Nov. 29, 1966 R. C. CLARK 3,288,177

APPARATUS FOR FILLING AND PACKING CONTAINERS

Original Filed Nov. 1, 1962 6 Sheets-Sheet 1

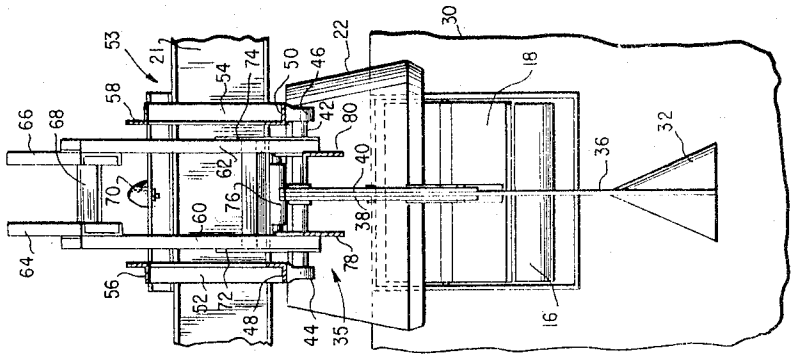


FIG. 2

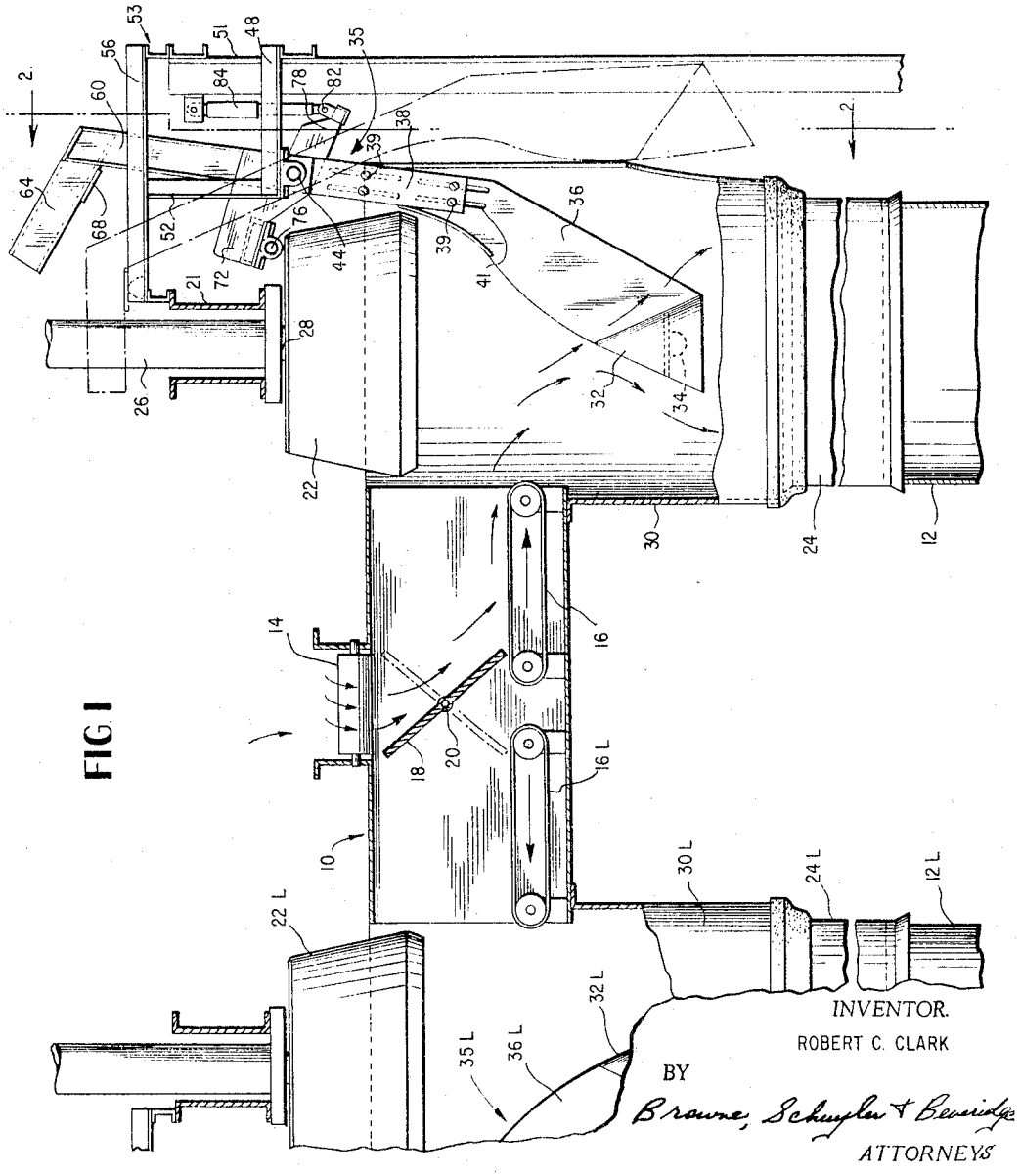


FIG. 1

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FIG. 4

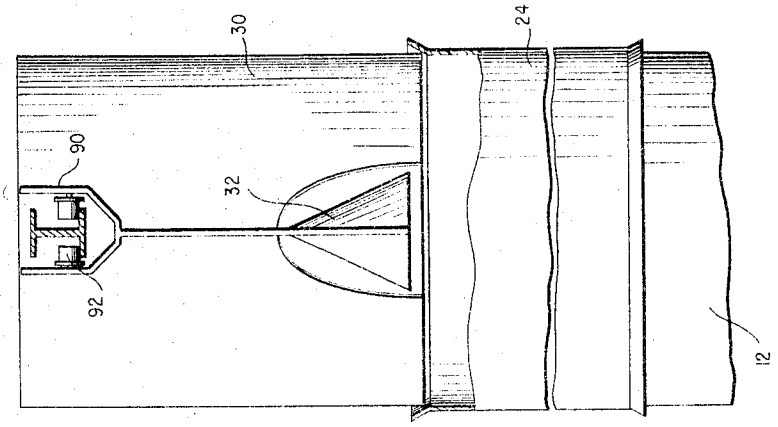
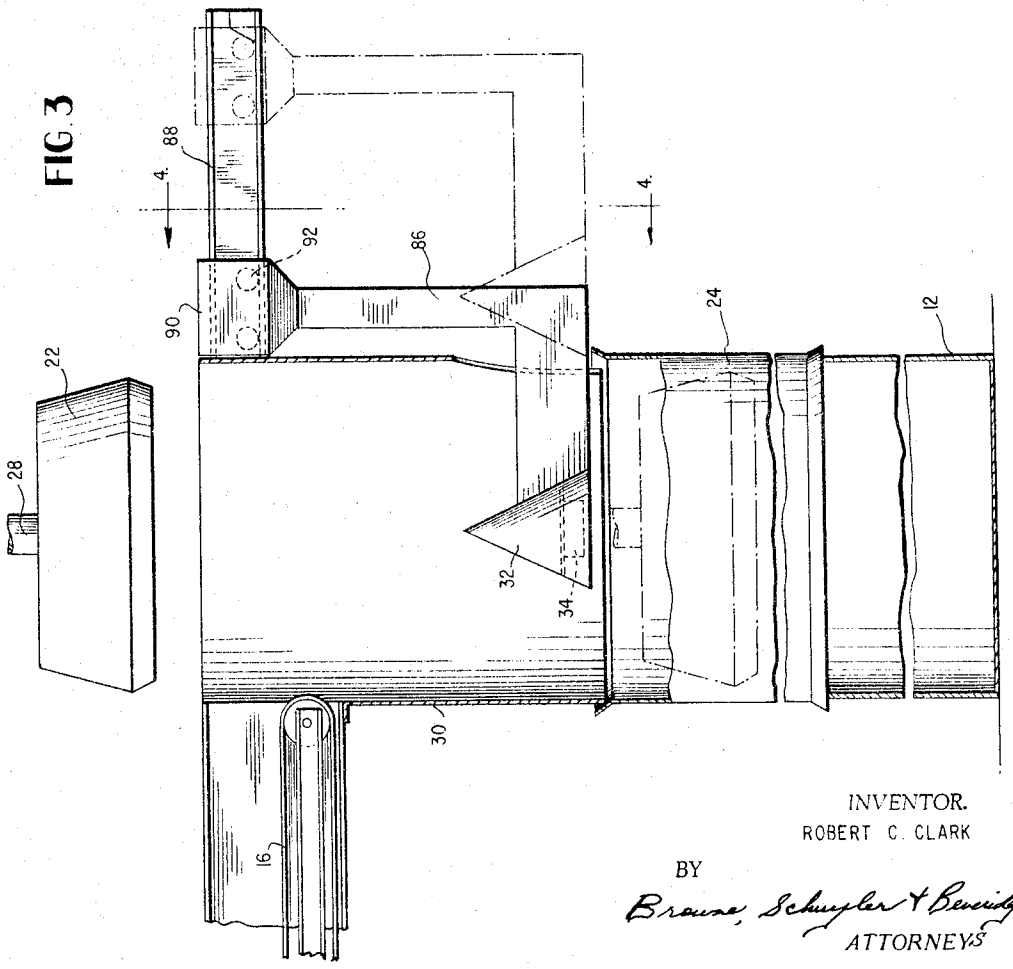


