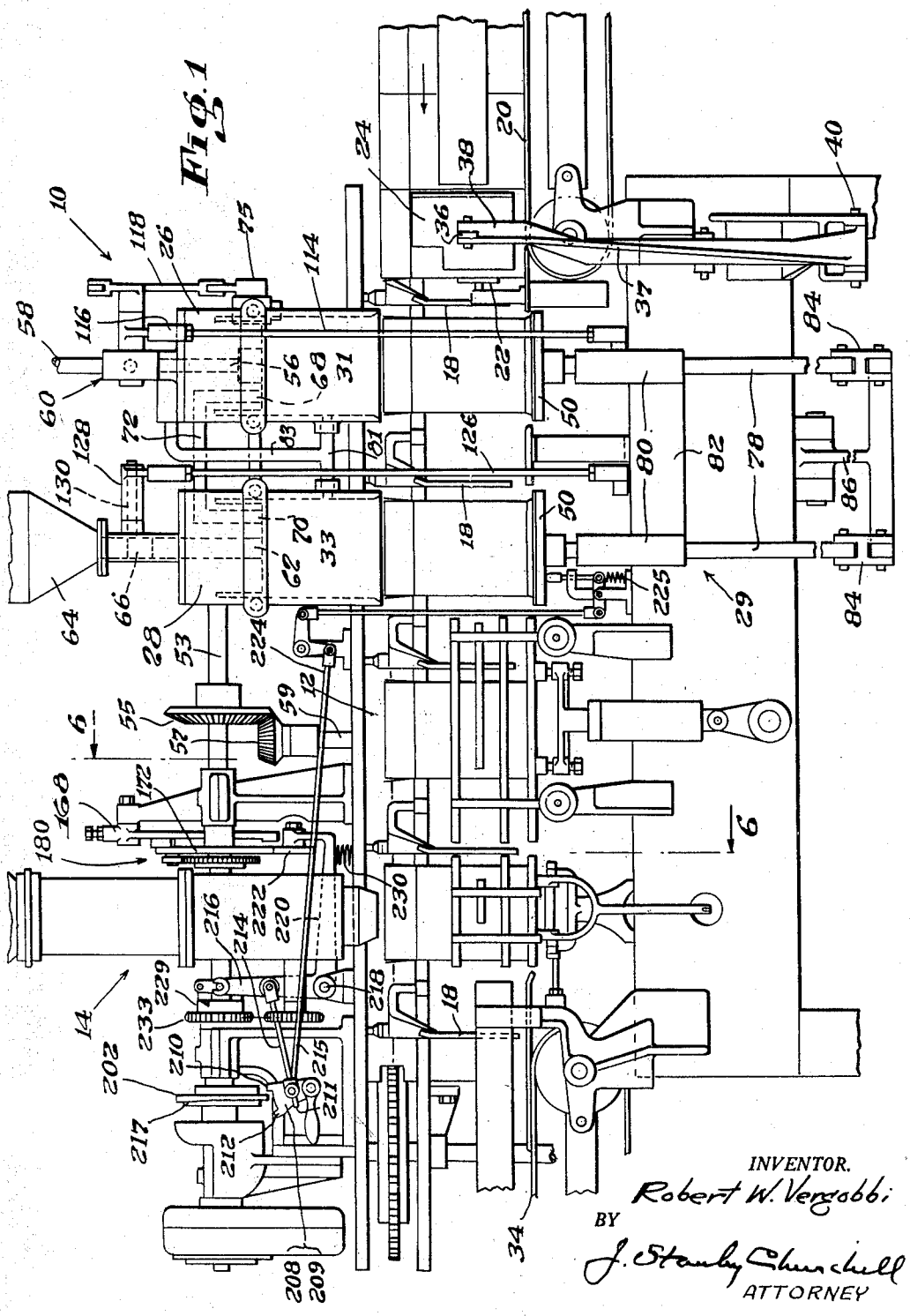
Dec. 12, 1950 R. W. VERGOBBI 2,533,641

METHOD OF AND APPARATUS FOR FILLING CONTAINERS

Filed Aug. 26, 1948 6 Sheets-Sheet 1

Fig. 1



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METHOD OF AND APPARATUS FOR FILLING CONTAINERS

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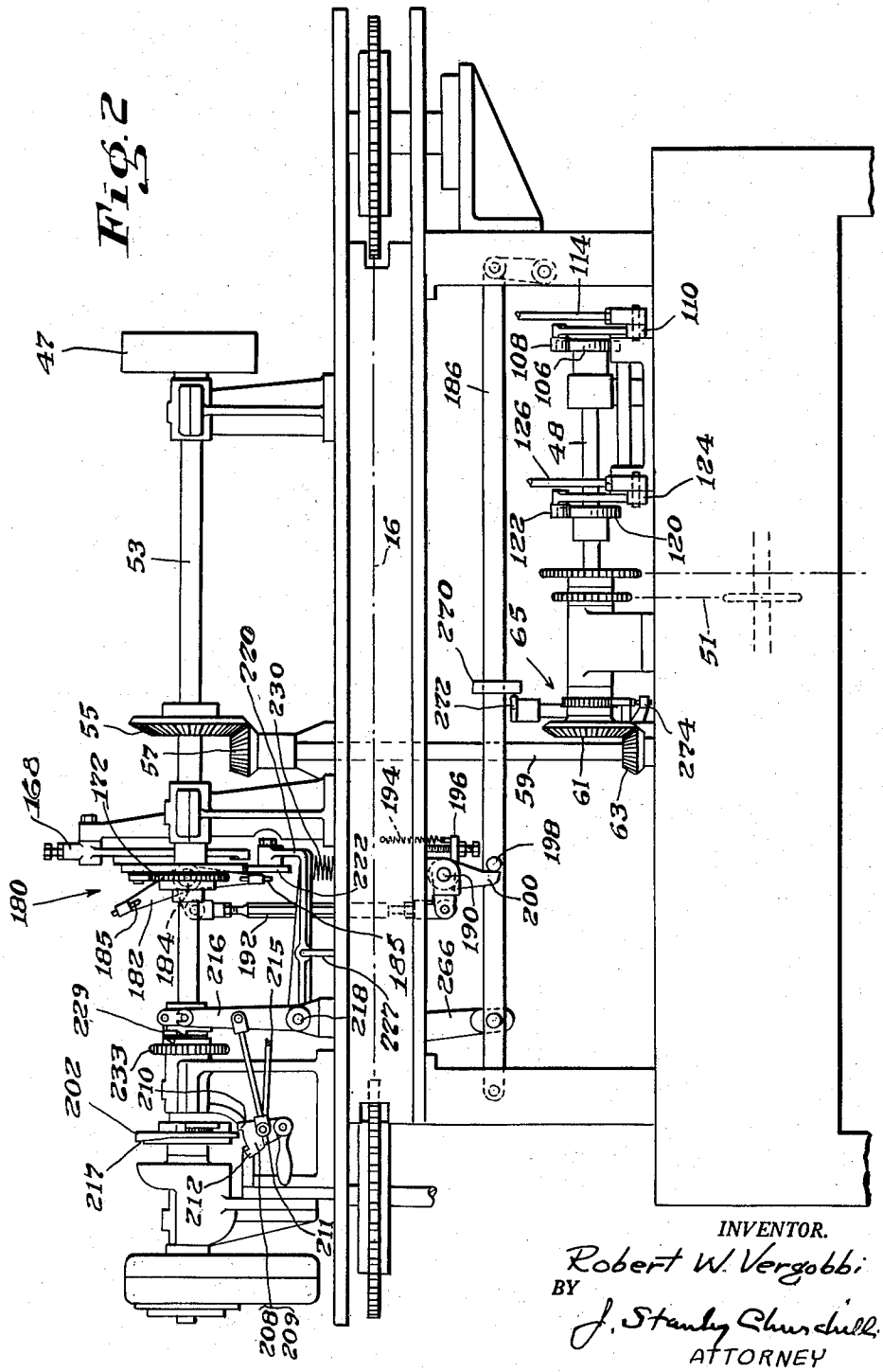
Fig. 2



