Oct. 8, 1963 W. F. LAUN 3,106,230

METHOD AND APPARATUS FOR FILLING NON-RIGID CONTAINERS

Filed March 14, 1960 4 Sheets-Sheet 1

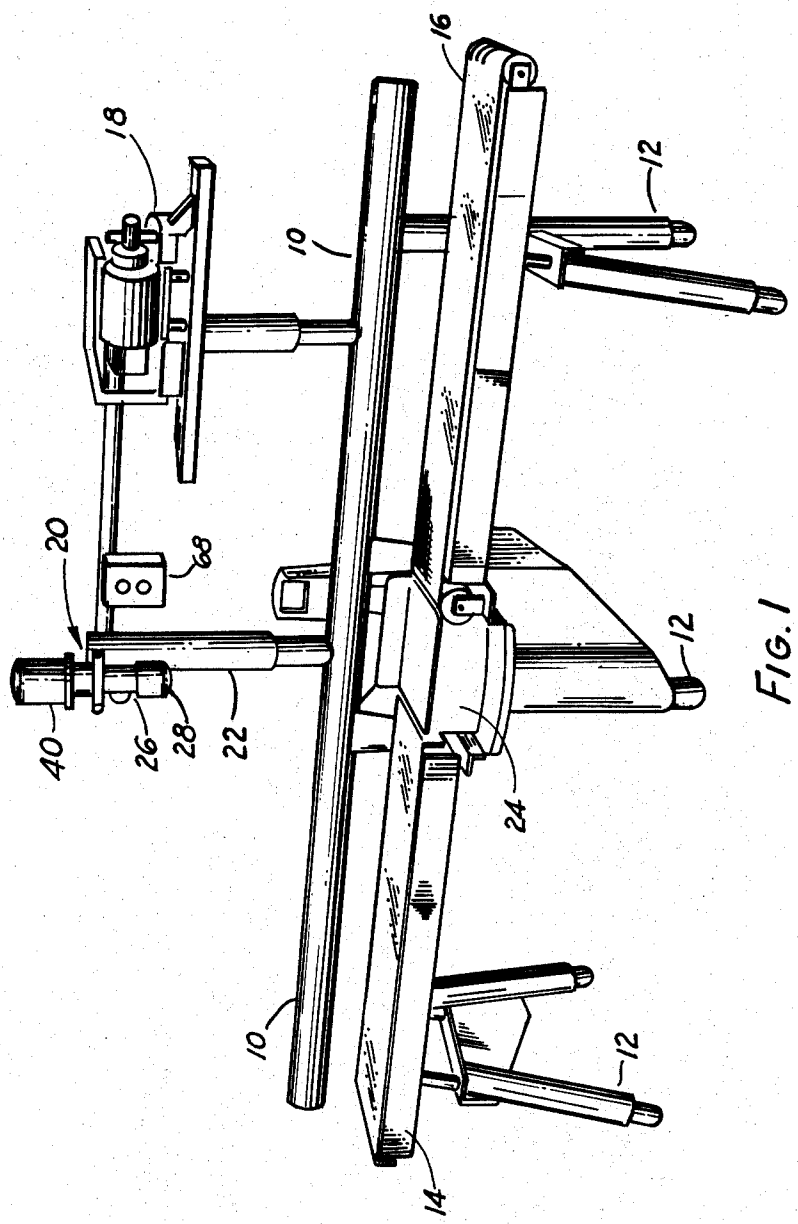


FIG. 1

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METHOD AND APPARATUS FOR FILLING NON-RIGID CONTAINERS

