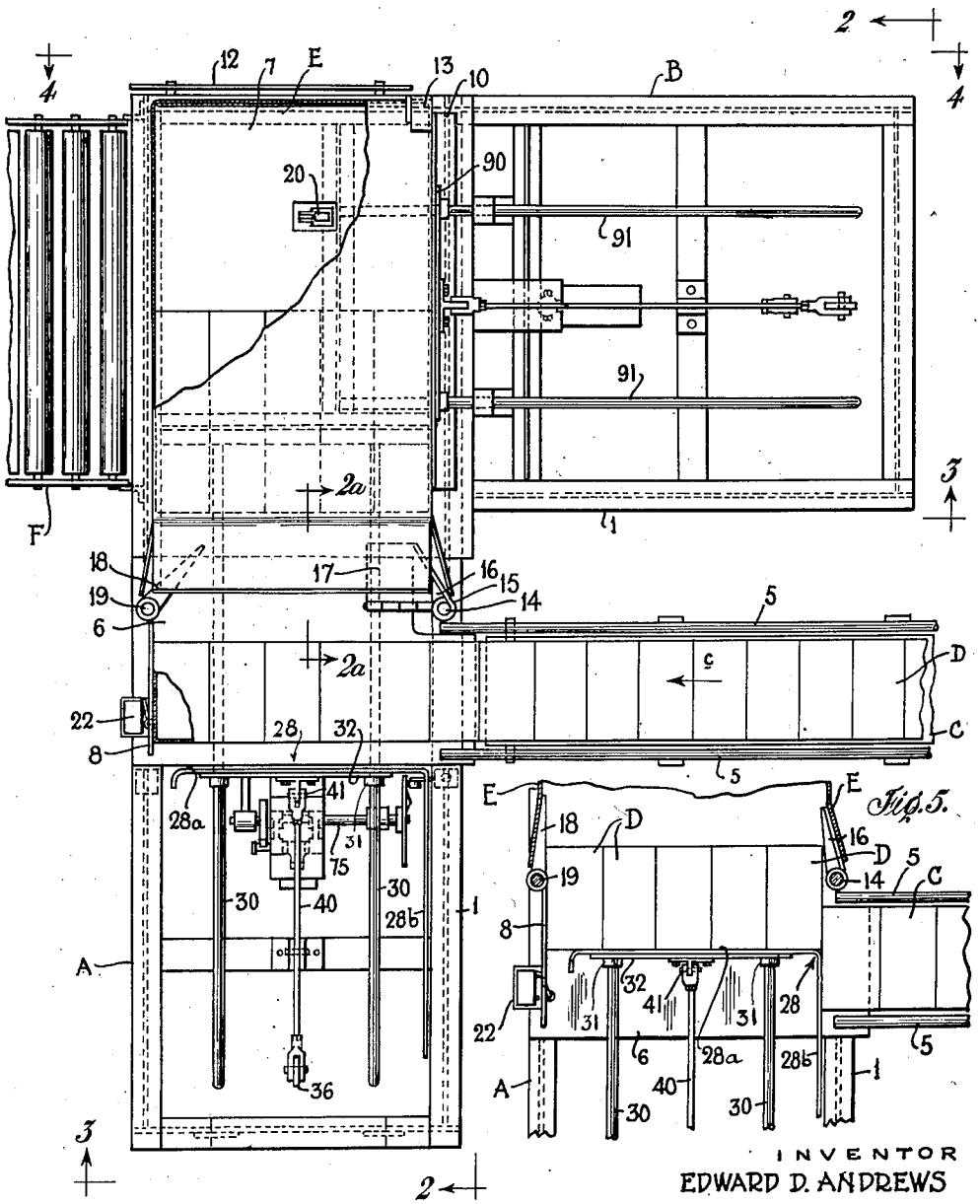

Fig. 5.