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METHOD OF AND APPARATUS FOR FILLING CONTAINERS

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Fig. 3

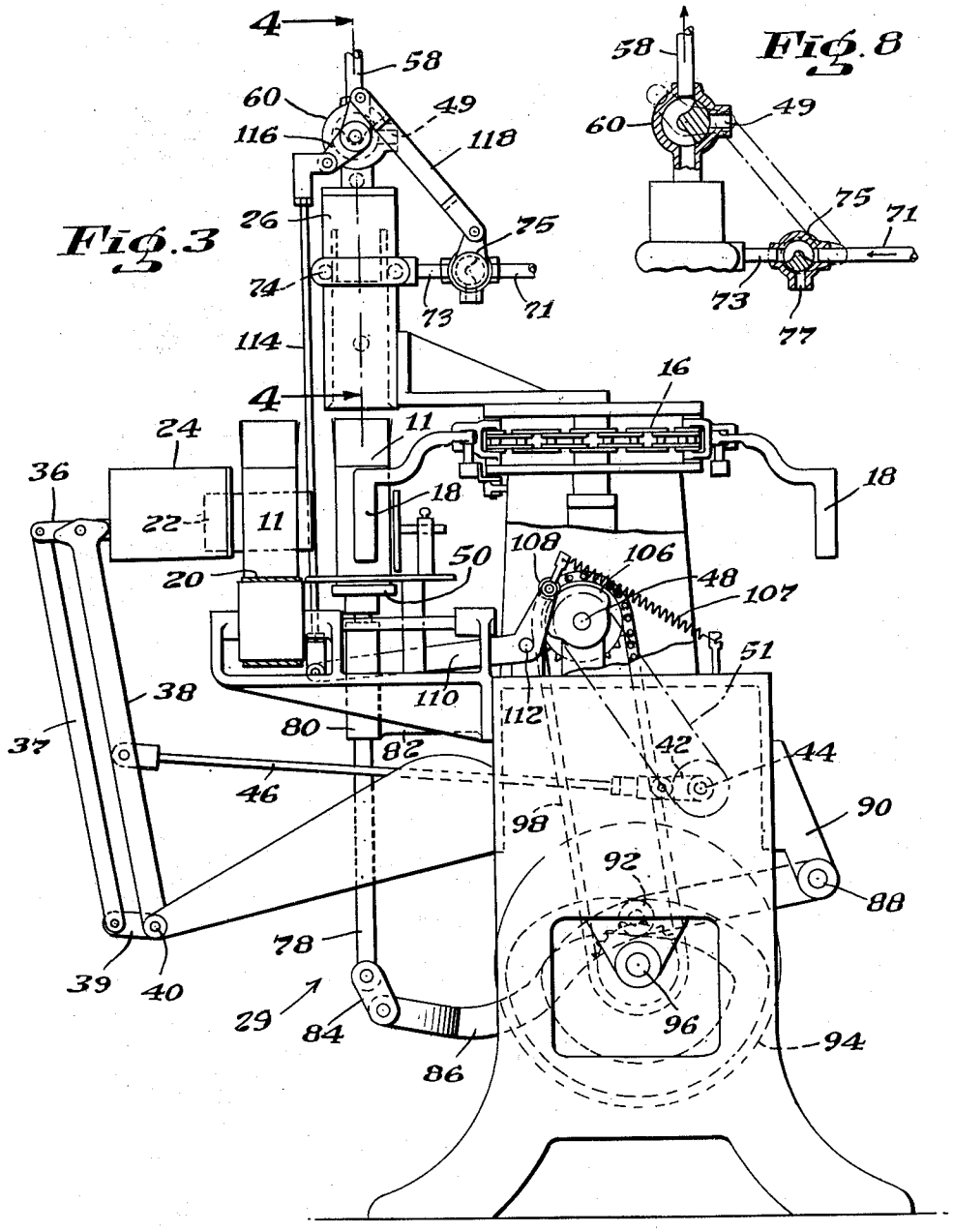

Fig. 8

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METHOD OF AND APPARATUS FOR FILLING CONTAINERS

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Fig. 4

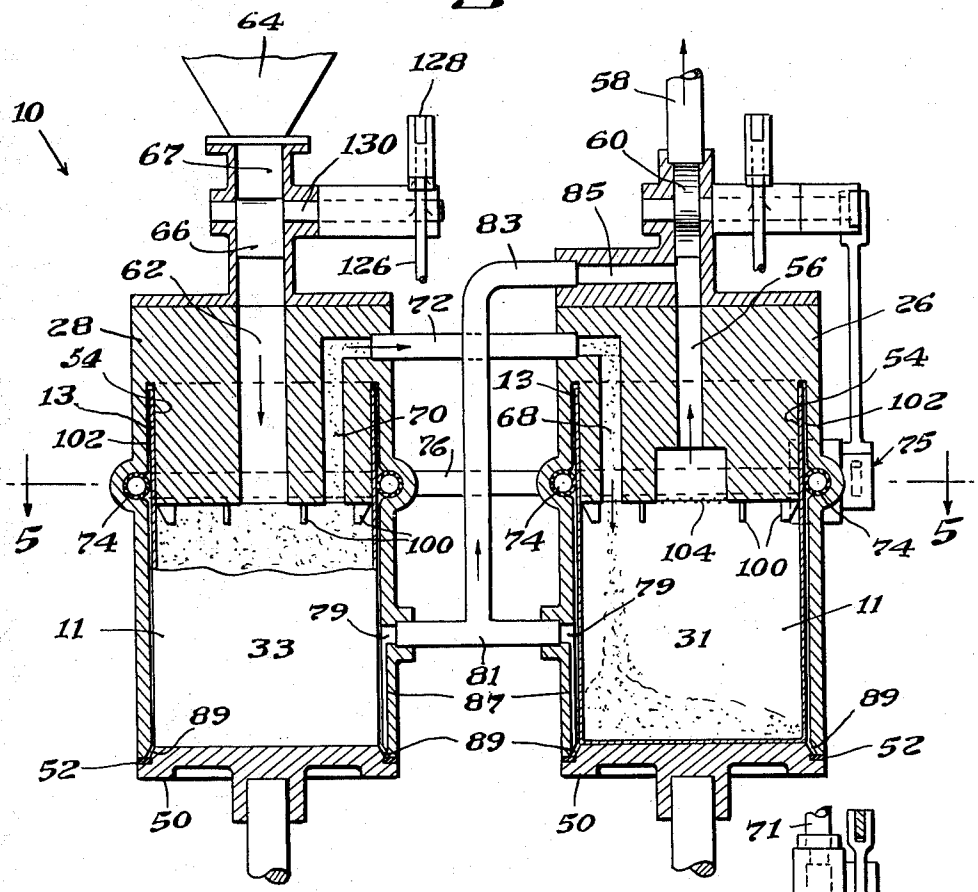

Fig. 5

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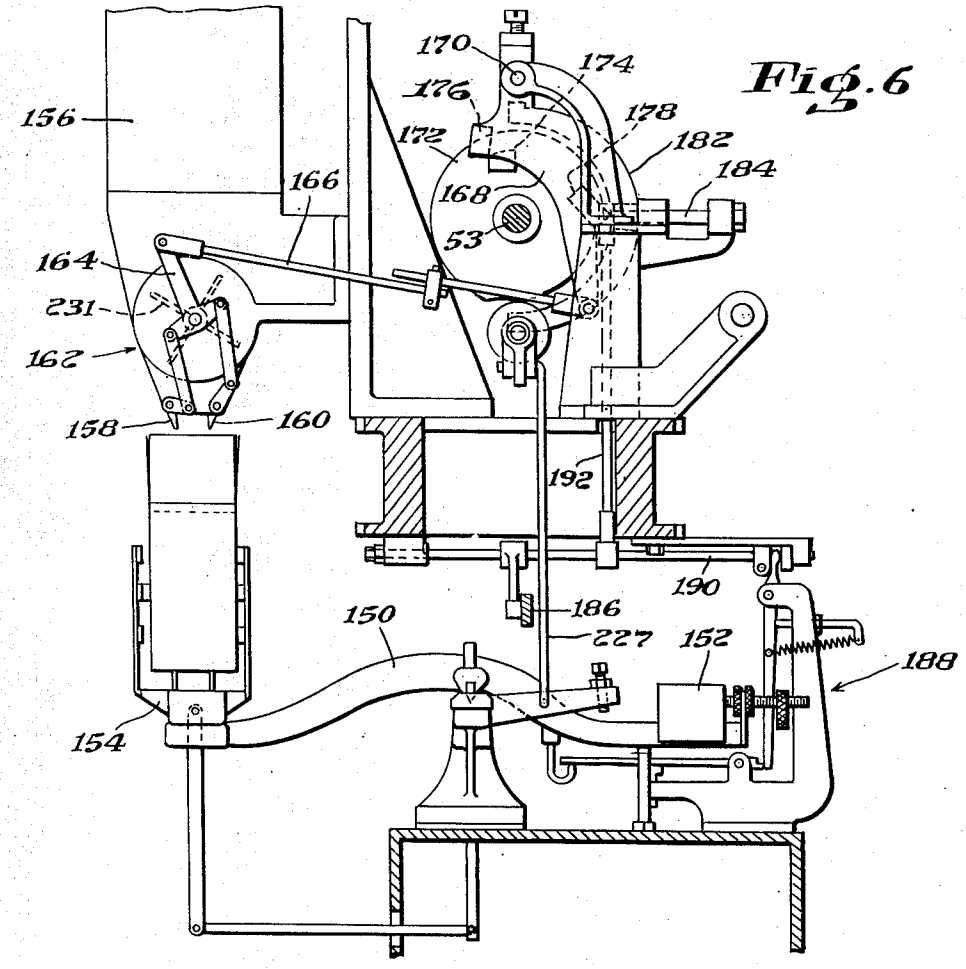

Fig. 6

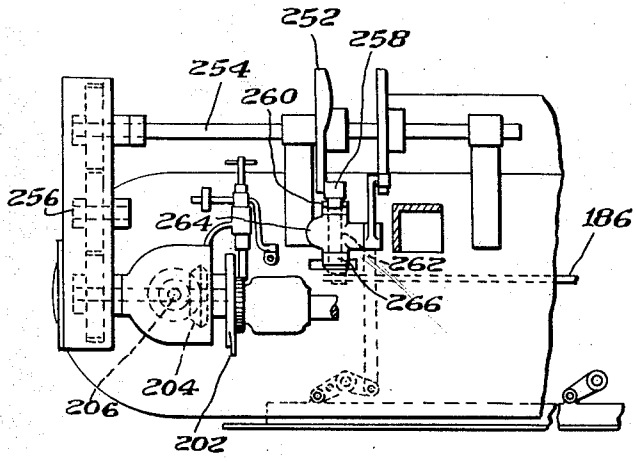

Fig. 7

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METHOD OF AND APPARATUS FOR FILLING CONTAINERS