Filed March 14, 1960 4 Sheets-Sheet 2

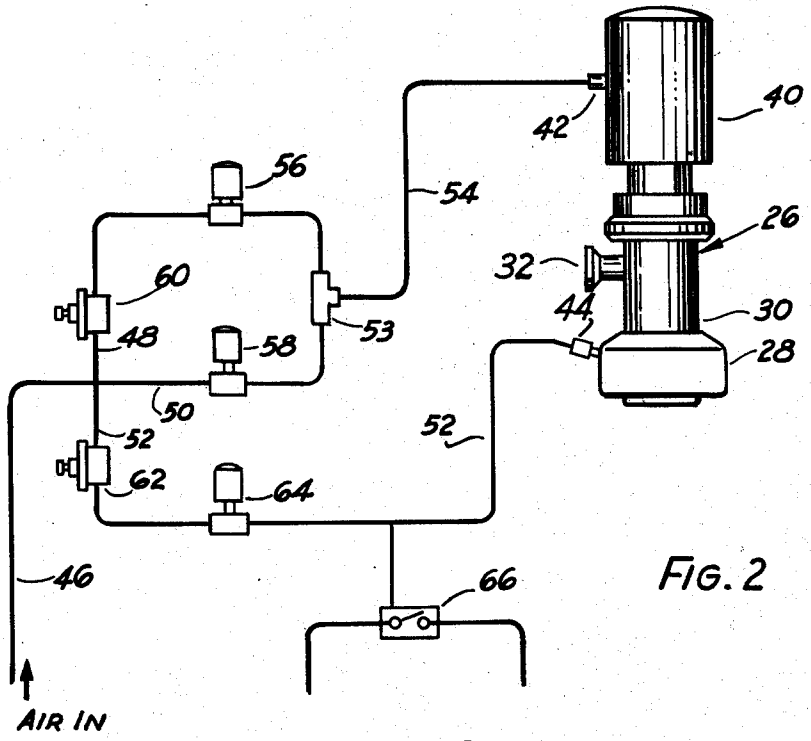


FIG. 2

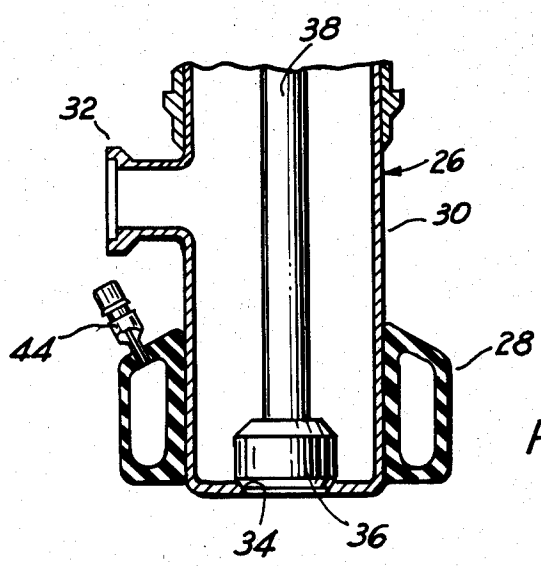


FIG. 3

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Oct. 8, 1963 W. F. LAUN 3,106,230