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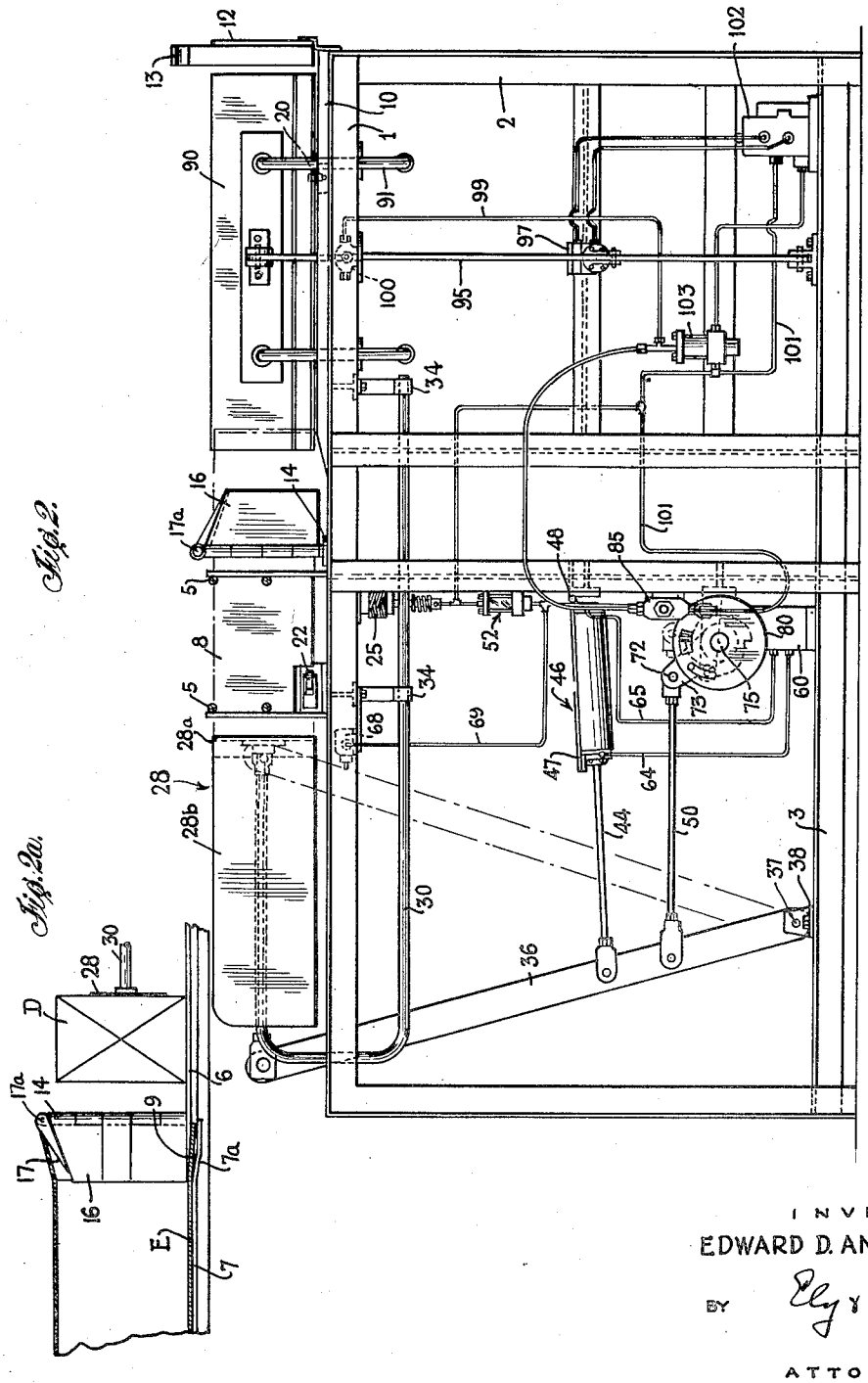

Fig. 2.

Fig. 2a.

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Fig. 3.

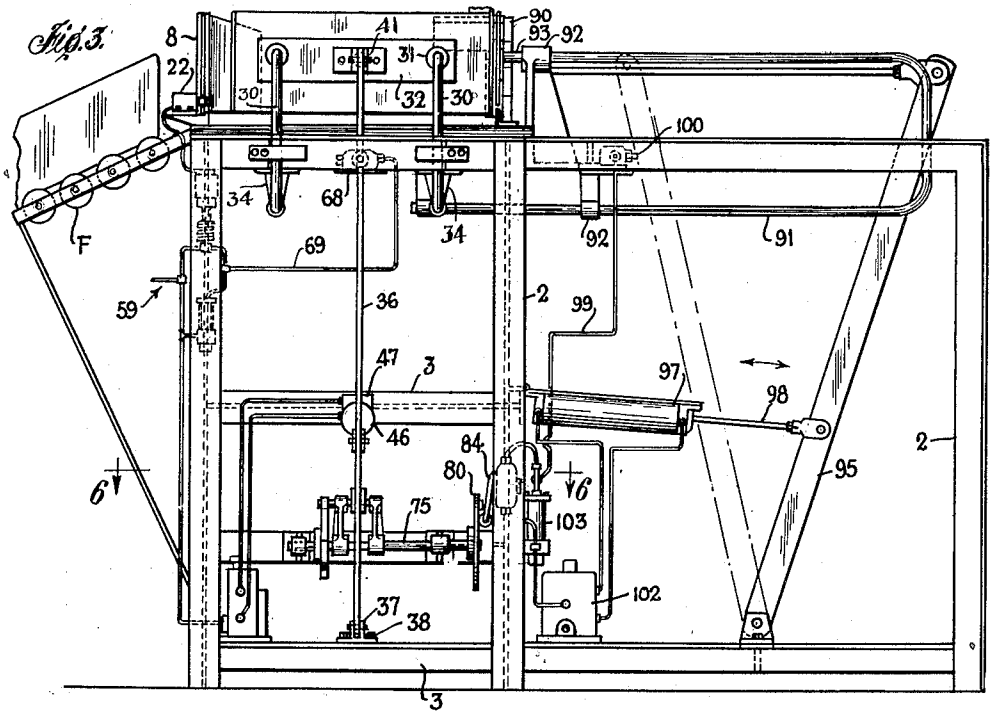
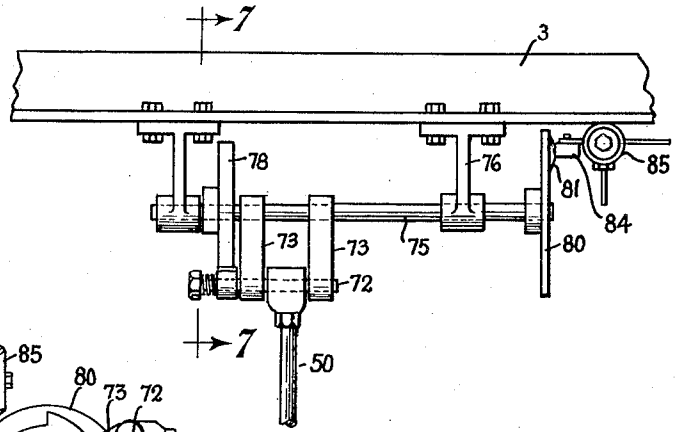