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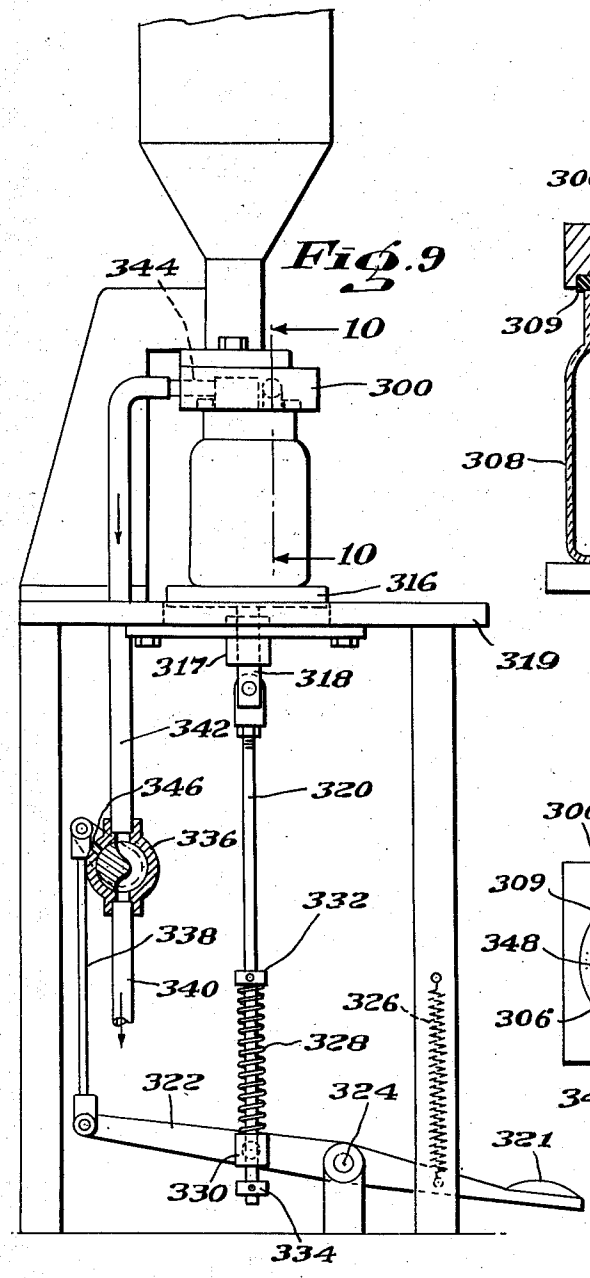

Fig. 9

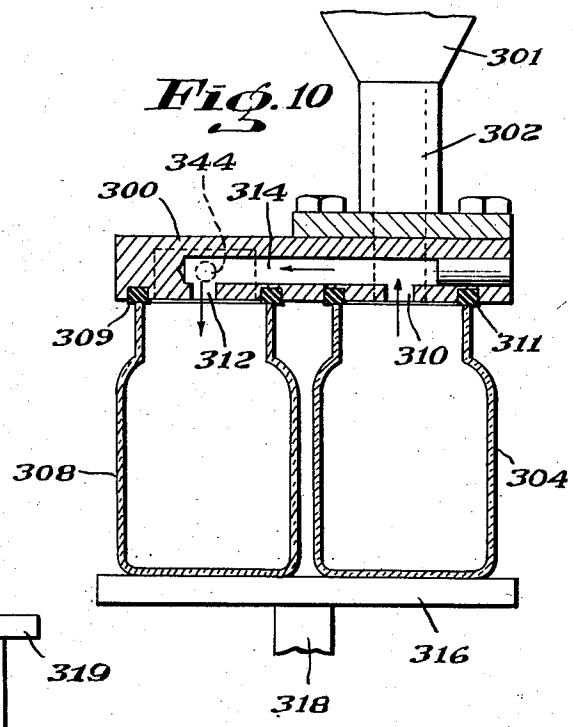

Fig. 10

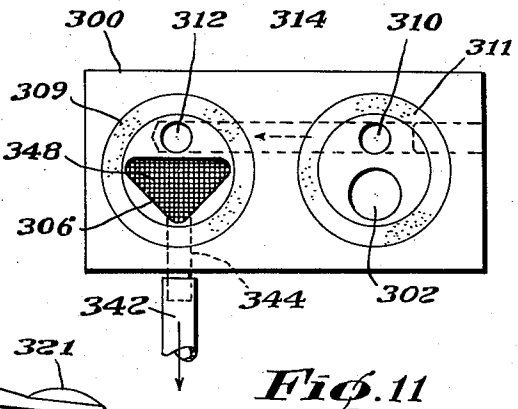

Fig. 11

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UNITED STATES PATENT OFFICE

2,533,641

METHOD OF AND APPARATUS FOR FILLING CONTAINERS

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Application August 26, 1948, Serial No. 46,218

19 Claims. (Cl. 226—116)

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This invention relates to a container filling machine embodying vacuum fil ing apparatus, and to a method of filling containers by vacuum.