METHOD AND APPARATUS FOR FILLING NON-RIGID CONTAINERS

Filed March 14, 1960 4 Sheets-Sheet 3

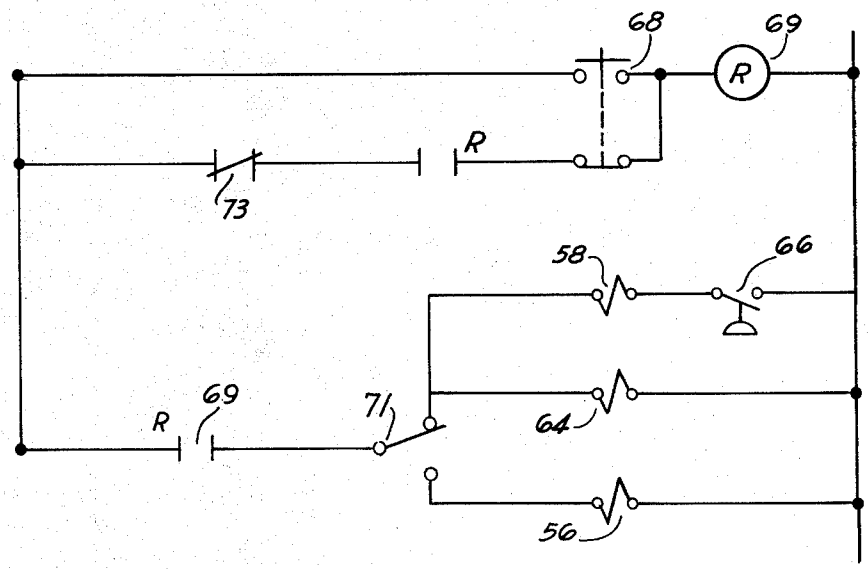


FIG. 2A

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METHOD AND APPARATUS FOR FILLING NON-RIGID CONTAINERS

Filed March 14, 1960 4 Sheets-Sheet 4

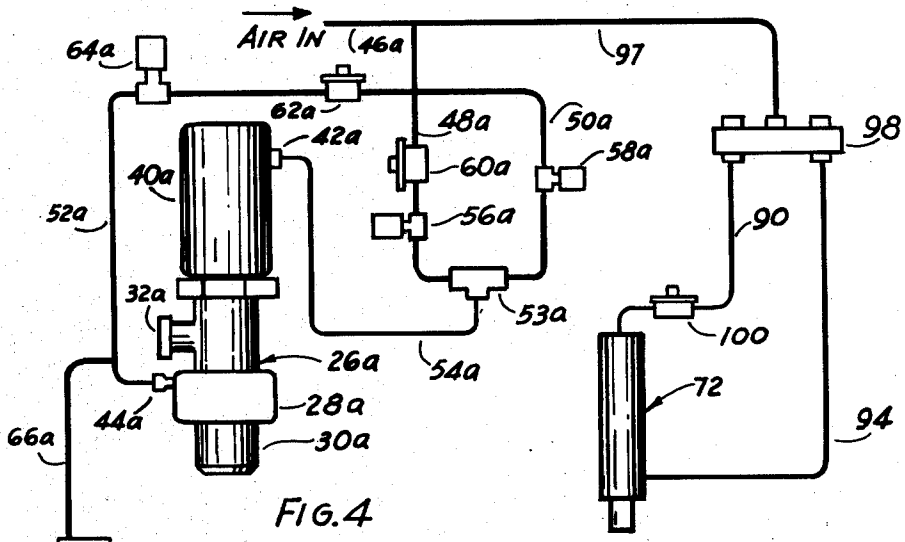


FIG. 4

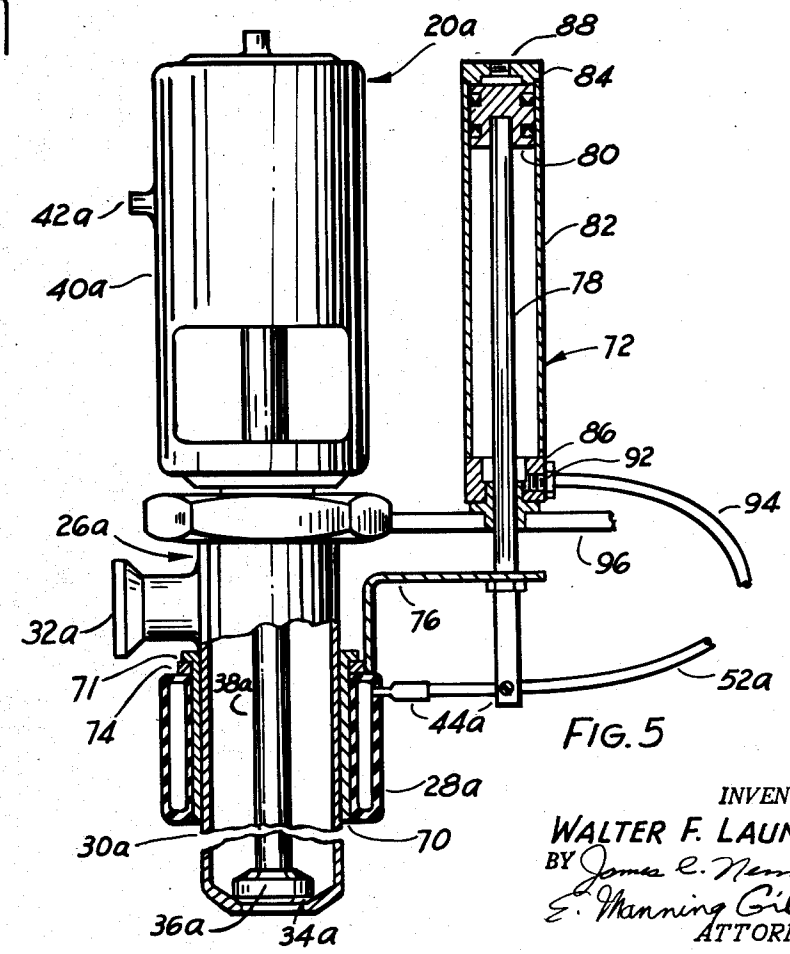


FIG. 5

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3,106,230

METHOD AND APPARATUS FOR FILLING NON-RIGID CONTAINERS

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Filed Mar. 14, 1960, Ser. No. 14,575
5 Claims. (Cl. 141—10)

This invention relates to a method and apparatus for filling containers and more particularly to a filling device and a method of filling flexible plastic bags with fluid materials.

Development of the flexible sheet plastic materials and their widespread use for packaging has in recent years reached into those industries handling comestible products. For example, in the dairy industry the combination of a plastic bag in a cardboard box container has found utility for storing and shipping milk and other dairy products. This, of course, has created problems in filling these bags with fluid products, one difficulty being properly to support them during filling. To overcome this difficulty, some means must be provided to hold the bag during the entire filling operation and also initially to suspend it to prevent a portion of the bag from becoming folded under and not filled.

A further difficulty when filling with milk is that milk will foam in the presence of air, and the foam will fill the bag before the full fluid volume is obtained, necessitating refilling. These problems have been satisfactorily overcome in filling containers such as glass bottles and paper cartons, since these containers are self-supporting and the filler opening can be sealed during the filling operation and the air withdrawn from the container through a vent tube. Attempts to use fillers designed for rigid containers to fill flexible containers, such as the plastic bag, have been unsatisfactory.

It is therefore a principal object of my invention to provide a satisfactory filler and method for filling non-rigid containers.

It is another object of my invention to prevent the foaming that can occur during the filling of non-rigid containers with milk, and other fluids that foam in the presence of air, by providing means to seal the filling opening.