FIG. 3



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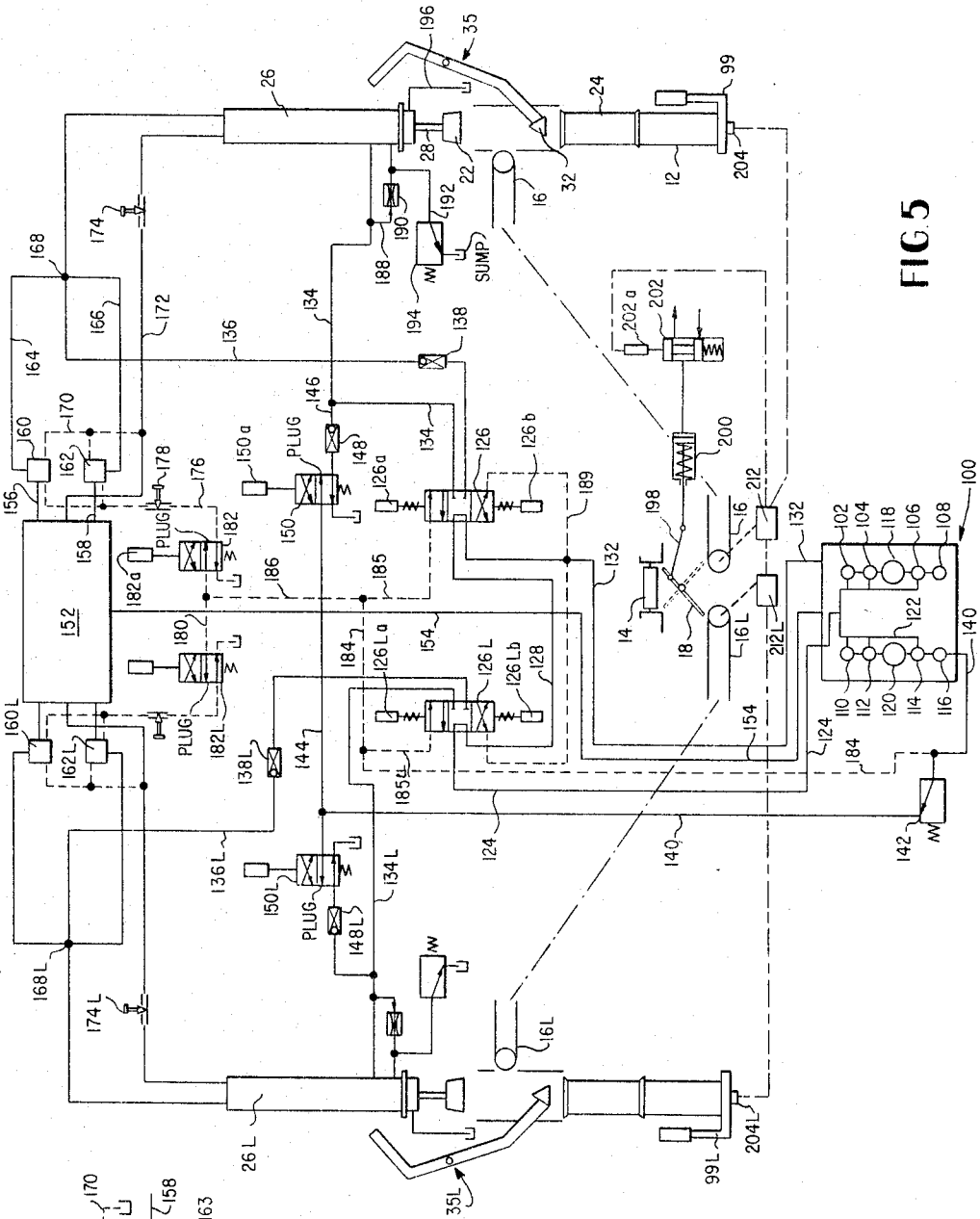


FIG 5

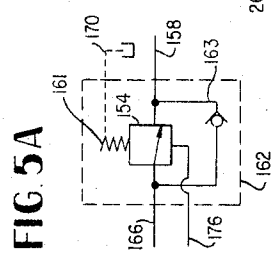


FIG 5A

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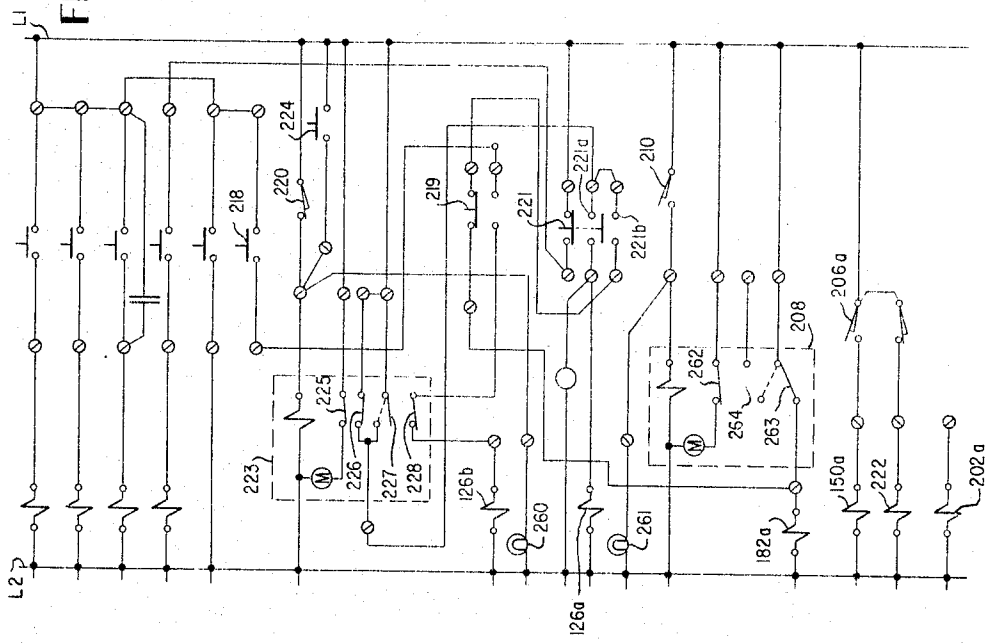
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APPARATUS FOR FILLING AND PACKING CONTAINERS