The invention has for an object to provide a novel and improved container filling machine for filling containers with flowable solid material in which provision is made for filling successive containers by vacuum in a manner such as to effect an overflow from the container being filled into a second container so as to obtain a compact uniform filling of the first container and whereby to enable successive containers to be filled in an economical, rapid and efficient manner.

A further object of the invention is to provide a novel and improved method of filling successive containers by vacuum which includes the step of diverting the surplus or overflow material from a filled container into a succeeding container whereby to effect rapid, economical and efficient filling of successive containers.

A still further object of the invention is to provide a novel and improved container filling machine embodying vacuum filling apparatus of the character above specified and in which provision is made for introducing additional weighed material into the completely filled containers to bring the filled containers to a predetermined weight.

With these general objects in view and such others as may hereinafter appear, the invention consists in the container filling machine, in the method of filling containers, and in the various structures, arrangements and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention Fig. 1 is a front elevation of a container filling machine embodying the present invention; Fig. 2 is a similar view with some of the parts omitted to illustrate the control mechanism; Fig. 3 is a side elevation of the present container filling machine; Fig. 4 is a cross-sectional view of the vacuum filling apparatus taken on the line 4—4 of Fig. 3; Fig. 5 is a cross-sectional view of the filling apparatus taken on the line 5—5 of Fig. 4; Fig. 6 is a side elevation, partly in cross-section illustrating a material feeding device and showing the weighing scale and associated control mechanism; Fig. 7 is a plan view of a portion of the machine shown in Fig. 1, to be referred to; Fig. 8 is a detail view, partly in cross-section, of a portion of the vacuum filling control mechanism illustrated in Fig. 3; Fig. 9 is a side elevation of a modified form of vacuum filling apparatus embodying the present

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invention; Fig. 10 is a cross-sectional view taken on the line 10—10 of Fig. 9; and Fig. 11 is an inverted plan view of the vacuum filling head shown in Fig. 10.

In general, the present invention contemplates a novel packaging machine and particularly a container filling machine embodying vacuum filling apparatus adapted for filling successive containers with finely divided flowable solid material such as flour, powdered sugar, or like commodities. In the prior vacuum filling machines of which I am aware, it has been the practice to effect filling of a container by vacuum by continuing the filling operation until the container is completely filled and then withdrawing the surplus material or overflow into the overflow chamber or receptacle, and when the overflow receptacle became filled it was emptied into the main supply hopper.

In accordance with the present invention provision is made for filling successive containers by vacuum in such manner as to divert the overflow from the container being filled into a second container thus eliminating the usual overflow receptacle, the necessity for periodic emptying of the same, and effecting a compact uniform filling of the first container in a rapid, efficient and economical manner. In the illustrated embodiment of the invention, provision is made for simultaneously operating upon two containers to effect complete filling of one container and diversion of the overflow to provide a partial load in the second container, the containers then being advanced one station of operation to effect complete filling of the previously partially filled container and to provide a partial load in a succeeding empty container.

In the preferred embodiment of the invention, as illustrated in Figs. 1 to 8, the machine is particularly designed for filling flexible walled containers such as cartons with finely divided solid materials, the commercial cartons usually being provided with top flaps adapted to be successively folded down and adhesively sealed to form the top closure after the carton has been filled. In its preferred form the invention contemplates a duplex filling head comprising two chambers within which the containers are operatively supported, one of the filling heads having an opening or passage therein adapted to be connected to a source of suction and the other filling head having a material inlet opening adapted to be connected to a supply of the material, provision being made for connecting the two filling heads to establish communication between the interiors of

the two containers. Provision is preferably made for preventing collapse of the containers during the filling operation by maintenance of vacuum around the outside of the cartons, and, preferably the filling heads are provided with means engageable with the lateral surface of the mouth of the container for sealing the containers with respect to the filling heads to permit the interiors of the containers to be evacuated by suction connected to the suction opening and for preventing leakage of the material into the evacuated space or shroud around the container.

The automatic machine illustrated in Fig. 1 is further provided with a tapping station for settling the material in the container filled by the vacuum filling apparatus and a weighing station having a material feeding device controlled by the weighing mechanism for introducing additional material into the container to provide a predetermined weight therein. Provision is also made for intermittently advancing successive containers into operative position to the various stations and for controlling the operation of the machine to prevent initiation of a container moving cycle of operation until the container filling and weighing operations have been completed.

The modified form of the invention illustrated in Figs. 9 to 11, is particularly designed for filling rigid containers, such as glass or metal containers, the invention being illustrated as embodied in a semi-automatic machine having a duplex filling head and arranged to divert the overflow from one container into a second container to provide a partial load therein, as will be hereinafter more fully described.

Referring now to the drawings, and particularly to Fig. 1, the invention is herein illustrated as embodied in an automatic packaging machine and particularly a container filling and weighing machine which may be similar in construction and mode of operation, excepting as hereinafter pointed out, to the machine illustrated in the United States Patent to Stanley R. Howard, No. 2,116,895, issued May 10, 1938, to which reference may be had for features not disclosed in detail in the present application.

In general, the illustrated machine comprises a container filling and weighing machine having novel duplex vacuum filling apparatus, indicated generally at 10, designed for simultaneous operation upon two containers, a tapping device, indicated generally at 12, adapted to settle the material in the containers filled by the vacuum filling apparatus, and a material feeding and weighing device, indicated generally at 14, arranged to weigh the container and to introduce additional material thereto to provide a predetermined weight of material therein.

The empty containers are fed into the machine by a continuously driven conveyor 20, the foremost container engaging a fixed stop 22, in which position successive foremost containers are arranged to be transferred into the path of successive carrier arms 18 by a pusher plate 24. The carrier arms 18 are attached to an intermittently operated conveyer chain 16 arranged to advance the containers one station each cycle of operation, the completely filled and weighed containers being delivered out of the machine on a discharge conveyer 34. The illustrated machine is arranged to operate in successive cycles during one portion of which the vacuum filling, tapping and weighing operations take place, and, during another portion of which the containers are advanced one station of operation, provision being made for controlling the machine to prevent initiation of the container moving cycle of operation until the filling and weighing operations have been completed, as will be hereinafter more fully described.

The pusher plate 24 is arranged to be operated in timed relation to the carrier arms 18 and, as illustrated in Figs. 1 and 3, the pusher plate 24 is mounted to one end of a bar 36 connected by parallel links 37, 38 to a short link 39 forming a four-bar linkage pivotally mounted at 40 to impart a substantially straight line motion to the pusher plate 24. As better shown in Fig. 3, the parallel linkage is arranged to be operated by a crank member 42 fast on a crank shaft 44 and connected to the parallel linkage by a connecting rod 46. The crank shaft is arranged to be rotated from a one-revolution cam shaft 48 through a chain and sprocket drive indicated generally at 51, the shaft 48 being driven, as shown in Fig. 2, from a continuously rotating drive shaft 53 through bevel gear connections 55, 57, vertical shaft 59, and bevel gear connections 61, 63. The cam shaft 48 is arranged to be controlled to make one revolution during the package filling and weighing cycle of operation by a one-revolution clutch, indicated generally at 65, which may comprise a pawl and ratchet clutch arranged to be actuated through control means to be hereinafter described. The main driving shaft 53 may be continuously rotated in any usual or preferred manner, as by an electric motor, not shown, belted to a pulley 47 fast on the shaft 53.

The vacuum filling apparatus, indicated generally at 10, comprises in general a pair of spaced filling heads 26, 28 designed for simultaneous operation upon two containers advanced into a position beneath the filling heads by the carrier chain 16, and elevated into operative position to the filling heads by elevating mechanism, indicated generally at 29. In the operation of the machine, during one cycle of operation, the foremost container, elevated into operative engagement with the filling head 28, is provided with a full load of material and the second container, elevated into operative engagement with the filling head 26, is provided with a partial load comprising the overflow produced during the filling of the completely filled container. During the succeeding cycle of operation, the partially filled container is advanced and elevated into operative position to receive a complete load, the overflow from this filling operation being diverted into a succeeding empty container to provide a partial load therein.