It is a further object of our invention to provide a filling device that will perform the function of aiding in the support of a non-rigid container during the filling operation.

It is another object of my invention to provide means for temporarily lifting the bag to be filled, thereby preventing any portion of the bag from folding under and not being filled.

It is a still further object of my invention to provide a filling apparatus that is of a simple and sanitary design and one that is easy and inexpensive to manufacture.

These and other objects of my invention will be readily apparent from a consideration of the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a view showing in perspective a filling device mounted on support means with other components to provide a filling and sealing apparatus that may be installed in a container conveyor line;

FIGURE 2 is a diagrammatic representation showing the air supply system for the filling device;

FIGURE 2A is a schematic diagram showing the electrical control circuit for the filling device;

FIGURE 3 is a sectional view of a portion of the discharge nozzle of the filling device;

FIGURE 4 is a diagrammatic representation showing the air supply system for a second embodiment of the invention; and

FIGURE 5 is a elevation view showing in detail the second embodiment of the filling device, part of the view being shown in section to reveal certain details of structure.

Referring now to FIGURE 1, the illustrated apparatus is arranged specifically for handling composite box-plastic bag type containers and consists of suitable supporting structure **10** mounted on a plurality of legs **12**. At one end of the apparatus there is mounted a table **14** suitable for receiving the containers to be filled from a conveyor line (not shown). At the discharge end of the apparatus there is mounted a short conveyor **16** which, after the containers are filled, moves them past a heat sealing apparatus **18** and then to another conveyor (not shown) for transfer to a storage or shipping area.

The filling device, indicated generally by the reference numeral **20**, is mounted on an upright member **22** that is secured to the supporting structure **10**. Directly below the filling device **20** and mounted on the structure **10** between the table **14** and the conveyor **16** is a weight measuring device **24**. The device **24** is connected in a control system, described hereinafter, for automatically regulating the flow of milk into the container.