Fig. 6.



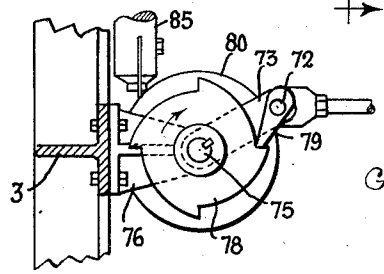


Fig. 7.

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Fig. 4.

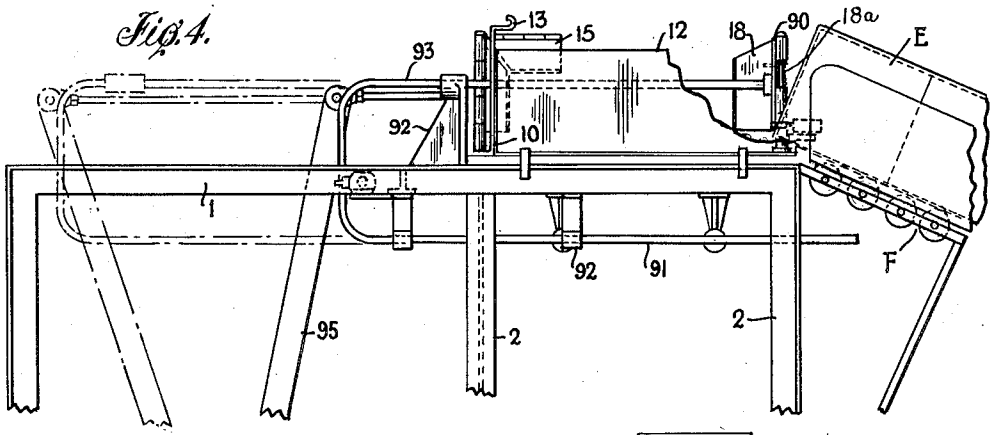

Fig. 8.

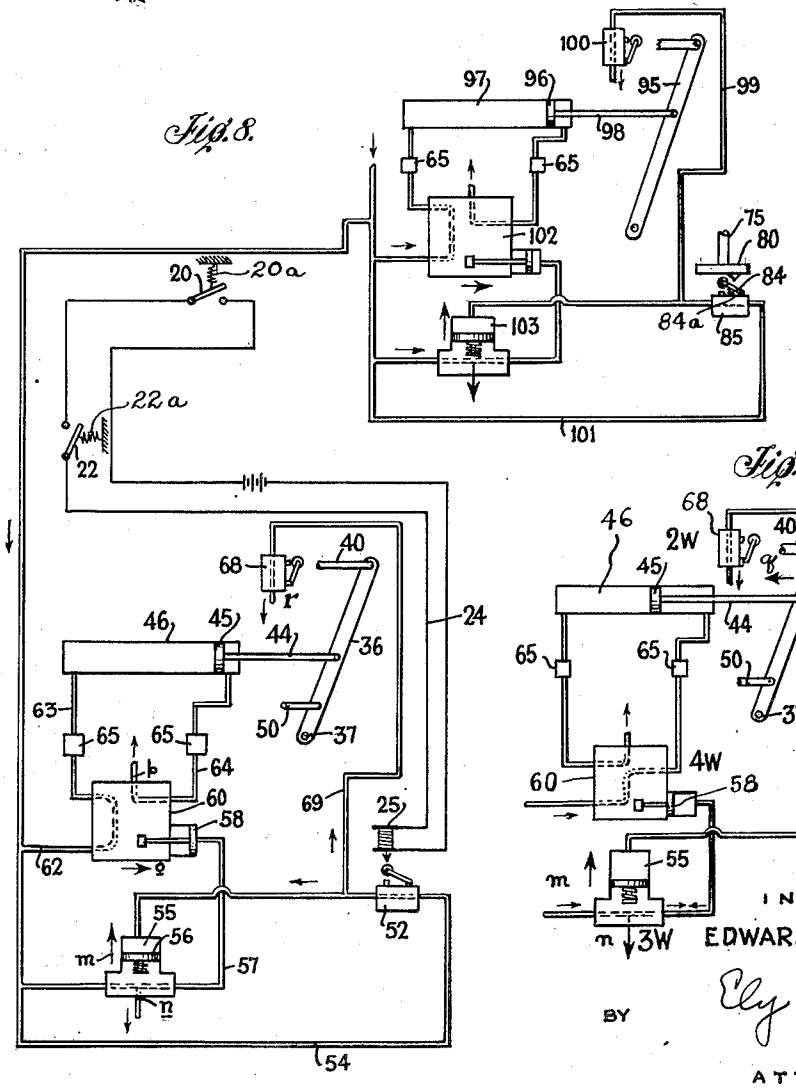

Fig. 9.

