March 5, 1957 C. F. CARTER 2,783,786

APPARATUS FOR FILLING COLLAPSIBLE CONTAINERS

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Fig. 1.

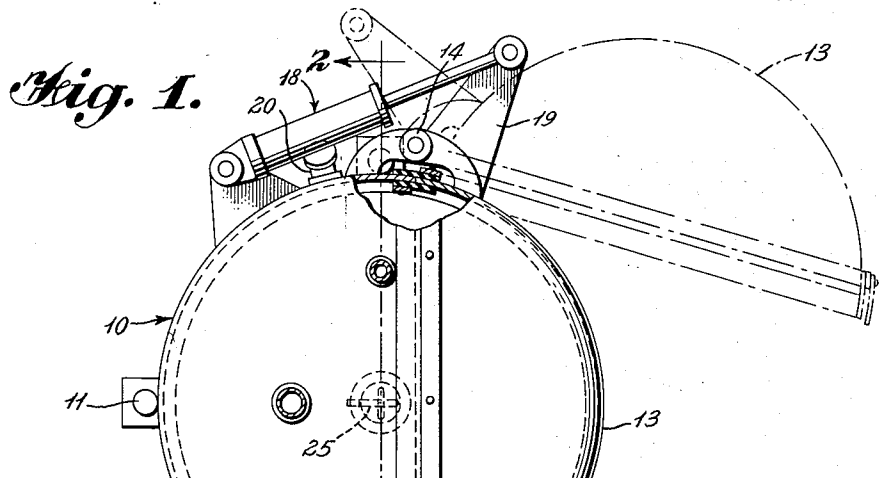

Fig. 2

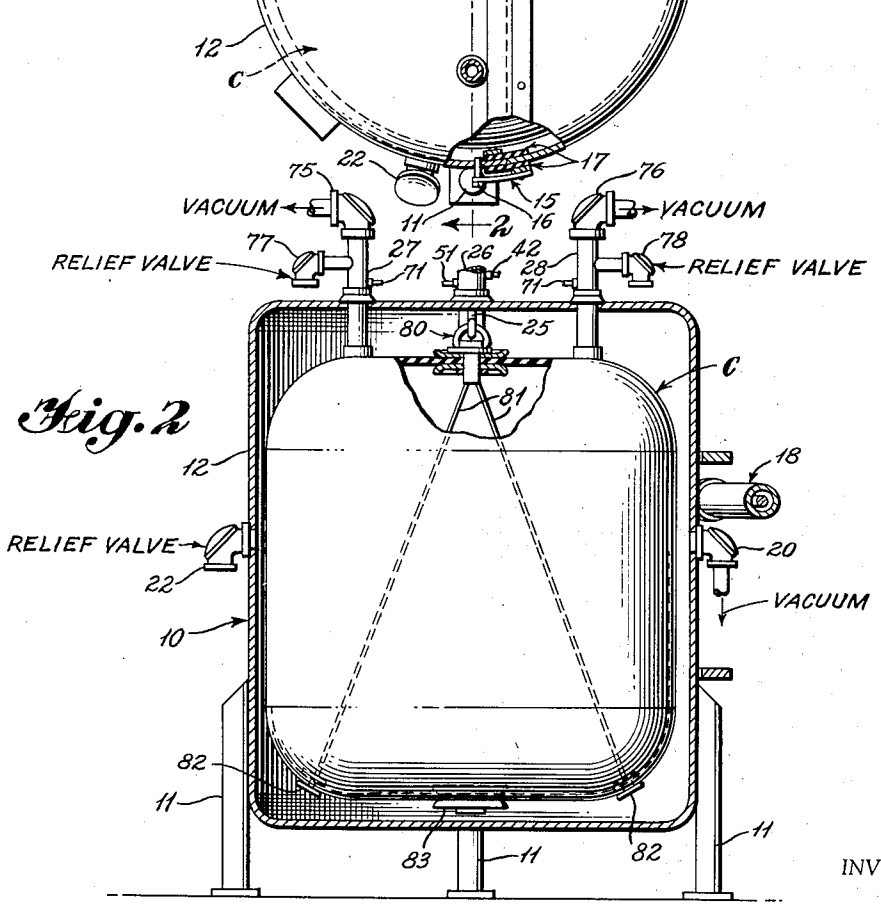

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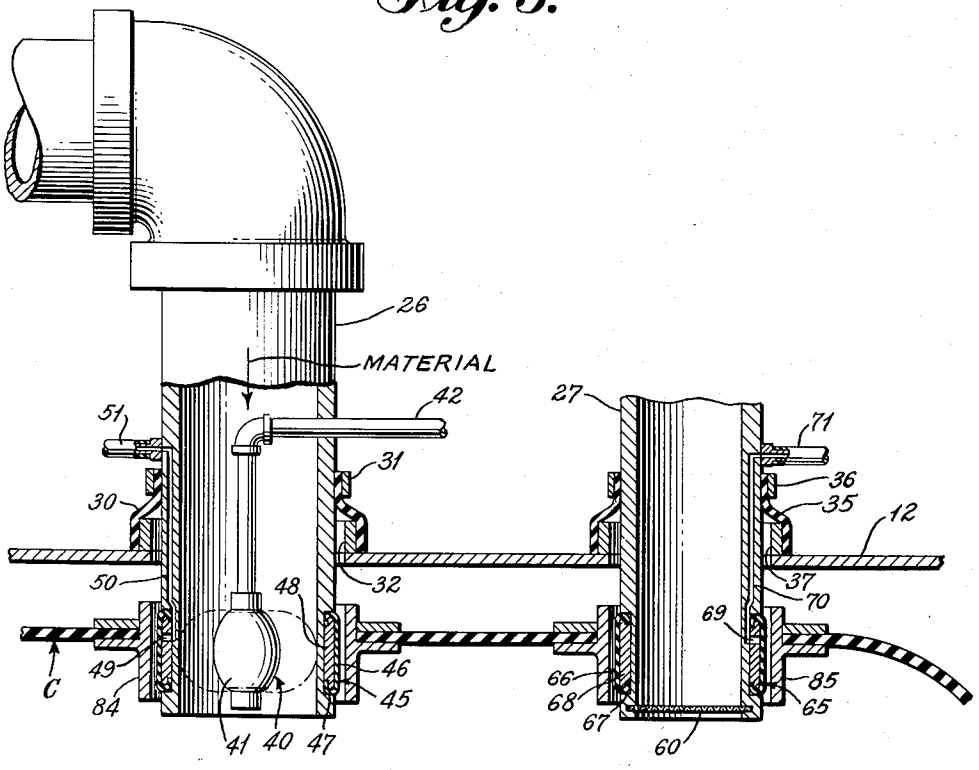
Fig. 3.



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APPARATUS FOR FILLING COLLAPSIBLE CONTAINERS

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Application October 19, 1955, Serial No. 541,332

5 Claims. (Cl. 141—51)

This invention relates generally to a filling machine for collapsible containers. More specifically, the invention is directed to a machine for filling flexible walled containers of the general type having a lifting ring and a material inlet opening in the top thereof and provided with a material outlet opening in the bottom thereof, and wherein the material is discharged into the container under the influence of vacuum to withdraw entrained air from the material during filling.

The handling of various liquids and particulate materials, which are flowable like a fluid, and transporting such materials in bulk has been the subject of considerable study. To a large extent, industries using materials in their operations which are ordered in quantity have, as to the liquid materials, had the liquids shipped to them in steel drums or other rigid containers. Similarly, dry particulate materials have, for the most part, been handled and shipped in drums or bags made of paper or other substance impervious to the particular material being shipped.