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FIG. 7



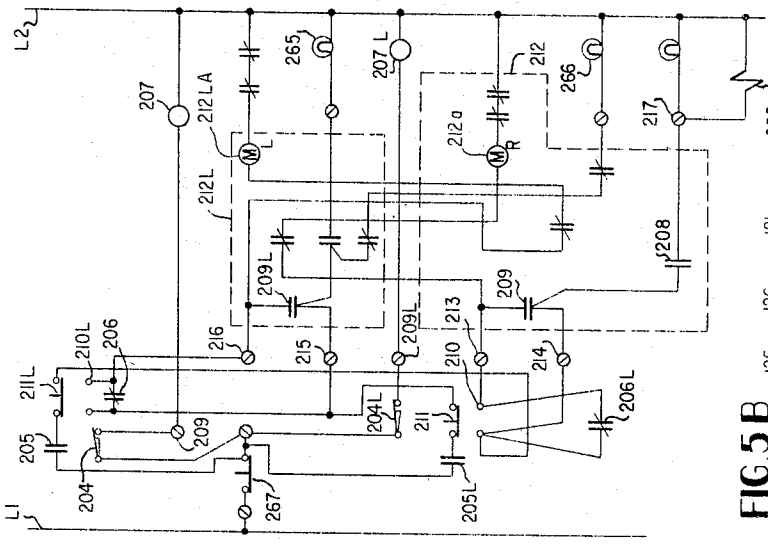


FIG. 6

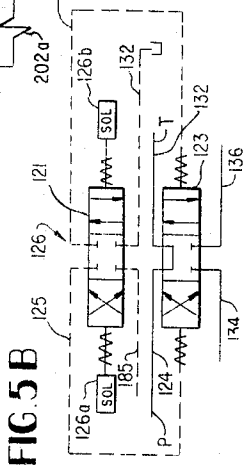


FIG. 5B

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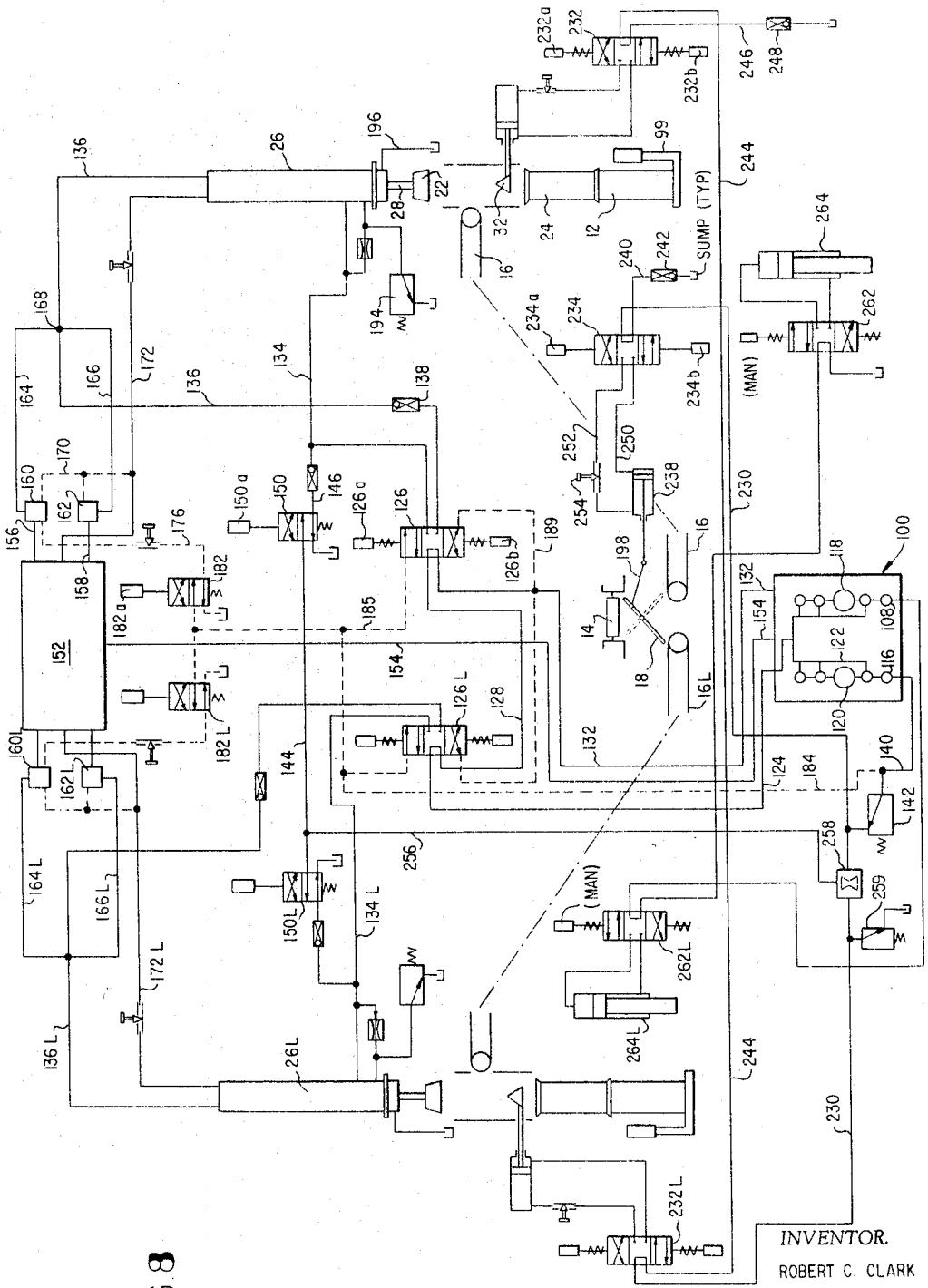
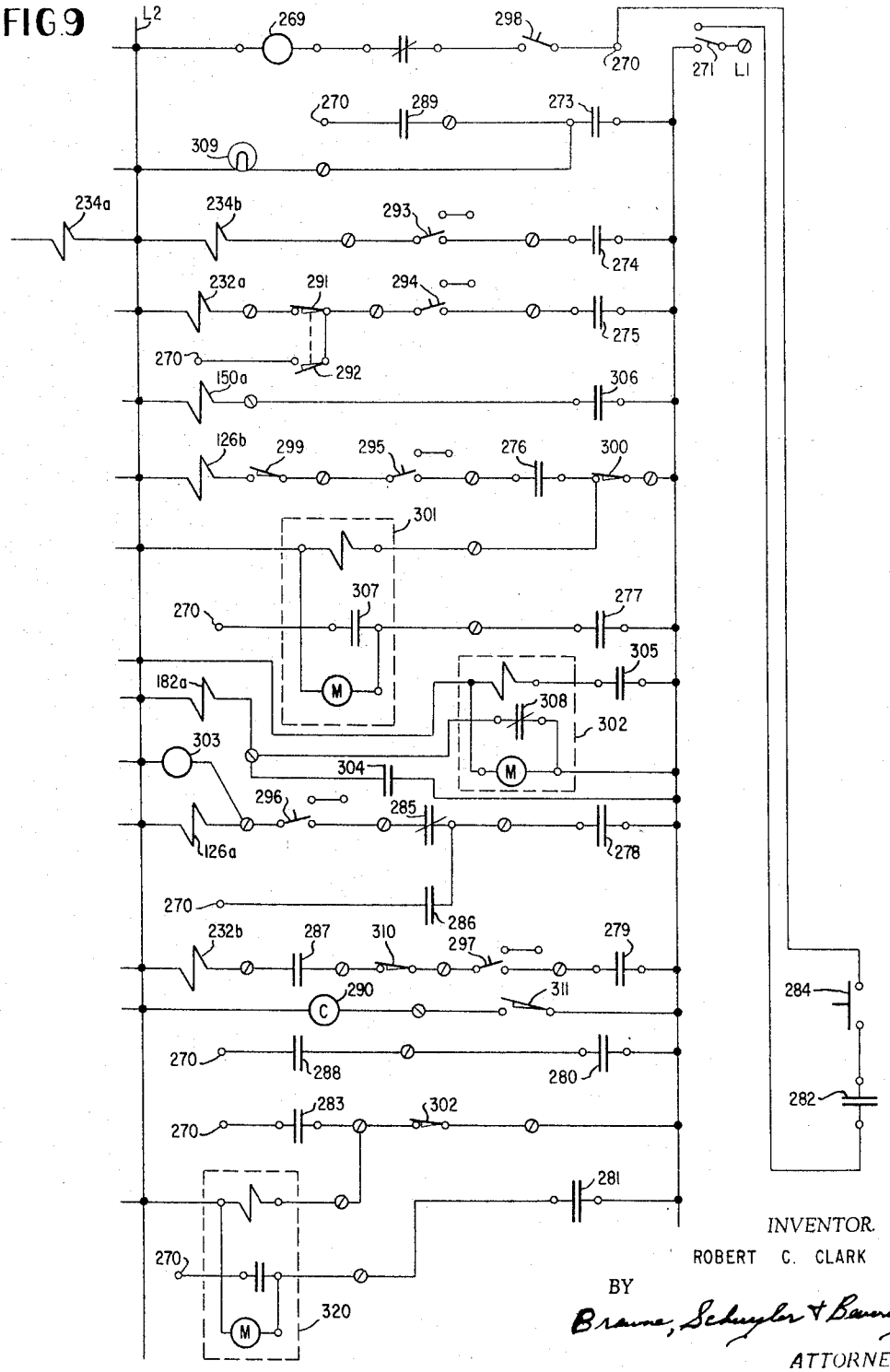