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2,578,277

UNITED STATES PATENT OFFICE

2,578,277

CONTAINER LOADING MACHINE HAVING AUTOMATIC CARTON EJECTOR

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Application April 26, 1946, Serial No. 665,294

19 Claims. (Cl. 226—14)

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The present invention has as its object the improvement of machines for loading large shipping containers with a plurality of smaller packages or boxes. Machines of this general type are old and well known and operate upon the principle of separating from the end of a line of the smaller packages successive rows thereof and feeding the rows into the open end of the container. When the requisite number of rows has been fed into the container, the filled container is ejected from the machine.

Machines such as described have heretofore been operated by a series of clutches, cams or the like and are not only expensive due to the complicated mechanisms required to perform the operations in exact timed relation, but also require frequent supervision and maintenance.

It is the purpose of the invention to devise a machine by which the operations may be carried on with a minimum of mechanical devices, thereby not only reducing the initial expense of the equipment, but substantially reducing supervision and maintenance. The object is obtained by devising a machine in which the package-row feeding mechanism and container-ejecting mechanism are actuated solely by fluid pressure combined with control devices which cause the feeding mechanism to function whenever a container is in position and the requisite number of packages are in position at the mouth of the container. The fluid pressure which is employed in the machine shown and described herein is compressed air, although hydraulic or other pressure means may be used. The layout of the machine is such that all that is required of the operator is to place an open container in position in the machine and the packages will move in an orderly fashion in rows or tiers into the container. When the container is filled, it is ejected and the loading operation will not be resumed until an empty container is placed in the machine.

In accomplishing the purposes of the invention, standard commercial valves and fittings have been employed throughout. The organization and combination of elements shown and described herein are the best known and preferred means of carrying out the objects of the invention, but this is not to be understood as limiting the invention to this arrangement for the machine may be modified or improved upon without departing from the principles of the invention as set forth in the appended claims.

The drawings show a machine which has been perfected for loading boxes of cereals into large shipping containers, but the principles of the

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invention may be employed wherever a number of articles or packages are loaded into a larger receptacle. The machine shown in the drawings is designed to load four rows containing five boxes each into each container, but the machine may be adapted for loading any number of rows, each containing any number of articles or packages, into any type of container. While the drawings show the loading of square packages, it may be used for loading cylindrical packages.

In the drawings:

Fig. 1 is a plan view of the machine. In this view a portion of the container has been broken away to show the top of the container table and two rows of the four required to fill the container. The machine is just at the point of feeding the third row of packages into the container.

Fig. 2 is a side elevation of the machine looking from the right of Fig. 1, the general plane of the view being shown by the broken line 2—2 in Fig. 1.

Fig. 2a is a section through a portion of the table on the line 2a—2a of Fig. 1.

Fig. 3 is a side elevation looking at the machine along the broken line 3—3 in Fig. 1.

Fig. 4 is an elevation looking at the rear of the machine along the line 4—4 of Fig. 1.

Fig. 5 is a fragmentary view showing a row of the packages partially entered into the mouth of the container.

Fig. 6 is a view on the line 6—6 of Fig. 3 showing the timing mechanism which controls the container-ejecting mechanism from the package feeding device.

Fig. 7 is a section on the line 7—7 of Fig. 6.

Fig. 8 is a diagrammatic layout showing the general arrangement of the pressure lines, valves and electrical wiring by which the machine is operated.

Fig. 9 is a further layout showing the positions of the valves when either the package feeding lever is acting to feed a row of the packages or the container ejecting lever is moving to eject the filled carton. The package feeding lever has been selected for this view, but the arrangement is the same for the container ejector.

Much of the piping has been omitted from the general views as the location thereof is optional and the layouts of Figs. 8 and 9 show the principles involved.

Various operating parts of the machine are carried upon a main framework 1 which is in the general form of the letter L and is made up of structural steel sections which it is unnecessary to describe. One wing, designated by the

letter A, supports the package feeding instrumentalities, while the wing B, at right angles thereto, supports the container ejecting devices. Uprights 2 located at the several corners support the framework 1 at a convenient height for the operator and several braces or cross members 3 also afford supports for other parts of the mechanism.

At the right of the wing A is the conveyor belt C which is driven continuously in the direction of the arrow *c* in Fig. 1. At the sides of the belt are located the two guide rails 5 which terminate just over the edge of the framework 1. This conveyor belt receives the packages or boxes D from the filling and sealing machines and carries them to the loading machine where they are pushed in a straight line over a table or plate 6 until they are arrested by the vertical wall 8 carried on the far side of the framework opposite the discharge point of the conveyor belt.