As best seen in FIGURES 2 and 3, the filling device **20** consists of a valve **26** with an inflatable bladder or doughnut-shaped member **28** secured around the discharge nozzle **30** thereof. The valve **26** has an inlet port **32** adaptable for connection with a milk supply line. At its open end, the discharge nozzle **30** of valve **26** has an inwardly extending flange formed around its entire circumference to define a valve seat **34** upon which seats the valve member **36**. The valve member **36** is actuated by a rod **38** that is connected to an air operated actuator **40**, which may be of any suitable type. However, I prefer to provide an actuator of the type disclosed and claimed in my co-pending application Serial No. 1,670, filed January 11, 1960, entitled "Reversible Actuator for Automatic Valves."

To move the valve member **36** off its seat **34**, air pressure is supplied to the actuator **40** through an inlet opening **42** in its side thereby lifting the rod **38** and unseating member **36**. A spring or other resilient means (not shown) inside the actuator **40** returns the valve member **36** to its seat **34** upon relief of the applied air pressure.

As shown in FIGURE 3, the doughnut-shaped inflatable member **28** is hollow and has an inlet port **44** through which the member **28** is inflated. To supply the necessary air to the inflatable member **28** and to the actuator **40**, I prefer to provide an air supply system as shown diagrammatically in FIGURE 2. Air under pressure is supplied to the system through a main line **46**. Air may be supplied in this line **46** at a pressure, for example, in the range of 35 to 50 p.s.i. The air supply from the main line **46** is divided into three branch lines **48**, **50** and **52**. Lines **48** and **50** are each connected through a shuttle valve **53** to a single air line **54** connected to the inlet **42** of the actuator **40**. In the branch lines **48** and **50** there are solenoid valves **56** and **58** respectively. In addition, line **48** contains a manually adjustable pressure reducing valve **60** to maintain the pressure in line **48** at about 18 p.s.i., for example.

Branch line **52** supplies air to the inflatable member **28** by connection with the inlet port **44**. The line **52** contains a manually adjustable pressure reducing valve **62** and a solenoid valve **64**. Also a normally open pressure switch **66** is connected to line **52**. The pressure in line **52** is preferably maintained in the order of one or two p.s.i.

When it is desired to fill a container, such as the combination plastic bag-cardboard box, with milk or other fluid, the container is placed on the weight measuring de-

vice 24 directly below the filling device 20. The filling opening of the plastic bag is then slipped over the inflatable member 28. To start the operation of the filling device 20, I prefer to provide in the electrical control system of FIGURE 2A a push-button start switch 68 which when depressed will energize the coil of an electrical relay 69 to close the relay contacts which in turn actuates solenoid valve 64 to open it and allow air pressure to flow through the branch supply line 52 into the inflatable member 28. The pressure switch 66 is set so that when the air pressure in line 52 has completely inflated the member 28, the switch 66 will close a circuit to energize the solenoid valve 58 in line 50, thereby supplying air at full line pressure through line 54 to the actuator 40. The air pressure supplied to actuator 40 will raise the rod 38 to lift the valve member 36 completely off seat 34 and allow milk to flow from discharge nozzle 30 into the bag to be filled. The member 28 when inflated seals the opening of the bag so that no air can enter during filling, and since the bags are normally supplied in a completely collapsed condition, they contain little or no air. Since no air is present in the bag and none enters during the filling operation, foaming will be substantially eliminated. In addition to sealing the opening of the bag, member 28 when inflated aids in supporting the bag so that it may be properly filled.

The valve member 36 will remain off seat 34 and milk will therefore be supplied to the bag until the bag is filled to the point where its weight reaches a pre-determined amount a few ounces less than the final desired amount. At that time, a micro switch 71 in the weight measuring device 24 will be actuated to de-energize the solenoid valve 58, thereby closing off the supply of air through line 50 of the actuator 40. However, simultaneously, the solenoid valve 56 will be energized and opened to allow air to flow through branch line 48, shuttle valve 52 and through line 54 into the actuator 40. Because of the reducing valve 60, the pressure in line 48 is lower than that of line 50 and therefore the valve member 36 will return part way to its seat 34, cutting down the flow of milk to a very small stream. At the same time the solenoid valves 56 and 58 act to change the air pressure being supplied to actuator 40, solenoid valve 64 is de-energized and closes, collapsing the inflatable member 28. The seal and support provided by member 28 is no longer necessary because the almost-full bag will now support itself. Furthermore, I have discovered that if the member is not collapsed at this time, it may exert a lifting force on the bag and a false weight indication will be given.