FIG 8

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FIG 9



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United States Patent Office 3,288,177
Patented Nov. 29, 1966

3,288,177

APPARATUS FOR FILLING AND PACKING CONTAINERS

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Original application Nov. 1, 1962, Ser. No. 234,956, now Patent No. 3,186,448, dated June 1, 1965. Divided and this application Jan. 18, 1965, Ser. No. 426,126
3 Claims. (Cl. 141—73)

This application is a division of my copending United States application Serial No. 234,956 filed November 1, 1962, entitled Method and Apparatus for Filling and Packing Containers and which has issued into United States Patent 3,186,448.

This invention relates to apparatus for filling and packing containers with fibrous, compressible, material and more particularly to apparatus for filling and packing hogsheads with tobacco.

An object of the present invention is to provide a novel and improved system for operating and controlling filling and compressing apparatus in connection with the handling of loose compressible material such as tobacco for example.

A further object of the present invention is the provision of a fully automatic system for operating and controlling the filling and packing apparatus.

The foregoing and other objects are achieved by the provision of a pair of horizontally spaced pressing plungers each reciprocably mounted to be extended to compress material in a container positioned beneath the pressing plunger, and retracted to a position vertically spaced above the container. For delivering the tobacco, or other compressible material, into the container positioned beneath the plungers, a pair of endless delivery conveyers are positioned between the plungers each disposed to deliver material into one of the containers.

The delivery conveyers continuously move in a single direction to discharge material into their respective containers. Tobacco or other compressible material is fed to the deliver conveyers by means of a feed conveyer having its end disposed at a point intermediate the opposite ends of the delivery conveyers from the containers. Flow from the feed conveyer is directed from one to the other of the delivery conveyers by means of a pivoted baffle or deflector mounted at the end of the feed conveyer. Cyclindrical chargers are positioned over the containers and the tobacco is deflected by the baffle first into one of the containers until the changer is filled to the desired level, whereupon the deflector is pivoted to direct the flow onto the delivery conveyer of the other container. The thickness of the bat or tow of tobacco discharged into the containers is controlled by the speed of the conveyers (which may be adjusted to compensate for changes in the grade of tobacco or moisture conditions, etc.) Since the delivery conveyers move only in a single direction, and since there is a delivery conveyer for each container, the bat of material has a uniform thickness throughout as it is discharged into the container. The conveyers may be driven by separate motors or, they may be interconnected to a single motor and driven at the same speed.

When one of the containers is filled, the hydraulic pressing plunger for the filled container may be then extended to compress the material in the container to the desired density. During the pressing operation of the filled container, the other container receives material from its delivery conveyer. When the first container is compacted, it is removed and placed in storage for shipment and an empty container is positioned at the receiving station beneath the pressing plunger.

In order to uniformly distribute the tobacco in the container, a conical, vibrating distributor is positioned axially above the mouth of the container in the path of flow of the material from the delivery conveyer. The conical distributor is disposed with its apex in an upward direction in axial alignment with the flow of material to radially deflect the material toward the inner periphery of the container wall.

In the form of the invention, to which this application is particularly directed, the distributors are moved in and out of position relative to the containers by fluid motors operated by solenoid valves. The solenoid valves for the fluid motors are electrically connected with the pressing plunger controls so that when the distributors are retracted, their associated pressing plungers are actuated to compress the material in the container, and upon retraction of the pressing plunger, the distributors are extended into the operative position over the mouth of the container.

For complete automatic operation, the deflector may be electrically interconnected with the distributors and pressing plungers to be actuated to its alternate positions in response to corresponding actuation of the press and distributor controls.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is an elevation view, partially in section, of a system embodying the invention in its preferred form;

FIG. 2 is an end view taken on line 2—2 of FIG. 1;

FIG. 3 is an elevational view, partially in section, of a modified form of the invention;

FIG. 4 is an end view taken on line 4—4 of FIG. 3;

FIG. 5 is a schematic view of the control system for the embodiment of FIG. 1;

FIG. 5*a* is a detailed view of the prefill valves;

FIG. 5*b* is a detailed view of pilot pressure actuated valve;

FIGS. 6 and 7 are wiring diagrams for the motor and press controls respectively of the system of FIGS. 1 and 5;

FIG. 8 is a schematic view of another system embodying the invention; and

FIG. 9 is a wiring diagram for the system of FIG. 8.

With reference to FIG. 1, reference numeral **10** denotes a supporting frame, or housing, extending between two horizontally spaced receiving stations at which a pair of containers **12** and **12L** are located to be filled and packed. Since the filling and pressing apparatus to the left of housing **10**, as viewed in FIG. 1, differs from that at the right hand side only in being left and right handed, only the right-hand apparatus will be described in detail. Like reference numerals will be employed to designate corresponding parts of the left hand pressing and filling apparatus with the sub-scrip L added to reference numerals designating specific parts of the left hand apparatus.