As illustrated in Fig. 4, each filling head 26, 28 of the duplex unit includes an upper section comprising a substantially rectangular block of a size adapted to fit into the open end of the container, each filling head being further provided with depending side-walls forming vacuum chambers 31, 33 open at their lower ends and of a size sufficient to receive the containers, herein shown as a flexible carton 11 having closing flaps 13. The cartons are arranged to be elevated into operative position to their respective filling heads by end closure members 50 upon which the containers are supported, and onto which they are advanced when the closure members are in their lowered position, as shown in Fig. 1. Each end closure member 50 is provided with a sealing gasket 52 arranged to form an airtight closure with the open ends of the chambers 31, 33 upon elevation of the containers into the filling heads, thus sealing the containers within the vacuum

chambers. The upper sections of the filling heads or blocks 26, 28 are formed as part of the upper wall of the vacuum chambers and each of the four side-walls of the chambers are spaced from the adjacent face 54 of the filling heads so as to accommodate the upstanding top flaps 13 of the cartons when the latter are in filling position.

One of the filling heads, 26, is provided with a central opening 56 arranged to communicate with a source of suction, such as a suction line 58, wherein suction is maintained by a suction pump, not shown, and which is controlled by a three-way valve 60 for initiating and terminating the filling operation, the valve 60 having ports for establishing communication between the suction line 58 and the suction opening 56, and having a port 49 open to the atmosphere. The second vacuum filling head, 28, is provided with a material inlet 62 connected by a passageway 67 to a supply hopper 64 supported above the inlet to permit the solid flowable material to be drawn downwardly through the inlet 62 during the filling operation. The flow of material into the filling head 28, may be controlled by a shutter 66 disposed in the passageway 67 between the hopper and the material inlet. Each filling head is further provided with an opening 68, 70 communicating with the interior of the containers being filled and connected by a pipe or conduit 72 extending between the filling heads.

In order to evacuate the containers, provision is made for sealing the mouth of the body portion thereof around the filling heads or blocks 26, 28 by sealing means engageable with the external lateral surface of the container, and as herein shown, the sealing element may comprise a resilient tube 74 fitted within grooves formed in the walls of the filling heads. The resilient tubes are arranged to be expanded into engagement with the body of the carton near the top of the body portion so that the carton may be completely sealed against the filling head to enable the vacuum to be produced within the cartons, and to prevent passage of the finely divided material into the space around the body of the carton, when such space is evacuated to prevent collapse of the carton, as will be described. As herein shown, the expansion and contraction of the tubes 74 may be controlled by a three-way valve 75 connected to one of the filling heads 26 by a pipe 73 and connected between the filling heads by a pipe line 76, the valve 75 being connected to a source of air pressure by a pipe 71. The valve 75 is further provided with an atmospheric vent 77 to permit release of the pressure at the end of the filling operation.

In some instances it is desirable that provision be made for preventing collapse of the walls of the container during the filling operation, particularly with flexible walled cartons. For this purpose a suction inlet is provided at 79 in one of the walls of each chamber 31, 33 and connected by a pipe 81 and pipe 83 to a passageway 85 communicating with the suction opening 56. As herein shown the inner face of one wall of each chamber 31, 33 is channelled at 87 and a peripheral passage is formed at the bottom of each chamber by openings 89, one of which is connected with the channels so that when the three-way valve 60 is positioned to evacuate the interiors of the containers vacuum is set up around and beneath each container, thus substantially equalizing the pressures and preventing collapse of the containers. At the termination of the filling operation atmospheric pressure is supplied by

the proper disposition of the valve 60 to within and without the container, the suction line being cut off at such a time as will be apparent from Fig. 8.

The elevating mechanism, 29, for elevating the containers into operative position to the vacuum filling heads, will now be described. As herein shown, in the operation of the machine the containers are successively advanced on to the container supporting and elevating members 50 which are secured to the upper ends of elevating rods 78 slidingly mounted in bearings 80 formed in a bracket 82 attached to the machine frame. The lower ends of the elevating rods 78 are connected by links 84 to the outer end of a cam lever 86 pivotally mounted at 88 in a bracket 90 attached to the machine frame. The cam lever 86 is provided with a roller 92 arranged to cooperate with a closed cam 94 fast on a cam shaft 96, and in the operation of the machine the containers supported on the closure members 50 are elevated into operative engagement with the duplex vacuum filling heads 26 and 28. The cam shaft 96 is arranged to be rotated through a chain and sprocket connection 98 from the cam shaft 48 to effect elevation of the containers during the container filling and weighing cycle of operation.

From the description thus far, it will be seen that in the operation of the machine, the containers 11 disposed beneath the filling heads 26, 28 and supported on the end closure and container supporting members 50 may be elevated to insert the containers into the vacuum chambers 31, 33 respectively and to effect sealing of the vacuum chambers. Suitable guides 100 may be provided at the lower end of each filling block to guide the top flaps 13 up into the clearance spaces 102 formed between the block and the depending side walls, and, when in filling position, the lower portions of the blocks 26, 28 extend into the carton so that the sealing tubes 74 will be disposed to engage the body portion of the carton at or below the score line. The lower end of the vacuum inlet 56 may be provided with a screen 104 of suitable mesh to prevent the passage of the finely divided solid material. The three-way valve 75 may now be opened, as shown in Fig. 8 to connect the tubes 74 with the air pressure line 71 to effect a tight seal of a portion of the body of the carton against the filling head. Simultaneously therewith, the three-way valve 60 is opened to connect the vacuum line 58 with the suction opening 56 communicating with the interior of the container in the chamber 31, and with the conduit 81, 83 communicating with the space about the outside of the carton. As illustrated in Fig. 3, the valves 60 and 75 are arranged to be actuated by a cam 106 fast on the one-revolution cam shaft 48 through connections including a cam roller 108 carried by one arm of a lever 110 pivotally mounted at 112, the second arm of the lever being connected by a link 114 to a bell crank 116 connected to the valve 60. The bell crank 116 is connected to the valve 75 by a link 118. The roller 108 is urged into engagement with its cam 106 by a spring 107 connected to the roller arm, as shown in Fig. 3. Thus, in the operation of the machine the valves 60 and 75 are simultaneously opened to effect sealing of the flaps of the containers against the filling heads and to effect evacuation of the containers in the chambers 31, 33 by virtue of the communicating openings 68, 70, and the connecting pipe line 72.

Upon evacuation of the containers, the shutter

66 disposed in the material inlet passageway 67 is arranged to be opened by a cam 120, see Fig. 2, fast on the cam shaft 48 and through cooperating linkage including a cam roller 122 carried by a lever 124 the latter being connected by a link 126 to an arm 128 fast on the shutter shaft 130, as clearly shown in Fig. 4. It will be observed that when the vacuum valve 60 is opened the exterior surfaces of the containers in the chambers will also be evacuated through the communicating pipe line 81, 83 to prevent collapse of the containers during the filling operation.

The establishment of a vacuum within the containers causes the rapid flow of the finely divided solid material into the container in the chamber 33 communicating with the material inlet 62. The continuity of the vacuum continues to withdraw the large volume of air that is normally occluded in the finely divided material, resulting in the filling of the container with a dense, firmly packed body of finely divided material. When the level of the material reaches the bottom of the filling block, 28 the overflow commences to flow into the second container through the communicating openings 68, 72, 70 the screen 104 preventing the material from passing into the suction line. After a predetermined time has elapsed during which time the second container has received a partial load, the shutter 66 in the material inlet is closed and the valve 60 is operated to cut off the suction and admit atmospheric air to the interiors of the containers. At the same time the vacuum within the shroud surrounding the body of the containers within the chambers is broken. Simultaneously therewith the valve 75 is operated to cut off the air pressure and to open the tubes 74 to the atmosphere and thereafter the elevator is caused to descend to withdraw the containers from the chambers 31, 33 and to present the containers in alignment with the conveyer arms 18. When the valve 60 is opened to admit air through the suction opening 56, the material adhering to the undersurface of the screen is blown back into the container, thus preventing clogging of the screen and clearing the suction line, each cycle of operation.