In order to make the filling as accurate as possible, the small stream of milk is allowed to flow through the partially open valve 26 until the final weight (and thus volume) of milk is attained at which time a normally closed magnetic mercury switch 73 (FIGURE 2A) in the weight measuring device 24 causes the solenoid valve 56 to become de-energized and close, thereby shutting off completely the milk flowing into the bag.

After the bag is filled, the operator must slide the container off the weight measuring device 24 onto the conveyor 16, which will then slowly move the container to the sealing means 18 and allow the operator to seal the filler opening of the container. Also, a foot switch may be provided to momentarily stop conveyor 16 if necessary to allow the operator to feed the bag into the sealer 18.

Referring now to the embodiment shown in FIGURES 4 and 5, parts corresponding to those of the embodiment shown in FIGURES 1, 2 and 3 will be given the same reference numeral followed by the subscript *a*. The filling device of this second embodiment, indicated generally by the reference numeral 20*a*, may be mounted together with sealing apparatus on suitable supporting structure (not shown) similar to that shown in FIGURE 1 for the first embodiment.

The filling device 20*a* consists of a valve 26*a* having a discharge nozzle 30*a* and an inlet port 32*a* adaptable for connection with a milk supply line. The valve 26*a* has a valve seat 34*a* at the end of a discharge nozzle 30*a* upon which seats the valve member 36*a*. Valve member 36*a* is actuated by a rod 38*a* that is connected to an air-operated actuator 40*a*.

Slideably mounted on the exterior of the discharge nozzle 30*a* is an annular sleeve 70 having an annular outwardly extending flange 71 at its top. Secured to and carried by the sleeve 70 is an inflatable member 28*a*. The sleeve 70 is supported and operated by connection with a two-way air-operated actuator indicated generally by the reference numeral 72. The sleeve 70 is operatively connected to the actuator 72 by means of a ring 74 secured around the exterior of the sleeve 70 under annular flange 71. The ring 74 is supported by a bracket 76 that is connected to the piston rod 78 of the actuator 72. The rod 78 is securely fastened to a piston 80 slideable in the hollow cylinder 82. The cylinder 82 is closed at the top 84 and bottom 86. To move the piston downward in cylinder 82, an inlet port 88 adapted for connection to an air supply line 90 (FIGURE 4) is provided in the top 84. Similarly, in the side of cylinder 82 near the bottom 86 an air inlet 92 is provided to allow air to be admitted under pressure to push the piston 80 upward in the cylinder 82. Inlet 92 is adapted for connection to an air supply line 94.

The entire actuator 72 is securely mounted on suitable supporting structure such as that of FIGURE 5 which shows the actuator 72 secured to the filling device 20*a* by means of a bracket 96.

Thus, if air under pressure is admitted through inlet 88 at the top of cylinder 82, the piston 80 will be forced downward in cylinder 82 and carry with it the piston rod 78. The rod 78 will in turn cause the sleeve 70 and member 28*a* to move downward on the exterior of the discharge nozzle 30*a*. Similarly, to move the sleeve 70 and inflatable member 28*a* back to their uppermost position on the discharge nozzle 30*a*, air under pressure can be admitted through the inlet 92 near the bottom of the actuator 72. Of course, the length of the discharge nozzle 30*a* and the corresponding proportional length of the cylinder 82 can be varied to suit the requirements of the particular installation.

The diagrammatic representation of FIGURE 4 shows the air supply system necessary for the proper operation of the filling device of FIGURE 5. This air supply system is similar to that of FIGURE 2 except that the air supply lines necessary for operation of the actuator 72 have been integrated therein. Pressurized air is supplied to the system through a main line 46*a*. The air from the main line 46*a* leads to three branch lines 48*a*, 50*a*, and 52*a*. Line 48*a* has a solenoid valve 56*a* and a pressure reducing valve 60*a* and leads to the inlet 42*a* of actuator 40*a* through shuttle valve 53*a* and line 54*a*. Air line 52*a* is connected to the inlet 44*a* of inflatable member 28*a* and contains a solenoid valve 64*a*, a pressure reducing valve 62*a* and a pressure switch 66*a*. The air supply system described so far is similar to that shown in FIGURE 2.