Housing **10** supports the discharge end of a feed conveyor **14** positioned intermediate the adjacent inner ends of a pair of delivery conveyers **16** and **16L** disposed to discharge material into containers **12** and **12L**, respectively. Conveyers **16** and **16L** are in the form of endless belts which move in a single direction to discharge material into containers. Since the grade, weight, density and moisture content of the tobacco varies over a wide range, the conveyors preferably are driven by variable speed motors to accomodate the varying conditions of the tobacco.

For alternately deflecting the flow from feed conveyer **14** from one to the other of delivery conveyers **16** and **16L**, a flap valve or deflector **18** is mounted on a pin **20** rotatably supported on housing **10** between conveyor **14** and the ends of conveyers **16** and **16L**. When deflector **18** is in the full line position indicated in FIG 1, the flow of

material from feed conveyer **14** is deflected onto delivery conveyer **16** to be discharged into container **12**, and when deflector **18** is pivoted to the broken line position illustrated in FIG. 1, the flow of material is deflected onto conveyer **16L** for discharge into container **12L**.

Mounted on a pair of beams forming a fixed support **21** above container **12** in axial alignment therewith, is a hydraulic ram or pressing plunger **22** which is extensible from its retracted position spaced above the container (the position illustrated in FIG. 1) to compress the material received in container **12**. The tobacco is discharged from delivery conveyer **16** in a continuous stream of approximately rectangular cross-section to fill container **12** and a cylindrical charger **24** supported on the upper end of the container. When the proper amount of material is received in charger **24**, the flow from conveyer **16** is shut off and plunger **22** is extended into the charger to compress the tobacco into the container.

Pressing plunger **22** may be operated in a conventional manner by a hydraulic cylinder **26** in which is reciprocably mounted rod **28** of the pressing plunger. Pressing plunger **22** moves into and out of the container and charger through a shield **30** fixedly supported above the container at the end of housing **10**.

As the material falls from the discharge end of delivery conveyer **16** into the container, it is radially deflected towards the periphery of container **12** by a conical distributor **32** which is pivotally supported adjacent plunger **22**. Distributor **32** is extended into the path of flow when plunger **22** is retracted and is retracted out of the path of movement of plunger **22** when the container is filled and the pressing plunger is extended.

Mounted within the distributor **32** is a mechanical or electrical vibrator **34**. As the bat of material falls onto the apex of the conical distributor, the vibration increases the efficiency of the distributor in breaking up the bat of material and deflecting the material radially toward the periphery of the container, and also prevents particles of the material from clinging to the surface of the cone.

Vibrators particularly suitable are pulsating magnet electrical vibrators Models V–9 and V–15, sold under the trade name Syntron by the Syntron Company of Homer City, Pa. The latter Syntron electric vibrators operate at 3600 vibrations per minute from rectified 115 or 230 volt 50 or 60 cycle alternating current.

In one form of the invention distributor **32** is mounted on one end of a plate member **36** forming part of a level indicated generally by reference numeral **35**. Plate member **36** is clamped at its other end between a pair of plates **38** and **40** (FIG. 2) by bolts or screws **39**. Plates **38** and **40** are rigidly connected to a shaft **42** which is rotatably supported at its ends between bearings or journals **44** and **46**. Distributor **32** is vertically adjustable relative to plates **38** and **40**, by means of slots **41** formed in plate **36** through which bolts **39** extend. Bearings **44** and **46** are formed respectively on a pair of members **48** and **50** of a supporting framework indicated generally at **53**. Frame members **48** and **50** are in turn supported between a column **51** and a pair of vertical frame members **52** and **54** respectively. Vertical frame members **52** and **54** are respectively secured to a pair of beams **56** and **58** supported between column **51** and beam **21**.

Rigidly connected to shaft **42** and projecting upwardly therefrom is a pair of lever arm members **60** and **62**. It is apparent that lever **35** is formed by plate members **36**, **38** and **40**, and arm members **60** and **62**, and that lever **35** is pivotally supported intermediate its ends on framework **53** by shaft **42**. Mounted on the upper ends of arm members **60** and **62** respectively, is a pair of channel sections **64** and **66** at the upper end of the level in which are mounted counter-weights. Channel members **64** and **66** extend laterally from the vertical axis of arm members **60**, **62** and plate members **38** and **40** with the result that the net force acting on the lever due to the position of the counter-weights biases the lever to rotate in a counterclockwise direction about bearings **44** and **46** as viewed in the right hand portion of FIG 1.

Extending between channel members **64** and **66** is a bumper plate **68** which cooperates with a rubber bumper **70** mounted on support **21**. Counterclockwise rotation of lever **35** to the broken line position illustrated in the right hand portion of FIG. 1 causes bumper plate **68** to engage the rubber bumper **70** and retracts distributor **32** to a position radially spaced from the contained and out of the path of movement of pressing plunger **22**.

Rigidly connected to arm members **60** and **62** and extending in a lateral direction therefrom to overlie the pressing plunger **22** is a pair of cam plates **72** and **74** for rotatably supporting a cam roller **76** which is disposed in the path of movement of the top of pressing plunger **22**. Extending from the opposite side of arm members **60** and **62** is a pair of shock absorbing plates **78** and **80** each having a roller **82** at their outer ends for cooperating with the ends of shock absorbers mounted on column **51** (one such shock absorber being indicated at **84**). Shock absorber **84** is resiliently compressible by rollers **82** as lever **35** rotates about shaft **42** in a counterclockwise direction.

In operation, container **12** and charger **24** are positioned underneath shield **30**, and deflector **18** is first actuated to the full line position in FIG. 1 to deflect the flow from feed conveyer **14** on to delivery conveyer **16**, which in turn discharges the material in a trajectory onto distributor **32**. The tobacco is discharged from conveyer **16** in a continuous stream having a substantially rectangular cross section the vertical thickness of which is determined by the speed of the conveyer, and is radially deflected by distributor **32** toward the periphery of the container. Consequently, the contained and charger are filled with a mass of material having a slight depression at its center.

As soon as the desired amount of material is received in container **12** and charger **24**, deflector **18** is actuated to the broken line position of FIG. 1 to deflect the flow from feed conveyer **14** onto delivery conveyer **16L**. As soon as deflector **18** is actuated, pressing plunger **22** descends into charger **24** to compress the tobacco into container **12**. The force of the counter-weights in channels **64** and **66** cause lever **35** to rotate in a counterclockwise direction about shaft **42** as plunger **22** descends with roller **76** following the movement of the top of plunger **22** until the plunger moves away from the roller whereupon lever **35** continues to rotate until bumper plate **68** engages bumper **70**. Shield **30** is provided with openings to accommodate the movement of lever **35** as it pivots distributor **32** between its extended and retracted positions.

When the material is compressed to the desired density by plunger **22**, the plunger is retracted and the top of the plunger engages roller **76** to rotate lever **35** in a clockwise direction against the biasing force of the counterweights. The filled container is removed and replaced with an empty container. Thus, while the material in container **12** is being compressed, the empty container **12L** is being filled and the cycle of operation is repeated with the containers being filled and packed at the same location. Since the material is discharged into each container from a separate single direction conveyer, the stream of material delivered into the container is always maintained at a constant cross section determined by the speed of the conveyer.

FIG. 5 schematically illustrates the hydraulic circuit for operating the presses of the embodiment of FIG. 1. The container-charger assembly **12**, **24** is seated on weighing scales **99**, and preferably including charger and supporting apparatus of the type disclosed in U.S. Patent No. 2,732,113 to W. L. Rice, dated January 24, 1956.