In the continued operation of the machine, the containers are advanced one station of operation to present the filled container on the tapping mechanism 12 to effect settling of the contents therein, and to present the partially filled container beneath the filling head 28. Simultaneously therewith a succeeding container is advanced beneath the filling head 26, so that during the succeeding cycle of operation, the partially filled container may be completely filled and the newly presented empty container provided with a partial load by the overflow from the filled container as previously described.

After the material in the filled container has been settled at the tapping station, the container is presented to the material feeding and weighing station 14, at which station the container is weighed and provided with an additional supply of material to bring the container up to a predetermined weight. The illustrated weighing device and material feeding mechanism is similar in construction and mode of operation to the weighing mechanism disclosed in the U. S. patent to William S. Cleaves, No. 1,739,061, issued December 10, 1929, to which reference may be had. In general, such mechanism includes a scale beam 150 having the usual counterweight 152 at one end and a scale pan 154 at its other end arranged to support the filled container in operative position to receive material from a supply hopper 156. The supply hopper 156 is provided with a pair of shutters 158, 160 for controlling the feed of the material and, the shutters are arranged to be opened and closed through a four bar linkage indicated generally at 162, including an arm 164 connected by a link 166 to a rocker arm 168 pivotally mounted at 170. The rocker arm is arranged to be moved in one direction to effect opening of the shutters at the start of the weighing operation and to be rocked in the opposite direction to effect closing of the shutters at the end of the weighing operation by a cam disk 172 provided with an abutment 174 arranged to cooperate with abutments 176, 178 provided on the rocker arm 168. The cam disk 172 is arranged to be rotated in successive half-revolutions through control mechanism including a pawl and ratchet clutch mechanism indicated generally at 180, see Figs. 1 and 2, the ratchet being fast on the main drive shaft 53, and the pawl being carried by the cam disk 172 so that in the operation of the machine, during one half revolution of the disk 172, the abutment 174 on the disk engages the abutment 176 of the rocker arm to effect opening of the shutters, and, during a succeeding half revolution, the abutment 174 engages the second abutment 178 of the rocker arm to effect closing of the shutters. The control mechanism includes a yoke arm 182 rockingly mounted on a shaft 184 each arm of the yoke having opposed pawl stops 185 arranged to disengage the pawl from its ratchet each half-revolution. The yoke arm 182 is arranged to be rocked in one direction to permit opening of the shutters to start the feeding operation by a resetting bar 186, as will be hereinafter described, and is arranged to be released and rocked in the opposite direction through mechanical tripping mechanism indicated generally at 188 arranged to be actuated by the scale beam when the package reaches a predetermined weight. The mechanical tripping mechanism 188 is fully illustrated and described in the Cleaves patent above referred to, and as herein shown, is operatively connected to a cross shaft 190 which is connected through linkage 192 to the yoke shaft 184. The rock shaft 190 is normally urged in a clockwise direction viewing Fig. 2, by a spring 194 connected to an extension 196 of the linkage 192, and is arranged to be urged in the opposite direction by a roller 198 carried by the bar 186 engageable with a depending arm 200 fast on the shaft 190. Thus, in the operation of the machine, when the container on the scale pan 154 has received sufficient material from the hopper 156 to provide a predetermined weight, the scale beam 150 is rocked to actuate the mechanical tripping mechanism 188 thus permitting the spring 194 to rock the shaft 190 and the yoke 182 to permit the disk 172 to make one-half revolution and effect closing of the shutters 158, 160 as described, and, at the end of the package moving cycle of operation, the resetting bar 186 is operated to rock the yoke 182 in the opposite direction to permit the disk 172 to make another half revolution to effect opening of the shutters 158, 160 through the connections described.

Provision is made for controlling the operation of the machine to perform the vacuum filling and weighing operations during one portion

of the cycle and to intermittently advance the containers one station of operation during a second portion of a cycle of operation, and as herein shown, the carrier chain 16 is arranged to be rotated from the main driving shaft 53 through a one revolution pawl and ratchet clutch mechanism, indicated generally at 202, and through cooperating bevel gears 204 to a vertical shaft 206 operatively connected to the carrier chain drive sprocket. Provision is made for controlling the one-revolution clutch 202 to effect the package moving cycle of operation when the package filling and weighing operations have been completed through a pawl stop mechanism 208 having opposed lugs 210, 212. The pawl stop 208 is operatively connected by a link 214 to one arm 216 of a bell crank pivotally mounted at 218, the second arm 220 of the bell crank being provided with a roller 222 arranged to cooperate with the cam disk 172. Thus in the operation of the machine, when the package on the scale pan 154 reaches its predetermined weight to effect rocking of the yoke 182, through the scale actuated control mechanism 188 above described, the disk 172 is permitted to make one-half revolution to effect rocking of the bell crank in a clockwise direction thus rocking the pawl stop 208 and permitting engagement of the pawl and ratchet clutch 202 for one revolution to effect the package moving cycle of operation. Provision is also made for preventing initiation of the package moving cycle until the elevator mechanism at the container filling station is returned to its lowermost position, and for this purpose a second pawl stop 209, similar to the illustrated pawl stop 208 and disposed directly behind the same, is operatively connected to the elevator mechanism through linkage, indicated generally at 224, arranged to be actuated upon descent of the elevating mechanism.

The cam roll 122 is maintained in engagement with the cam surface of the disk 172 by a coil spring 230 interposed between the undersurface of the arm 220 of the bell crank and the top of the machine platen thus normally urging the pawl stop 208 in a counter-clockwise direction, as illustrated to effect disengagement of the clutch 202, the linkage 224 being likewise urged in a direction to maintain the second pawl stop 209 in clutch disengaging position by a spring 225 until actuated to withdraw the pawl stop upon descent of the elevating mechanism. Each pawl stop arm 208, 209 may be provided with a friction connecting element 211 arranged to permit frictional sliding movement of the arms 208, 209 relative to the links 214, 215 to thereby permit resetting of the pawl stops to disengaging position by engagement of a cam surface 217 of the one revolution clutch 202 with the lugs 212, as described in the Howard patent No. 2,116,895 above referred to. The bell crank arm 220 is also provided with the usual connecting linkage, indicated at 227, see Fig. 6, for locking the scale beam 150 at the end of the weighing operation and for unlocking the scale beam to initiate a weighing cycle at the end of the package moving cycle of operation. The arm 216 of the bell crank may be connected at its upper end to the usual clutch mechanism 229 to effect rotation of the hopper stirrers 231 through the chain and sprocket drive 233 during the material feeding and weighing operation.

From the description thus far it will be observed that in the operation of te machine the pawl stop arms 208, 209 are normally maintained in a position to effect disengagement of the one revolution clutch 202 to prevent initiation of a package moving cycle of operation until the vacuum filling and weighing operations have been completed, and, in practice either the vacuum filling or the weighing operation may be completed first to effect rocking of its respective pawl stop, engagement of the clutch 202 being prevented until both pawl stops 208, 209 have been withdrawn.

Upon completion of the vacuum filling and weighing operations, the package moving cycle of operation is initiated, as described, to advance the containers one station of operation, and in the continued operation of the machine provision is made at the end of the package moving cycle of operation for resetting the weighing mechanism and for initiating a container filling cycle of operation. As best shown in Fig. 2, the resetting mechanism includes the elongated resetting bar 186 arranged to be longitudinally moved through connections from a cam 252 mounted fast on a secondary shaft 254, see Fig. 7. The secondary shaft 254 is arranged to be rotated one revolution during the package moving cycle of operation through connections from the one-revolution clutch 202 including a gear train 256, as shown in Fig. 7. The connections between the cam 252 and the resetting bar 186 include a cooperating cam roll 258 carried by an arm 260 fast on one end of a short shaft 262 rockingly mounted in a bracket 264. An arm 266 fast on the other end of the shaft 262 is connected to the resetting bar 186. The resetting bar is arranged to be moved to the left, viewing Fig. 2 at the end of the package moving cycle of operation to effect engagement of the roller 198 carried thereby with the arm 200 fast on the rocker shaft 190, thus effecting resetting of the mechanical tripping mechanism 188 and rocking of the yoke arm 186 in a clockwise direction through the previously described linkage, and permitting the cam disk 172 to make one-half revolution. During this half revolution the shutters 158, 160 are opened and the bell crank arm 220 is permitted to be rocked upwardly by the coil spring 230 to effect unlocking of the scale beam. The resetting bar is further provided with a depending member 270 arranged to engage an arm 272 operatively connected to a pawl stop 274 so that when the resetting bar 186 is moved to the left, viewing Fig. 2, the pawl stop 274 will be moved to permit operative engagement of the pawl and ratchet clutch 65 to effect elevation of the containers into operative engagement with filling heads 26, 28 and initiation of the vacuum filling operation, as described.