The surface of the belt will slip beneath packages which may be arrested by the wall 8 or by the package loader, to be described. When the forward package in the line comes to a halt against the wall 8, a solid row of packages will lie across the table 6 in position to be fed into the container.

In alignment with the table 6 is a second table 7 which lies across the wing B. The top of the table 7 is slightly lower than the top of the table 6 so that when the container is in position the inside lower wall of the container is on the same level as the top of table 6. As shown in Fig. 2*a* the rear edge of the table 6 is spaced from the table 7, which is offset, as at 7*a*, to provide a slot 9 to receive the lowermost flap of the container E. This arrangement keeps the flap out of the way of the packages. The operator places the container on the table 7 with its open end toward the left as shown in Fig. 2 and inserts the lower flap in the slot 9. One side of the container rests against the guide rail 10 and the closed end of the container is located against a rear end wall 12. To hold the container in position, the machine is provided with an angular bracket 13 under which one corner of the container is received. The operator inserts the container over spreaders which hold the side and top flaps open so the packages may enter. The spreader at the front right-hand corner of the table 6, as viewed in Fig. 1, consists of a dual angular plate 15 mounted on a post 14 rising from the framework. One portion 16 of the plate 15 holds the end flap outwardly and the other portion 17 holds the top flap up and out of the way. A second arm 18, located on a post 19 at the opposite corner of the container, holds the other end flap out of the path of the packages.

The several spreaders are mounted so that they project into the path of the packages as they are moved into the container, but yield and spread apart as the packages enter. The parts 16 and 18 are pivoted on the posts 14 and 19 and are urged inwardly by coiled springs, one of which is shown at 18*a* in Fig. 4. The upper portion 17 is pivotally mounted on a pin 17*a* secured to the upper end of post 14, and rests by gravity on the upper edge of the portion 16. This arrangement facilitates the insertion of the packages.

It will be noted that the wall 8 is in alignment with the vertical side of the container and that the five packages at the leading end of the row are in register with the mouth of the container.

At this point attention is directed to the two control devices which act to set the machine in motion when two conditions are fulfilled, i. e., an empty container is in place and a full row of packages is lined up in front of the open container.

These control devices are shown as electrical switches and the operation is controlled electrically in the preferred form of the invention. It will be appreciated, however, that air or other fluid control valves would be the mechanical equivalent thereof and may be employed in their stead.

The switch 20, which is illustrated in the drawings, may be designated as the container switch, and is located in an aperture in the top of the table 7. This switch is urged by the spring 20*a* in the direction of the arrow appearing in Fig. 8 so that it tends to rise above the top of the table and in this condition the switch is open, but when a container is properly located on the table, the switch is closed by the weight of the container.

The switch 22, which may be designated as the package switch, is located in an aperture in the wall 8. This switch is also urged by the spring 22*a* in the direction of the arrow appearing in Fig. 8 so that it tends to project inwardly of the wall 8 in the position shown in Fig. 5, but when the leading package is moved by the belt into position against the wall 8, the switch is depressed and closes.

Referring to Fig. 8, the switches 20 and 22 are both normally open and in series in the electrical circuit 24 which actuates the solenoid 25 that may be located at any convenient point in the machine, such as shown in Fig. 2. While the belt C is in operation, all that the operator is required to do is to place the empty container in position, which act closes the switch 20, and if the row of packages is across the mouth of the container, or as soon as the forward package closes the switch 22, the solenoid is energized and the package feeding mechanism starts to function.

The package loader or pusher is a relatively large, sheet metal plate 28 which is located in alignment with the container. The front face 28*a* of the feeder or loader 28, when idle, is located a short distance in front of the line of packages D and is of sufficient extent to engage the requisite number of packages. The wing 28*b* is in alignment with the right-hand inner wall of the container and, therefore, coincides with the meeting faces of the fifth and sixth packages. It is of sufficient extent so that it holds back the oncoming row of packages while making its feeding stroke.

The loader is carried by any suitable means which supports and guides its horizontal movement. The means shown comprises the two U-shaped arms 30, the upper and shorter branches of which are connected to the plate 28 by sockets 31 carried on the cross plate 32 attached to the back of the plate 28. The lower and longer branches of the arms 30 are received in aligned slide bearings 34 depending from the underside of the framework.

The loader is actuated by a lever 36, the lower end of which is pivoted at 37 in a bracket 38 attached to one of the lower braces 3. The upper end of the lever 36 is connected to one end of a link 40, the other end of which is pivotally connected to a bracket 41 secured to the back of the loader 28. At an intermediate point the lever 36 is pivotally connected to a second

link 44, the far end of which carries a piston 45 (see Fig. 8) movable in the cylinder 46. The cylinder 46 is carried on the underside of a plate 47 which is pivoted to one of the members 3 at the point indicated by the numeral 48 in Fig. 2.