Reference numeral **100** indicates a twin pump unit including a right-hand series of pumps **102**, **104**, **106** and **108** operated by a motor **118**, and a left-hand series of

pumps 110, 112, 114 and 116 driven by a motor 120. Pumps 102, 104, 106, 108, 110, 112 and 114 are connected to feed into a common manifold 122 in turn connected with an output conduit 124 extending from the pump unit. Output conduit 124 communicates with a conduit 128 through a double-solenoid, four-way valve 126L, and conduit 128 communicates with a return conduit 132 through a double solenoid, four-way valve 126. Conduit 132 communicates with the reservoir of the pump unit at atmospheric pressure. When both solenoids of valves 126 and 126L are deenergized, the valves are spring-biased to the positions illustrated in FIG. 5, and conduits 124, 128 and 132 form a closed circuit between the outlet of the pump unit and the reservoir.

Valve 126 controls communication between conduits 128, 132 and a pair of conduits 134 and 136 which communicate with cylinder 26 below and above respectively, the piston carried by rod 28 of pressing plunger or ram 22. Conduit 136 is provided with a non-return check valve 138.

Pump 116 feeds into a pilot pressure conduit 140 with a relief valve 142. Conduit 140 intersects a conduit 144 connected between a pair of single-solenoid, four-way valves 150 and 150L. Valve 150 is spring-biased so that when its solenoid is deenergized conduit 144 communicates with a plugged port of the valve, and when the solenoid is energized, conduit 144 communicates with a conduit 146 which is in turn connected with conduit 134 and provided with a non-return check valve 148.

The reservoir of the pump unit communicates with a prefill tank 152 through an overflow conduit 154. Pipes 156 and 158 connect the interior of prefill tank 152 with a pair of pilot pressure actuated prefill valves 160 and 162 respectively. Prefill valves 160 and 162 are also connected with conduits 164 and 166 respectively, which intersect conduit 136 at a cross-connection 168. Prefill valves 160 and 162 are spring-loaded to a position shutting off communication between pipe 156 and pipe 164 and between pipe 158 and pipe 166, respectively.

Prefill valve 162 is schematically illustrated in detail in FIG. 5*a*. Valves 160, 160L and 162L are constructed identically with valve 162. Communication between conduits 166 and 158 is controlled by a valve element 159 which is biased by a spring 161 to disconnect conduits 166 and 158. Pilot pressure from conduit 176 actuates valve element 159 against spring 161 to connect conduit 166 with 158. When pilot pressure is relieved, valve element 159 returns to its normal position and the fluid from the pilot pressure line drains to the reservoir through conduit 170. A conduit 163 bypasses valve element 159 between conduits 158 and 166. Conduit 163 is provided with a check valve which permits flow from conduit 158 to conduit 166 when valve element 159 is closed by spring 161, but does not permit flow from conduit 166 to conduit 158.

Prefill tank 152 communicates with the top of cylinder 26 through a conduit 172 which is provided with an adjustable needle valve 174 for controlling the rate of flow through pipe 172.

Prefill valves 160 and 162 are actuated by fluid pressure from pilot pressure conduit 176. When solenoid 182*a* is energized, pilot pressure conduit 176 is communicated with conduit 180 and the pilot pressure actuates prefill valves 160 and 162 to connect conduits 156 and 158 with conduits 164 and 166 respectively. Upon deenergization of solenoid 182*a*, prefill valves 160 and 162 return to their normal position to shut off communication between conduits 156 and 169 and between conduits 158 and 166. The fluid from conduit 176 trapped in valves 160 and 162 then drains into conduit 172 through pilot pressure drain conduit 170.

When the solenoid of valve 182 is energized, conduit 176 communicates through the valve ports with a pilot conduit 180 between valves 182 and 182L. Outlet conduit 140 communicates upstream of relief valve 142 with a pilot conduit 184, which in turn communicates with conduit 180 through a conduit 186. Conduit 184 also communicates with valves 126 and 126L through conduits 185 and 185L, respectively. Valves 126 and 126L are also connected by a pilot pressure drain conduit 189 which intersects conduit 132.

A suitable construction of valve 126 is schematically illustrated in detail in FIG. 5*b*, in which valves 126 consists of a pilot valve member 121 and a main valve member 123. Valve members 121 and 123 are biased by springs to their neutral positions illustrated in FIG. 5*b*. Upon energization of solenoid 126*b*, pilot pressure conduit 185 is connected with a conduit 125. The pressure in conduit 125 actuates valve member 123 to the right as viewed in FIG. 5*b* to connect conduit 134 with drain conduit 132, and connect conduit 136 with output pressure conduit 124. Conversely, when solenoid 126*a* is energized, pilot pressure from conduit 185 is connected with a conduit 127 to actuate valve member 123 to the left and connect conduit 134 with conduit 124, and conduit 136 with drain conduit 132.

Cylinder 26 is provided with a cushion (not shown) beneath its connection with pipe 134 on which the piston carried by rod 28 rests when plunger 22 is extended to compress the material in the container-charger assembly 12, 24. Consequently, a counter-balance conduit 188 provided with a counter-balance restriction 190 connects the portion of the cylinder beneath the cushion with pipe 134. Hydraulic fluid is prevented from accumulating in the lower end of cylinder 26 by a bleed line 196 which, as indicated, drains to the reservoir at atmospheric pressure.

Deflector, or flap valve 18 is connected through linkage 198 with the stem or plunger of a fluid motor 200 which is spring-biased to urge deflector 18 to the feed left direction (to delivery conveyer 16L.) Motor 200 is controlled by a solenoid valve 202 which is biased to connect the piston of motor 200 with atmosphere, and which, upon energization of its solenoid, connects the motor with a source (not shown) of air or other fluid under pressure, to actuate the deflector to the feed right position to direct the flow from feed conveyer 14 onto delivery conveyer 16.

The electrical circuitry for the system is schematically illustrated in FIGS. 6 and 7. Conveyers 16 and 16L are operated by motors which are connected in series with normally closed switches.

With reference to FIG. 6, typical electrical circuitry for the control system of conveyer 16 and 16L is illustrated. Reference numerals 212 and 212L indicate the starters for the motors of conveyer 16 and 16L respectively. Starters 212 and 212L are illustrated connected between main power lines L1 and L2 to operate in response to actuation of scale switches 204 and 204L. Scale switch 204 is normally closed and is connected in series with a coil 207 which operates relay contacts 205 and 206 which are shown in their deenergized positions (i.e. contacts 205 are normally open, and contacts 206 are normally closed). When coil 207 is energized, contacts 205 close and contacts 206 open. Contacts 205 are in series with a starter switch 211L, which corresponds with a similar starter switch 211 in series with contacts 205L.

Starter switch 211L is operable to close contacts 210L to complete a circuit from safety switch 267, relay contacts 205L, starter switch 211, contacts 210L and terminal 216 to motor starter 212L. When starter switch 211 actuates contacts 210, a circuit is completed from switch 267, relay contacts 205, switch 211L, terminals 210 and 213 to motor starter 212. When motor starter 212 is energized, contacts 209 and 208 close to energize solenoid 202*a* to actuate the flap valve to the feed right position.