However, the main air line 46*a* also supplies air to a fourth branch line 97 that leads into a 4-way solenoid valve 98. The two air pressure supply lines 90 and 94 connect the solenoid valve 98 to the inlets 88 and 92, respectively, of the actuator 72. Line 90, leading to inlet 88 at the top of the actuator 72, has a pressure reducing valve 100 therein so that movement of the piston 80 downward in the cylinder 82 will be relatively slow.

The electrical control circuit of this second embodiment is similar to the circuit of the first embodiment shown in FIGURE 2A.

Thus, to fill the plastic bag of a combination bag-box container using this second embodiment of my invention, the container is placed on a weight measuring device, similar to the device 24 shown in FIGURE 1, directly below

the filling device 20*a*. The filling opening of the container or bag is then slipped over the inflatable member 28*a*. To start operation of the filling device 20*a*, a push-button start switch (not shown, but similar to the switch 68 shown in the circuit of FIGURE 2A) is depressed to energize solenoid valve 64*a* and thereby allow air under pressure to flow through the supply line 52*a* into the inflatable member 28*a*. At this time, with the inflatable member 28*a* positioned on the upper-most portion of the filler discharge nozzle 30*a*, the filler opening of the bag is gripped by inflated member 28*a* and the bag is held suspended a slight distance off its support. This prevents the bottom portion of the bag from being folded under during the filling operation and thereby not being completely filled. The pressure switch 66*a* is set so that when the member 28*a* has become completely inflated, switch 66*a* will close a circuit to energize solenoid valve 98 in line 97 and solenoid 58*a* in line 50*a*.

When the solenoid 58*a* is energized, air is admitted through the line 50*a* through the shuttle valve 53*a* into the actuator 40*a*, thereby unseating the valve member 36*a* from seat 34*a*. Simultaneously, by reason of solenoid valve 98 opening, air is also admitted through line 90 into inlet 88 at the top of actuator 72. The pressurized air being admitted through inlet 88 causes the piston 80 to move slowly downward in the cylinder 82, carrying with it the piston rod 78 which moves the sleeve 70 and inflatable member 28*a* slowly down the discharge nozzle 30*a*. This action allows the plastic bag to be lowered to and supported by the weight measuring device as it is being filled. The amount of travel of the inflatable member 28*a* down the filler discharge nozzle 30*a* is such that when it reaches the end of the nozzle 30*a*, member 28*a* no longer supports any of the weight of the bag.

Prior to the time the final desired weight is reached, a micro switch (not shown but similar in function to switch 71 of the circuit of FIGURE 2A) in the weight measuring device is contacted to cause simultaneously four changes in the operation of the filling device. First, solenoid 58*a* is de-energized to stop the flow of pressurized air to the actuator 40*a* through line 50*a*, and second, solenoid 56*a* is energized to allow lower pressure air to flow through line 54*a* into actuator 40*a*. This change in air pressure to actuator 40*a* allows valve member 36*a* to return partially to its seat 34*a* thereby reducing the flow of milk into the bag to a small stream.

The third change effected by contact of the micro switch is closing of solenoid valve 64*a* thereby collapsing inflatable member 28*a*. As in the first embodiment, this eliminates the possibility of false weight readings due to any lifting action on the bag by the inflatable member 28.

The last change effected by the micro switch is to the two-way solenoid 98. When this valve 98 becomes de-energized, the air supply to inlet 88 of actuator 72 is shut off and at the same time the other port in valve 98 is opened to allow air from line 97 to flow through line 94 to the inlet 92 at the bottom of actuator 72. The pressurized air flowing through inlet 92 will act upon piston 80 and push it rapidly back to the top of cylinder 82 and thereby return the inflatable member 28*a* to its initial uppermost position on discharge nozzle 30*a*.