Also pivotally connected to the lever 36 is a third link 50 which actuates the timing mechanism by which the container ejector functions when the full complement of packages has been loaded into the container. This will be described in a later portion of the specification.

The piston 45 is actuated by the fluid pressure, compressed air in the present case, when the two control devices 20—22 are actuated. As noted above, this energizes the solenoid which, in turn, opens a two-way valve 52 located in the main air line conduit 54 for the package loader. The opening of the valve 52 introduces air into a standard three-way pilot valve 55. A valve of this type is shown diagrammatically in Figs. 8 and 9. It contains a piston 56 which is spring loaded in the direction of the small arrow *m*. This piston controls a passage through which compressed air passes along the line 57 branching from the main line. The exhaust port is indicated by the arrow *n*. When the piston 56 is depressed on opening the valve 52, air under pressure flows through the line 57 and moves the piston 58 which operates the valve mechanism of a standard four-way valve 60. The details of this valve are not shown as such valves are available on the open market. The valve mechanism is air loaded in the direction of the arrow *o* so that when the pressure is relieved from the piston 58 the four-way valve assumes the position shown in Fig. 8. When, however, pressure is admitted to the top of the piston 58 through the line 57, the piston moves in the direction opposite to the arrow *o*.

The four-way valve receives air under pressure through a branch line 62. As shown in Fig. 8, the lever 36 is at the extreme outer end of its travel and the left-hand end of the cylinder 46 is in direct communication with the line 62 through the conduit 63, and the right-hand end of the cylinder is in communication with the exhaust *p* through the line 64. Check valves 65 in the lines 63—64 reduce the speed of the piston to the desired point so as to avoid too abrupt movement of the lever and its connected elements.

While the lever is moving in the direction of the arrow *q* in Fig. 9, the four-way valve is reversed through the action of the valve 52 and the pilot valve 55 as is indicated on the four-way valve in Fig. 9.

In order to reverse the lever 36 when it reaches the end of its feeding stroke, the air circuits are restored to the position shown in Fig. 8. This is done by locating a normally closed two-way valve 68 in position so that it will be struck by the lever 36 and opened when the lever reaches the inner limit of its movement. The location of this valve 68 is shown in Fig. 2. It is on the end of a branch line 69 from an extension of the main line 54 and discharges to the atmosphere at *r*. When the valve 68 is opened in the manner set forth, the pilot valve 55 opens the line 57 to the exhaust *n*, whereupon the piston 58 moves to the right in Fig. 8 and the line 62—63 is opened through the four-way valve 60, and the lever 36 completes its return stroke, where it will remain until both switches 20—22 are again closed.

As stated above, the mechanism which has been selected to show the invention is designed to load four rows of packages in the container whereupon the container is ejected from the machine. The timing mechanism to perform this operation will now be described.

The link 50 is pivotally connected at the end remote from the lever 36 to a pin 72 carried in the outer ends of rocker arms 73 which are rotatable on a shaft 75 mounted in brackets 76 secured to one of the cross members 3. On the shaft 75 is keyed the four-step ratchet 78 which is rotated intermittently by the pawl 79 carried by the pin 72. Therefore, as the lever 36 makes each return stroke after moving a row of packages into the container the shaft 75 is rotated a quarter of a turn. If the number of rows to fill a container was changed the ratchet would be changed to have a corresponding number of teeth.

On the shaft is located a cam disk 80 having a single cam formation or hump 81 which, in order to give a slight dwell after the last loading stroke, is located slightly behind a ratchet tooth. Bearing against the face of the disk 80 in the path of the hump 81, is the lever 84 which is pressed against the disk 80 by spring 84*a*. When the lever 84 is moved by the hump 81, this serves to open a third two-way valve 85 which controls the air circuits which in turn actuate the ejector in the manner to be later described.

The container ejector comprises a plate 90 which, when retracted, lies a short distance to the rear of guide rail 10 in a position to engage the container. The plate 90 is carried on the ends of the U-shaped arms 91 similar to the arms 30 and similarly mounted except that the upper branches of the arms are guided in supplementary brackets 92. The ejector is connected to the pivoted lever 95 which is actuated by the piston 96 in the pivoted cylinder 97, being connected thereto by the link 98. The return movement of the lever 95 is secured by the two-way valve 100 located on the end of the airline 99 in position to be opened by the lever at the forward end of its stroke. The air is supplied to the ejector operating system from a main line 101 connected to the line 54, at any point, and receiving air under pressure from a common source.

As the operation of the ejector system is the same as has been described for the loader system, no additional description is needed. The equivalent four-way valve bears the numeral 102 and the three-way pilot valve the numeral 103. The major difference between the two systems is that the two-way valve 85 is opened once to every four openings of the valve 52 because this is the number of rows of packages which will fill the particular container illustrated and that the valve 85 is cam operated while the valve 52 is solenoid operated.