Assuming that both containers are empty, the main power switches and switch 267 are closed to connect the

motors with the main power source. Upon starting up the system to initially feed to the left container 12L, switch 211L is actuated to close terminals 210L momentarily to energize coil 212L*a* of motor starter 212L, which in turn closes relay contacts 209L, and switch 211L returns to its normal position. Contacts 209L are held closed by the coil 212L*a* to complete the circuit through relay contacts 205L, switch 211, terminal 215 and relay contacts 209L to coil 212L*a* to energize motor starter 212L. When the selected weight of material has been received in container 12L, switch 204L opens to shut off motor starter 212L. When motor starter 212L shuts off, coil 207L is deenergized due to the opening of scale switch 204L and contacts 205L open and contacts 206L close. A circuit is then completed through contacts 205, switch 211L relay contacts 206L, terminals 210 and 213 to coil 212*a* of motor starter 212. Upon energization of coil 212*a*, contacts 209 and 208 close to energize solenoid coil 202*a* and actuate deflector 18 to feed material on to the right-hand conveyor 16.

Motor starter 212 is energized until the selected weight of material is received in container 12 whereupon scale switch 204 opens to deenergize coil 207 and shut down motor starter 212.

FIG. 7 schematically illustrates typical electrical circuitry for operating the right-hand press, it being understood that the left-hand press is operated by a similar circuit. Referring also to FIGS. 5 and 7 and assuming that container 12 is filled, switch 219 is actuated to close switch contacts 219*a*. Switch 218 is closed to complete the circuit through contacts 219*a*. When contacts 219*a* are closed by switch 219, solenoid 126*b* of valve 126 is energized to connect conduit 136 with the main pressure conduit 128 to actuate the press downwardly. As soon as pressing plunger 22 leaves its uppermost position, limit switch 210 opens to actuate timer motor 208. When timer motor 208 reaches the end of its time cycle, switches 262 and 263 open to deenergize solenoid 182*a* and connect pilot pressure line 176 with drain. Consequently valves 160 and 162 close to shut off communication between conduits 156 and 164 and between conduits 158 and 166. Conduit 136 is under pressure from output line 124 from the pump unit. When plunger 22 reaches a selected position within the container, limit switch 220 is opened by a cam operation to energize timer motor 223. Solenoid 126*b* is energized during the time that timer motor 223 is running. When the time cycle is completed switches 225, 226 and 228 open and switch 227 closes. When switch 228 opens, solenoid 126*b* is deenergized and valve 126 returns to its neutral position connecting conduit 136 with the pump reservoir to disconnect conduit 136 from the pump output line.

To raise pressing plunger 22, switch 221 is actuated to close contacts 221*a* and 221*b*. Switch 227 in time 223 completes a circuit through contacts 221*a* to solenoid 126*a* to actuate valve 126 to a position connecting conduit 134 with the output pressure line 124 and 128. Pressure is then supplied by the pumps to the cylinder beneath the plunger piston. Simultaneously contacts 221*b* are closed by switch 221 to energize solenoid 182*a* of valve 182 and connect the pilot pressure line 176 with conduit 180 to open prefill valves 160 and 162. As pressing plunger 22 moves upwardly the hydraulic fluid in the cylinder above the plunger piston drains back into the prefill tank through conduits 136, 164 and 166. When plunger 22 reaches its uppermost position, limit switches 206*a* and 210 are returned to their normally closed positions.

When switch 206*a* closes, solenoid 150*a* is energized to connect conduit 134 with holding conduit 144 and maintain the plunger in its upper position.

After the initial start up, material is fed onto delivery conveyor 16L, and distributor 32L operates to uniformly distribute the material in container 12L and charger 24L. When the proper weight of material is determined by weighing scale 99L, the scale switch 204L opens shutting off the motor of conveyor 16L and turning on the motor of conveyor 16. Solenoid 202*a* is in turn energized to move deflector 18 to deflect the flow from feed conveyor 14 onto delivery conveyor 16.

Solenoid 126L*a* may then be energized to connect conduit 136L with output conduit 124 to deliver pressure into the top of cylinder 26L to extend plunger 22L into the container. Lever 35L rotates counterclockwise to retract distributor 32L as the plunger moves downwardly. Conduit 134L is connected with the reservoir to release the pressure beneath the piston. Plunger 22L remains in its extended position to settle the material in the container for a time determined by timer motor 212L. Upon the expiration of the time, solenoid 126L*b* is energized and solenoid 126L*a* is deenergized to connect conduit 134L with output conduit 124 and connect conduit 136L with the pump reservoir through conduits 128 and 132. Check valve 138L prevents the escape of pressure through conduit 136L, and the fluid in cylinder 26L above the piston escapes into prefill tank 152 through conduit 172L. Prefill timer motor 208L is energized by limit switch 210L at the top of the pressing plunger which in turn energizing solenoid 182L*a* to control the pressure in pilot pressure conduit 176L.

During the time that plunger 22L is in its upper position, solenoid 150L*a* is energized to connect conduit 146L with output conduit 140. Thus, pressure is continuously fed to conduit 134L to compensate for any leakage beneath the piston and hold the plunger in its upper position.

Reference numeral 222 indicates a solenoid winding which actuates supporting cylinder for the container on the scale. When solenoid 222 is energized, the container is supported on the scale, and when solenoid 222 is deenergized, the weight of the container is shifted from the scale in a manner fully disclosed in Rice Patent No. 2,732,113.

FIG. 8 illustrates a hydraulic system for full automatic operation of rams 22 and 22L, distributors 32 and 32L, and deflector 18. Components and elements identical with those described in the FIG. 5 embodiment are identified by the same reference numerals in FIG. 8.

Delivery conduit 140 communicates with a conduit 230 connected between a double solenoid, four-way valve 232L and a double solenoid, four-way valve 234. Valve 232L controls a fluid motor 236L which positions distributor 32L relative to the container. Valve 234 controls the position of deflector 18 through a fluid motor 238. When either solenoid of valve 234 is energized, the valve internally maintains the energized position, even though the solenoid is deenergized until the other solenoid is energized. Upon energizing the other solenoid the valve shifts to the opposite position and holds in that position likewise after the solenoid is deenergized. Connected between valve 232L and valve 232 is a conduit 244 which in turn communicates with a bleed conduit 246 when both solenoids of valve 232 are deenergized. Bleed conduit 246 is also provided with a non-return check valve 248.

Valve 232 is connected with conduits 250 and 252 connected at opposite ends of fluid motor 236 to alternately move distributor 32 into and out of the path of plunger 22. Conduit 252 is provided with an adjustable needle valve 254. Conduit 230 communicates with conduit 144 through a holding conduit 256 which supplies pressure to valves 150 and 150L as previously described. Pressure is maintained in conduit 256 by a regulator 258 at the junction of conduits 230 and 256.

An output conduit 260 is connected with pump 108 which extends to a manually operated four-way valve 262L which in turn controls a hydraulic cylinder 264L operative to press the cover on a filled container when it is removed from the receiving and weighing station. A conduit 263 extends between valve 262L and a similar valve 262. Valve 262 is biased to a neutral position in

which conduit 263 communicates with a conduit 266 connected to drain into the reservoir. When the operating member of valve 262 is moved downwardly as viewed in FIG. 8, the plunger of cylinder 264 is actuated by the pressure from conduit 263 to project from the cylinder, and when the operating member is moved upwardly from the neutral position, the piston is retracted into the cylinder. The starter for the motor of conveyor 16 is electrically connected with solenoid 234*a* of valve 234 so that when conveyer 16 is operating, deflector 18 is actuated by motor 238 to feed from conveyer 14 to the right container-charger assembly 12, 24. When solenoid 202*a* is deenergized, deflector 18 is biased to feed material into container 12L. The starters for the motors of delivery conveyers 16 and 16L are interconnected electrically so that when the motor for conveyer 16L stops, the motor for conveyer 16 starts, with the result that one or the other of the delivery conveyers is always in operation.