The reduced flow of milk from nozzle 30*a* will continue until a mercury switch (not shown but similar in function to switch 73 of the circuit of FIGURE 2A) in the weight measuring device causes the solenoid valve 56*a* to become de-energized, thereby shutting off completely the flow of milk into the bag. Thus, the filling device 20*a* is ready for the start of another filling cycle, and the filled bag may be moved off the weight measuring device and to a heat sealer similar to that described in connection with the embodiment shown in FIGURE 1.

In this second embodiment shown in FIGURES 4 and 5, instead of providing the two-way solenoid valve 98 and the air line 94 leading to the bottom of the actuator 72, a single solenoid valve can be used if a spring is provided in cylinder 82 to return the piston 80 to the top of cylinder 82 when the air pressure exerted through inlet 88 has been released. In either case, the second embodiment of my invention provides a solution to the problem of the bag becoming folded under as it fills and not being completely filled. Also, by preventing the bag from becoming folded under itself while being filled, the possibility is eliminated that the milk will overflow by filling up the bag before the necessary weight is reached to shut off the valve 26*a*.

It is thus seen that I have provided a simple, but efficient, method and apparatus for filling non-rigid containers. Inflatable member 28 will prevent air from entering the container during the filling operation and thereby eliminate foaming. Without the problem of foaming, the filling operation may proceed at a relatively rapid rate. It should be understood, however, that my filler apparatus may also be used in filling rigid containers if suitable means is provided to remove the air from the container prior to the filling operation.

Having thus described my invention, it will be obvious to those skilled in the art that various modifications may be made without departing from the spirit and scope of my invention. It is my intention that such modifications be included within the scope of the following claims.

I claim:

1. The method for filling a flexible container with fluid through an opening therein comprising the steps of: sealing the filling opening of the container around the filling means by expanding a member into tight engagement with the portion of the container surrounding said opening while said container is collapsed and free from air; lifting and holding the container off its support by raising said expandable member; filling said container through an opening in said expandable member; slowly lowering said container to its support by lowering said expandable member; and releasing said expandable member from engagement with the filler opening.

2. A fluid filling apparatus of the class described comprising a filling valve having a fluid inlet port and a fluid discharge port, a valve member movable to open and close the discharge port of said filling valve, an air-operated actuator operatively connected to said valve member, an inflatable device affixed around the discharge port of said filling valve, a first air supply line connected to said actuator, a second air supply line connected to said inflatable device, normally closed valves in said air supply lines, means to open the valve in said second air line, and means responsive to a pre-set pressure in said inflatable device to open the valve in said first air line to operate said actuator and thereby move the valve member to open said discharge port.

3. A device for filling a flexible container having an opening therein, said device comprising a filling valve, an elongated discharge nozzle on said valve having a discharge opening at its end, a valve member in said filling nozzle and having connected thereto a valve rod to open and close said discharge opening, valve opening means operatively connected to said valve rod to actuate said rod and cause discharge of filling fluid from said nozzle, a sleeve telescopically mounted and movable on the exterior wall of said nozzle, means to move said sleeve up and down on said nozzle from a lowest position near the end of said nozzle, an expandable member mounted on the exterior wall of said sleeve and movable therewith, said member being expandable so as to engage and hold the inside walls of said container around the opening therein, means to inflate the expandable member to a predetermined pressure that is sufficient to hold and suspend the weight of the container, and means responsive to said predetermined pressure in the inflatable member to actuate the sleeve moving means and the valve opening means.

4. The device of claim 3 in which the valve opening means is a two-way, air-operated actuator operatively

connected to said sleeve to move said sleeve and expandable member up and down on said discharge nozzle during the filling of the container.

5. A fluid filling apparatus for filling a flexible container having an opening therein, said apparatus comprising a filling device having fluid inlet and discharge ports, valve means operative to open and close said discharge port, an air-operated actuator operatively connected to said valve means to control movement of said valve means, an inflatable bladder mounted on the exterior wall of said discharge port, said inflatable bladder being expandable so as to engage and seal the inside walls of said flexible container around the opening therein, means to inflate said bladder to a predetermined pressure sufficient to seal the opening in said container, and means responsive to said predetermined pressure in said bladder to operate said actuator and open said valve means thereby providing for flow of filling fluid from said discharge port.

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