Operation

The operator places the empty container on the table extension 7 with the open end presented to the loader. If the row of packages D is advanced so that the leading one rests against the wall 8, the solenoid sets in operation the train of valves by which the loader 28 is reciprocated for the requisite strokes to fill the container When the loader has made the number of strokes necessary to fill the container the cam disk 80 opens the valve 85 and sets in motion the ejector 90 which moves the filled container off the table and onto the gravity conveyor F. The

removal of the container opens the switch 20 and the circuit to the solenoid is broken and the machine stops until a fresh container is put in place. While the container is in place the circuit is broken each time a row of packages is moved into the container but it is reestablished whenever the row of packages again assumes the position shown in Fig. 1.

It will be seen that the complete automatic operation of the loader and ejector is effected wholly by fluid pressure, in conjunction with the electrical starting system represented by the switches 20—22 or an equivalent thereof. There are no complicated clutches or like mechanical devices which have heretofore made machines of this type so expensive both as to initial cost and maintenance charges.

The machine shown herein is illustrative of the invention only and it is not intended to limit the invention to the specific embodiment thereof which has just been described. The term "package" is employed to incidate all kinds of articles which may be loaded into the container.

As mechanical equivalents for the electrical circuits shown, pressure lines may be used with the substitution of valves and fluid-pressure operated devices as will be understood by a machine designer.

What is claimed is:

1. A container loading machine comprising the combination of a support for container, means for positioning a row of articles across the mouth of the container, a reciprocating feeder movable to detach a number of said articles from the row and move them into the container, a container ejector, a fluid operated means to reciprocate the feeder, a second fluid operated means to actuate the ejector, and a timing mechanism operated by the feeder to set the second fluid operated means in motion.

2. A container loading machine comprising the combination of a support for a container, means for positioning a row of articles across the mouth of the container, a reciprocating feeder movable to detach a number of said articles from the row and move them into the container, a container ejector, a fluid operated means to reciprocate the feeder, a second fluid operated means to reciprocate the ejector, and a timing mechanism operated upon a predetermined number of reciprocations of the feeder to set the second fluid operated means in motion.

3. A container loading machine comprising the combination of a table for supporting the container, a conveyor operable to advance a row of packages across the mouth of the container as it rests upon the table, a stop to arrest the row in position in register with the mouth of the container, an electro-magnetic device, a circuit for said device, two normally, open switches in series in said circuit one of said switches located so as to be closed by pressure exerts by the container when the container is in position on the table and the second of said switches located so as to be closed when the row of packages reaches the stop, a fluid pressure actuated feeder movable across the row of packages to place them in the container, and valve mechanism actuated by the energization of electro-magnetic device by the closing of said circuit to set the feeder in motion.

4. A container loading machine comprising the combination of a table for supporting the container, means to advance a row of packages to a position in register with the mouth of the container, a solenoid, an electric circuit for energizing the solenoid, two normally open switches in series in said circuit, one of said switches being closed by the container when in loading position on the table, the second switch being closed by the packages when in position, a feeder reciprocable across the row of packages toward and from the container, and means to set the feeder in operation, said last named means being operated by the energization of the solenoid.

5. A container loading machine comprising the combination of a table for supporting the container, means to advance a row of packages to a position in register with the mouth of the container, a solenoid, an electric circuit for energizing the solenoid, two normally open switches in series in said circuit, one of said switches being located in a position to be closed by the container when in position on the table, the second switch being closed by the packages when in position, a feeder reciprocable across the row of packages toward and from the container, a piston and cylinder connected to the feeder, and valve means actuated by the solenoid to admit fluid under pressure to the cylinder and thereby move the feeder toward the container.

6. A container loading machine comprising the combination of a table for supporting the container, means to advance a row of packages to a position in register with the mouth of the container, a solenoid, an electric circuit for energizing the solenoid, two normally open switches in series in said circuit, one of said switches being located in a position to be closed by the container when in position on the table, the second switch being closed by the packages when in position, a feeder reciprocable across the row of packages toward and from the container, a piston and cylinder connected to the feeder, and valve means actuated alternately by the solenoid and by the movement of the feeder to admit fluid under pressure to opposite ends of the cylinder and thereby reciprocate the feeder.

7. A container loading machine comprising the combination of a table for supporting a container, means to advance a row of packages to a position in register with the mouth of the container, a feeder reciprocable across the row of packages toward and from the container, a piston and cylinder connected to the feeder, and valve means having an actuating element located at the table and in position to be set in operation by the container when in loading position on the table and additional means actuated by the packages when in register with the container to admit fluid under pressure into one end of the cylinder and thereby cause the feeder to move toward the container.

8. A container loading machine comprising the combination of a table for supporting the container, means to advance a row of packages to a position in register with the mouth of the container, a feeder reciprocable toward and from the container, a piston and cylinder connected to the feeder, and valve means set in operation alternately by (1) the presence of the container when in loading position on the table and the packages when in register with the container and (2) by the feeder at the end of its forward stroke to admit fluid under pressure to opposite ends of the cylinder and thereby cause the feeder to reciprocate.

9. A loading machine of the type described for inserting rows of packages in a container

comprising a reciprocable package feeder movable toward and from the mouth of the container, a reciprocable ejector for the container, a piston and cylinder connected to the feeder, a second piston and cylinder connected to the ejector, valve means set in motion by the positioning of the container and the packages in the path of the feeder to admit fluid pressure to the first cylinder to reciprocate the feeder, and a second valve means set in motion by the feeder after it has made a predetermined number of strokes to admit fluid pressure to the second cylinder to reciprocate the ejector.