Referring now to Figs. 9, 10, and 11, a modified form of duplex vacuum filling apparatus is therein illustrated as embodied in a semi-automatic machine, and is particularly designed for filling rigid containers, such as glass or metal containers. The modified form of filling apparatus includes a duplex filling head 300 provided with a material inlet 302 in communication with the interior of one container 304, and, is provided with a suction opening 306 in communication with the interior of the second container 308. The material inlet 302 is connected to a supply hopper 301, and, the suction opening 306 is connected to a source of vacuum by a passageway 344, pipe 342, control valve 336, and vacuum line 340. The container engaging face of the duplex filling head is provided with resilient portions herein shown as comprising sealing rings 309, 311 pressed into annular grooves in the underside of the head and arranged for sealing engagement with the upper

edge of the containers, and, communication is established between the interiors of the two containers by openings 310, 312, connected by a passageway 314.

Provision is made for elevating the containers into operative engagement with the filling head and, as herein shown, the containers are placed upon an elevating plate 316 mounted at the upper end of a vertically reciprocating rod 318 slidingly mounted in a bearing member 317 attached to the underside of the platen 319. The vertically reciprocating rod 318 is connected by a link 320 to one arm 322 of a foot treadle pivotally mounted at 324, the treadle being normally urged in a counter-clockwise direction by a spring 326 connected to the second arm 321 of the treadle. The rod 320 is yieldingly connected to the treadle arm 322 by a coil spring 328 interposed between a swivel block 330, carried by the lever 322, and a collar 332 fast on the rod 320. A second collar 334 fast on the lower end of the rod 320 is arranged for engagement with the opposite side of the swivel 330 to effect positive descent of the elevating plate 316. Thus in the operation of the machine, when the operator steps on the treadle 321 the rigid containers 304, 308 are yieldingly elevated into sealing engagement with the sealing rings 309, 311 of the duplex filling head 300 to seal the containers to the filling head.

Provision is made for evacuating the containers and initiating the filling operation when the containers have been elevated into sealing engagement with the filling head, and for this purpose the valve 336 which may comprise a three-way valve is operatively connected to the treadle lever 322 by a link 338. The three-way valve is provided with ports arranged to establish communication between the vacuum lines 340, 342 when the treadle arm 322 is rocked upwardly, and, is further provided with a vent port 346 arranged to be uncovered by the valve 336 when the treadle lever 322 is rocked downwardly at the end of the filling operation. The operating connections between the treadle arm 322 and three-way valve 336 are so arranged that in the operation of the machine, the containers are first yieldingly engaged with the sealing rings 309, 311 of the filling head 300, and during further movement of the treadle lever 322 and compression of the coil springs 328, the valve 336 is rocked to cut off the atmospheric port 346 and to open the line 342 to the source of suction to initiate the filling operation. Conversely, when the treadle is rocked in the opposite direction at the end of the filling operation, the valve is rocked in a counter-clockwise direction to cut off the source of vacuum and to open the interiors of the containers to the atmosphere prior to disengagement of the mouths of the containers from the sealing head.

From the above description it will be observed in the operation of the machine the containers are placed on the elevating plate 316 in alignment with the sealing rings 309, 311 and are yieldingly elevated into engagement with the sealing head 300, whereupon, during continued movement of the treadle arm 322 the valve 336 is rocked to effect evacuation of the containers, and material is withdrawn from the supply hopper 301 through the material inlet 302 and into the container 304. When the container 304 becomes completely filled, the surplus material is directed into the second container 308 through the passageways 310, 314, 312 to provide a partial load therein. As illustrated in Fig. 11, the suction opening 306 communicating with the container 308 may be provided with a screen 348 of a mesh suitable to prevent the passage of the finely divided solid material. If, in operation, the screen 348 becomes clogged, the operator may break the suction by operation of the three-way valve, thus admitting air through the suction opening 312 which operates to blow the material adhering to the surface of the screen back into the container. The vacuum may then immediately be reestablished to complete the filling operation. Upon partial filling of the container 308 by the overflow from the completely filled container 304, the operator releases the treadle lever 322 which operates to first actuate the valve to open the containers to the atmosphere, and thereafter effect disengagement of the containers from the sealing head during the continued descent of the elevator plate 316. In the continued operation of the machine the operator may remove the completely filled container 304 and advance the partially filled container 308 into a position beneath the sealing ring 311 and provide a succeeding container into operative position beneath the sealing ring 309 in preparation for a succeeding cycle of operation wherein the previously partially filled container 308 may be completely filled and the succeeding container provided with a partial load by the overflow from the completely filled container.

When filling transparent containers, such as glass containers, the operator may discontinue the filling operation when he observes that the second container is partially filled, or, if the container be non-transparent the filling operation may be discontinued after a predetermined time has elapsed to provide the second container with a partial load.

The gate member 66 may be used if desired to shut off the flow of material from the hopper 64 until a relatively high vacuum has been established in the containers, and then opened to permit the rapid flow of material into the first container and overflow to be diverted into the second container. This operation results in production of a compact and most economical filling of the container by reason of the production of the high vacuum therein.

From the above description of the selected embodiments of the invention, it will be observed that the illustrated duplex vacuum filling structures provide a simple and convenient apparatus capable of rapidly filling successive containers with finely divided solid flowable material by vacuum and wherein the surplus material from a filled container may be diverted into a second container to provide a partial load therein, thereby eliminating the usual over-flow bowl and its consequent disadvantages.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling head adapted for air tight connection with the open upper end portions of two containers supported in filling position, said filling head being provided with a material inlet communicating with the interior of one of said containers, and being provided with a suction opening communicating with the second of said con-

tainers, and means for establishing communication between the interiors of the two containers whereby to cause evacuation of both containers by suction applied to said suction opening and thereby effect an overflow from said first container into said second container so as to obtain compact uniform filling of said first container, and automatically operating valve means for controlling the filling operation.

2. In a vacuum operated filling machine for filling containers with flowable solid material, filling mechanism comprising two filling heads adapted for air tight connection with the open upper end portions of two containers, supported in filling position one filling head being provided with a material inlet communicating with the interior of one of said containers, the other filling head being provided with a suction opening communicating with a second container, and means for establishing communication between the interiors of the two containers whereby to cause evacuation of both containers by suction applied to said suction opening and thereby effect an overflow from said first container into said second container so as to obtain compact uniform filling of said first container, and cam-operated valve means for automatically initiating and terminating the filling operation.

3. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two filling heads adapted for air tight connection with the open upper end portions of successive containers supported in filling position, one filling head being provided with a material inlet communicating with the interior of one container, the other filling head being provided with a suction opening communicating with a second container, means for establishing communication between the interiors of the containers whereby to cause evacuation of both containers by suction applied to said suction opening and thereby effect an overflow from said first container into said second container so as to obtain compact uniform filling of said first container, automatically operating means for initiating and terminating the filling operation, and container moving means operative between successive filling operations for moving the second container into the position of the first container and for moving an empty container into the poistion of said second container.

4. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling head comprising two chambers spaced apart and arranged to receive a container in operative filling position in each chamber, one of said chambers being provided with a material inlet communicating with one container, the other chamber being provided with a suction opening communicating with the second container, connections between the chambers adapted to cause evacuation of both containers by suction applied to said suction opening and thereby effect an overflow from said first container into said second container so as to obtain compact uniform filling of said first container, and control means for initiating and terminating the filling operation.

5. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two spaced chambers, each chamber having a filling head, one filling head being provided with a material inlet and the other filling head being provided with a suction opening, each chamber having an opening through which a container may be introduced, air tight closure means for the last mentioned openings, means providing a seal for engaging the open upper end portions of the containers supported in filling position, a conduit extending between said filling heads and communicating with the interior of each container to cause evacuation of both containers by suction applied to said suction opening and thereby effect an overflow from said first container into said second container so as to obtain compact uniform filling of said first container, and suction control means for initiating and terminating the filling operation.

6. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two spaced chambers, each chamber having a filling head, one filling head being provided with a material inlet and the other filling head being provided with a suction opening, each chamber having an opening through which a container may be introduced, air tight closure means for the last mentioned openings, means providing a seal for engaging the open upper end portions of the containers supported in filling position, a conduit extending between said filling heads and communicating with the interior of each container to cause evacuation of both containers by suction applied to said suction opening to permit complete filling of one container to pass into the second container, suction control means for initiating and terminating the filling operation, and means for establishing a vacuum around the body of each container in its respective chamber to prevent collapse of a flexible container.

7. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two spaced chambers, each chamber having a filling head, one filling head being provided with a material inlet and the other filling head being provided with a suction opening, each chamber having an opening through which a container may be introduced, air tight closure means for the last mentioned openings, means providing a seal for engaging the open upper end portions of the containers supported in filling position, a conduit extending between said filling heads and communicating with the interior of each container to cause evacuation of both containers by suction applied to said suction opening to permit complete filling of one container and to permit the overflow of material from one container to pass into the second container, suction control means for initiating and terminating the filling operation, and means for intermittently advancing successive containers one station of operation between filling operations.

8. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling head comprising two chambers spaced apart and each having an opening at one end to permit introduction of a container to be filled, means for sealing each opening, means for sealing the open upper end portions of the containers in air tight relation to the filling head, one of said chambers having a material inlet communicating with one container, and the second chamber having a suction opening communicating with the other container, a conduit providing communication between the interiors of both containers whereby to cause evacuation of both containers by suction applied

to said suction opening, to permit complete filling of one container and overflow to pass from the first container into the second container, suction control means for initiating and terminating the filling operation, and means for advancing the containers one station of operation between successive filling operations.

9. In a machine of the character described, vacuum operated filling mechanism for filling containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow of material into a second container, weighing mechanism including a weighing scale and material feeding means adapted to provide an additional increment of material to bring the container up to a predetermined weight, and means controlled by the weighing scale for terminating the flow of material when the predetermined weight is reached.

10. In a machine of the character described, cyclically operating container moving means, vacuum operated filling mechanism for filling the containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow of material into a second container, weighing mechanism including a weighing scale and material feeding means arranged to provide an additional increment of material to bring the container up to a predetermined weight, means controlled by the weighing scale for terminating the flow of material when the predetermined weight is reached, and control means for preventing initiation of the container moving means until the container filling and weighing operations have been completed.

11. In a machine of the character described, container moving means, vacuum operated filling mechanism for filling the containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow of material into a second container, container moving means for advancing the containers one station of operation between filling operations, and means for controlling the operation of the machine to prevent initiation of a container moving cycle of operation until the filling cycle is completed.

12. In a machine of the character described having a container moving cycle of operation and a container filling cycle of operation, vacum operated filling mechanism for filling the containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow of material into a second container to provide a partial load therein, means for moving the containers into and from operative filling position, means for advancing the containers one station of operation between filling operations, and means for controlling the operation of the machine to prevent initiation of a container moving cycle of operation until the filling cycle is completed.

13. In a machine of the character described having a container moving cycle of operation and a container filling cycle of operation, vacuum operated filling mechanism for filling containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow of material into a second container to provide a partial load therein, means for moving the containers into and from operative filling position, means for advancing the containers one station of operation between filling operations, and control means operatively connected to said moving means for preventing initiation of a container moving cycle of operation until the filling operation is completed and the moving means has returned to its initial position.

14. In a machine of the character described having a container moving cycle of operation and a container filling cycle of operation, vacuum operated filling mechanism for filling the containers with flowable solid material comprising a duplex filling head adapted to complete the filling of one container and to divert the overflow from said one container into a second container to provide a partial load therein, means for moving the containers into and out of operating filling position, means for advancing the containers one station of operation each container moving cycle, weighing mechanism including a weighing scale and material feeding means arranged to provide an additional increment of material to bring the container up to a predetermined weight, means controlled by the weighing scale for terminating the flow of material when said predetermined weight is reached, and control means operatively connected to said weighing scale and to said moving means for preventing initiation of a container moving cycle of operation until the container filling and weighing operations are completed.

15. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two spaced chambers, each chamber having a filling head, one filling head being provided with a material inlet and the other filling head being provided with a suction opening, each chamber having an opening through which a container may be introduced, means for moving the containers into and out of said chambers, air tight closure means for said chamber openings, means providing a seal engageable with the open upper end portions of the containers supported in filling position, a conduit extending between said filling heads and communicating with the interior of each container to cause the evaculation of both containers by suction applied to said suction opening to permit the complete filling of one container and to permit the overflow from one container to pass into the second container, suction control means for initiating and terminating the filling operation, means for intermittently advancing the containers one station of operation, and means for controlling the operation of the machine to prevent initiation of the intermittent movement of the containers until the filling operation is completed and the container moving means has returned to its lowered position.

16. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling mechanism comprising two spaced chambers, each chamber having a filling head, one filling head being provided with a material inlet and the other filling head being provided with a suction opening, each chamber having an opening through which a container may be introduced, means for moving the containers into and out of said chambers, air tight closure means for said chamber openings, means providing a seal engageable with the open upper end portions of the containers supported in filling position, a conduit extending between said filling heads and communicating with the interior of each con-

tainer to cause evacuation of both containers by suction applied to said suction opening to permit the complete filling of one container and to permit the overflow from one container to pass into the second container, suction control means for initiating and terminating the filling operation, means for intermittently advancing the containers one station of operation between filling operations, means for establishing a vacuum around the body of each container in its respective chamber during the filling operation to prevent collapse of a flexible container, and means for controlling the operation of the machine to prevent initiation of the intermittent movement of the containers until the filling operation is completed and the moving means returned to its initial position.

17. In a vacuum operated filling machine for filling containers with flowable solid material, a duplex filling head comprising two chambers spaced apart and arranged to receive a container in operative filling position in each chamber, one of said chambers being provided with a material inlet communicating with one container, the other chamber being provided with a suction opening communicating with the second container, connections between the chambers adapted to cause evacuation of both containers by suction applied to said suction opening and thereby permit complete filling of said one container and to direct the overflow from one container into the second container, means for breaking the vacuum at the end of the filling operation, and means disposed in said material inlet for controlling the flow of material therefrom.

18. In the method of filling containers in succession by vacuum, the steps comprising moving two containers into filling position, evacuating both containers, filling one container, and diverting the overflow therefrom into the second container so as to obtain a compact uniform filling of the first container, breaking the vacuum and moving the filled container from filling position and the second container into a position to be completely filled, moving a third and empty container into the filling position occupied by the aforesaid second container and repeating the aforesaid steps.

19. In the method of filling containers in succession by vacuum, the steps comprising moving two containers into filling position, evacuating both containers, filling one container, and diverting the overflow therefrom into the second container so as to obtain a compact uniform filling of the first container, breaking the vacuum and moving the filled container from filling position and the second container into a position to be completely filled, moving a third and empty container into the filling position occupied by the aforesaid second container, and introducing additional weighted increments into the completely filled containers to bring them to a predetermined weight.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,037,467	Hapgood	Apr. 14, 1936
2,054,492	Young	Sept. 15, 1936