Solenoid 150*a* of valve 150 is energized and deenergized in response to actuation of a switch 206 at the top of press pluger 22. Solenoid 182*a* is deenergized during the time that pressing plunger 22 is pressing material in container 12, the time being controlled by a prefill timer motor 208, operated by a limit switch 210.

To start the system into operation, pump motors 118 and 120 are started up, sending hydraulic fluid under pressure through outlet conduit 124. With solenoids 126L*a* and *b*, and 126*a* and *b* deenergized, the fluid circulates back to the reservoir through conduits 124, 128 and 132. Outlet conduit 140 and pilot pressure conduit 184 are connected with the output of pump 116, and with solenoids 150*a* and 150L*a* deenergized, pressure is trapped in conduits 140 and 144 since conduit 144 communicates with the plugged ports of valves 150 and 150L. Excessive pressure is released from conduit 140 by relief valve 142.

FIG. 9 schematically illustrates typical electrical circuitry for the embodiment of FIG. 8. This system may be operated manually or automatically depending upon the position of switches 293, 294, 295, 296, 297, and 298. When these switches are closed the system is fully automatic. To convert to a manual system, the switches are moved to their upper position as viewed in FIG. 9. Reference numeral 269 identifies the coil of a stepping switch having a common terminal 270 which is connected with stepping switch contacts 272 through 283. To initially start up the system, a reset switch 284 is closed to set the stepping switch in its initial position. Relay contacts 288 and 289 are normally open and are closed when the selected weight of material is received in container 12. Limit switches 291 and 292 are operated upon retraction of the cone. Limit switch 291 is normally closed and is opened upon retraction of the distributor, and limit switch 292 is normally open and is closed upon retraction of the distributor. Limit switch 299 is normally open and is closed upon retraction of distributor 32. Limit switch 300 is normally closed and is opened by the pressing plunger when the plunger is fully extended into the container. Limit switch 310 is normally closed and is opened upon extension of distributor 32 into the path of plunger 22.

In the automatic system of FIG. 8, conveyers 16 and 16L both operate continuously in opposite directions. To start the system into operation, main power switch 271 is closed and reset switch 284 is closed to start the stepping switch into operation. In the first position of the stepping switch, contacts 273 are closed and solenoid 234*a* is energized to cause flap valve 18 to feed onto the right-hand conveyer 16. Pilot light 309 burns to indicate that the cycle has begun. Distributor cone 32 is actuated to its extended position in the path of flow from conveyer 16. When the selected weight of material is received in the container-charger assembly 12, 24, relay contacts 289 close to move the stepping switch to its second position. In the second position, stepping switch contacts 274 and 275 close and contacts 273 open. Upon closing of contacts 274, solenoid 234*b* is energized to actuate deflector 18 to feed onto conveyer 16L. Contacts 275 energize solenoid 232*a* to retract distributor cone 32 of the path of plunger 22. When distributor 32 reaches its retracted position it opens limit switch 291 and closes limit switch 292, and 299. Limit switch 292 moves the stepping switch to the third position closing contacts 276 and 277 and opening contacts 274 and 275. When contacts 276 are closed, solenoid 126*b* is energized to actuate the pressing plunger 22 to move downwardly into the container. As soon as plunger 22 leaves its uppermost position, limit switch 311, located at the top of the pressing plunger, opens to deenergize relay coil 290 which in turn opens relay contact 305 to start timer motor 302 into operation. As soon as pressing plunger 22 reaches its lowermost position, limit switch 300 opens to start timer motor 301 into operation. Limit switch 300 may be operated in any conventional manner, such as by a cable attached at one end to the pressing plunger and extending over a pully on the cylinder for mechanical connection with limit switch 300.

During the time plunger 22 is travelling downwardly, timer motor 302 is operating and solenoid 182*a* is energized to hold prefill valves 160 and 162 in their open position. Timer 301 starts into operation as soon as plunger 22 reaches its lowermost position due to actuation of limit switch 300. When the end of the time cycle of motor 301 is reached contacts 307 close to actuate the stepping switch to the fourth position. When the stepping switch moves to the fourth position, stepping switch contacts 278 close and contacts 276 and 277 open. When relay contacts 278 close relay coil 303 is energized to energize solenoid 126*a*. Upon energization of relay coil 303, relay contacts 304 close to energize solenoid 182*a* and open prefill valves 160 and 162 to permit conduits 136, 164 and 166 to drain into prefill tank 152 as the plunger moves upwardly. When the plunger 22 reaches its uppermost position, limit switch 311 closes to energize relay coil 290. When coil 290 is energized, relay contacts 285 open, and relay contacts 286 and 287 close to deenergize solenoid 126*a* and relay coil 303. Upon closing of relay contacts 286, the stepping switch moves to the fifth position closing stepping switch contacts 279 and 280. Upon closing of contacts 279, solenoid 232*b* is energized to extend distributor 32 into its operative position above charger 24.

The above described operation completes the cycle for a single stroke operation of the pressing plunger.

In the event that it is desired to compress the material twice in the container to obtain the proper density, a timer motor 320 may be connected in the system to be operated by a limit switch 302. Accordingly, when a first selected weight of material is received in the container, plunger 22 will fully extend to actuate limit switch 300 at the lowermost position of the plunger. Upon subsequent completion of the filling operation, the plunger will compress the additional material and actuate limit switch 302.

FIGS. 3 and 4 disclose a modified version of the invention; components identical in construction with corresponding components of the previously described embodiment being identified by like reference numerals. In FIG. 3, distributor 32 is supported on an L shaped support member 86 movably mounted on a fixed beam 88. Formed at the top of the vertical leg of support member 86 is a yoke 90 having a pair of rollers 92 rotatably mounted thereon for movably supporting the distributor on beam 88.

When an empty container 12 is positioned underneath pressing plunger 22, support member 86 is moved to the full line position of FIG. 3 to extend distributor 32 into the path of flow of material from conveyer 16 and into the path of movement of pressing plunger 22. As material falls from the discharge end of conveyer 16 onto the

apex of distributor **32**, it is deflected radially toward the periphery of the container as previously described. When the proper amount of material has been discharged into container **12** and charger **24**, support member **86** is moved to the broken line position to retract distributor **32** out of the path of movement of pressing plunger **22** and the material is compressed within the container by plunger **22**.

While specific embodiments of the invention have been illustrated and described, it should be understood that the invention is not confined to the precise construction shown, and that various alterations and modifications are possible without departing from the scope of the invention.

What is claimed is:

1. Apparatus for packing loose, compressible material in containers comprising in combination; a container to be packed with the loose compressible material, a distributor mounted for movement between an extended position axially disposed above the mouth of the container and a retracted position radially spaced from the axis of the container, first actuating means for moving the distributor between said positions thereof, means including a pressing plunger movable vertically into the container to compress material therein, second actuating means for moving said plunger vertically into the container to compress material therein, and means for energizing said second actuating means for initiating downward movement of said pressing plunger in response to the arrival of said distributor at its fully retracted position, said last-mentioned means including a switch actuated by said distributor when the distributor reaches said

retracted position thereof whereby the plunger will not start its downward movement towards the container until the distributor is in its fully retracted position.

2. Apparatus defined in claim **1** further including a solenoid means for controlling said first actuating means, and a stepping switch means for energizing said solenoid means, said stepping switch means being energizable by said first switch means when the distributor reaches its fully retracted position.

3. Apparatus defined in claim **2** wherein said first and second actuating means are fluid motors and wherein said stepping switch means also controls said second actuating means.

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