10. A loading machine for inserting rows of articles in a container, comprising a reciprocable article feeder movable toward and from the mouth of the container, a reciprocable ejector for the container, a piston and cylinder connected to the feeder, a second piston and cylinder connected to the ejector, an electro-magnetic device, a circuit to said device, said circuit being normally open but constructed and adapted to be closed by the positioning of the container and the articles in the path of the feeder, valve means set in motion by the said device to admit fluid pressure to the cylinder to reciprocate the feeder, and a second valve means set in motion by the feeder after it has made a predetermined number of strokes to admit fluid pressure to the second cylinder to reciprocate the ejector.

11. In a machine of the character described, a table for supporting a container, a reciprocable feeder for inserting rows of articles successively into the container, a reciprocable ejector for the container movable in a path intersecting the line of movement of the feeder, fluid pressure means to actuate the ejector, valve mechanism to control said fluid pressure means, and a timing mechanism actuated by the feeder and operable after a predetermined number of strokes of the feeder to set the valve mechanism in motion and thereby cause the ejector to operate.

12. In a machine of the character described, a table for supporting a container, a reciprocable feeder for inserting rows of articles successively into the container, fluid pressure means to actuate the feeder, a reciprocable container ejector movable across the table, a second fluid pressure means to actuate the ejector, a set of valves to control the first named fluid pressure means and a second set of valves to control the second named fluid pressure means, and a timing mechanism actuated by the feeder and operable after a predetermined number of strokes of the feeder to operate the second set of valves and thereby cause the ejector to reciprocate across the table.

13. A container loading machine comprising the combination of a table for supporting a container, means to advance a row of packages to a position in register with the mouth of the container, two control devices, one of said control devices being actuated by the presence of the container when in loading position on the table, the other control device being actuated by the packages when they are in position at the mouth of the container, a feeder reciprocable across the row of packages toward and from the container, and means to operate said feeder set in motion by the joint action of the said control devices.

14. A container loading machine comprising the combination of a table for supporting a container, means to advance a row of packages to a position in register with the mouth of the container, two control devices, one of said control devices being actuated by the container when in loading position on the table, the other control device being actuated by the packages when they are in position at the mouth of the container, a feeder reciprocable across the row of packages toward and from the container, and means to operate said feeder set in motion by the joint action of the said control devices, a container-ejector, and a timing device controlled by the feeder and operable upon a predetermined number of operations of the feeder to actuate the container-ejector.

15. A container loading machine comprising the combination of a table for supporting a container, means to advance a row of packages to a position in register with the mouth of the container, two control devices, one of said control devices being actuated by the presence of the container when in loading position on the table, the other control device being actuated by the packages when they are in position at the mouth of the container, a fluid-pressure actuated feeder reciprocable across the row of packages toward and from the container, and means to operate said feeder set in motion by the joint action of the said control devices

16. A container loading machine comprising the combination of a table for supporting a container, means to advance a row of packages to a position in register with the mouth of the container, two control devices, one of said control devices being actuated by the container when in position on the table, the other control device being actuated by the packages when they are in position at the mouth of the container, a fluid-pressure actuated feeder reciprocable across the row of packages toward and from the container, and means to operate said feeder set in motion by the joint action of the said control devices, a fluid-pressure actuated container-ejector, and a timing device controlled by the feeder and operable upon a predetermined number of operations of the feeder to actuate the container-ejector.

17. A container loading machine comprising the combination of a stationary support for a container, means for positioning a succession of groups of articles across the mouth of the container, a reciprocating feeder to shift a group of said articles into the container while the container is on the support, an ejector for removing a filled container from the support, fluid operated means to actuate the ejector, and a timing mechanism operated by the feeder to actuate the ejector upon a predetermined number of reciprocations of the feeder.

18. A container loading mechanism comprising the combination of a stationary support for a container, means for positioning a succession of groups of articles across the mouth of the container, a reciprocating feeder to shift a group of said articles into the container while the container is on the support, an ejector for removing a filled container from the support, two normally open switches in series, one switch located in position to be closed by the container on the support and the second switch located in position to be closed by the group of packages when in position in front of the container, means to actuate the feeder only when both switches are closed, fluid operated means to actuate the ejector, and a timing mechanism operated by the

feeder to actuate the ejector upon a predetermined number of strokes of the feeder.

19. A container loading machine comprising the combination of a stationary support for a container, means positioning a succession of groups of articles across the mouth of the container, a reciprocating feeder to shift a group of said articles into the container while the container is on the support, fluid operated means for reciprocating the feeder, an ejector for removing a filled container from the support, two normally open switches in series, one switch located in position to be closed by the container when in loading position on the support and the second switch located in position to be closed by the group of packages when in front of the container, means to actuate the said fluid operated means only when both switches are closed, and timing

mechanism to actuate the ejector upon a predetermined number of strokes of the feeder.

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