To facilitate the handling and shipping of fluids and particulate materials in bulk, there has recently been developed a flexible walled container made in sizes ranging from a size corresponding to the 55-gallon steel drum up to containers designed to hold 2,500 gallons. These containers are made of plies of synthetic rubber and cord fabric which form the walls of the container, much in the manner as employed in the production of automobile tires. By providing a neoprene interior and exterior, this type of container is made highly resistant to aging due to exterior weather conditions or attack by gasoline, oils, greases or temporary contact with corrosive chemicals. For reinforcement of the container construction, a flexible cable is connected between the top and bottom thereof to provide optimum dimensional stability and load-carrying capacity.

One of the advantages attributable to the type of container as described above is the fact that the material transported therein is fully enclosed during shipment and handling. The containers are provided with a material inlet opening in the top wall thereof and a material outlet opening in the bottom wall. A lifting ring is mounted in the top wall and connected with the flexible cable extending through the interior of the container so that during filling and emptying the container may be suspended from the lifting ring.

Obviously, in filling these containers with liquid materials, the liquid can flow freely into the container. However, problems have been encountered in securing the desired degree of filling of these containers with particulate materials which, although they have the characteristic of flowing like fluids, also tend to become fluffy by reason of air entrained between the material particles. Additionally, many finely divided particulate materials tend to pack so that under presently known methods continuous agitation of the material is necessary to maintain flow into the container being filled.

Recognizing the problems encountered in the filling of collapsible flexible walled containers as described above, the instant invention has been developed to overcome such problems and enable rapid filling of such containers with particulate materials, such filling being accomplished by employing a vacuum to withdraw entrained air from the material during filling.

It is an object of this invention to provide an improved apparatus for filling collapsible containers which includes a container enclosing shroud, a material tube and air withdrawal conduits with seal means on said tube and said conduits to cooperate with openings of the container to provide air-tight seals at the points of entrance of said tube and said conduits into the container.

It is also an object of this invention to provide a filling apparatus including a container-enclosing shroud, material supply tube and air withdrawal conduits extending through and yieldably mounted with respect to said shroud, and a container hanger mounted in said shroud, said material supply tube and air withdrawal conduits being engageable with openings in the top of the container and a lifting ring on the container engageable with said hanger.

It is a further object of the instant invention to provide a filling apparatus as recited in the above object with the material supply tube and air withdrawal conduits having encircling inflatable seals which upon inflation cooperate with openings in the top wall of such container to form air-tight seals at their points of entrance into the container.

The above and other more specific objects of the instant invention will be clearly apparent by reference to the hereinafter set forth description of a particular embodiment of the invention as illustrated by the accompanying drawings. It will be recognized that the structure shown on the drawings is merely illustrative of one embodiment embracing the features of the instant invention and that within the scope of the appended claims, other structures and modifications are contemplated within the scope of the instant invention. Referring to the drawings:

Figure 1 is a plan view of the filling apparatus showing, in phantom view, the shroud access door in its open position;

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1; and

Fig. 3 is a detailed sectional view of the structure pertinent to the material supply tube and one of the air withdrawal conduits.

Referring specifically to Figures 1 and 2, there is shown thereon the filling machine of the instant invention which includes a shroud 10 mounted on supporting legs 11. Shroud 10 is made up of a stationary housing 12 to which the legs 11 are secured and an access door 13 hinged at 14 to the housing 12 so as to be movable to the position as shown in phantom view in Figure 1 for the introduction of a collapsible container to be filled. A suitable latch 15 is provided on access door 13 to engage with a pin 16 on the housing 12 for holding the door closed. Seal elements 17 are provided at the junction of door 13 with housing 12, one of such elements being secured along the inner edge of housing 12 and the other secured to the outer edge of door 13 to enclose the junction when the door is closed. A suitable door actuating hydraulic cylinder 18 may be provided connected between housing 12 and an arm 19 extending outwardly from hinge 14.

As a part of the filling operation employed in utilization of the filling machine, a vacuum is produced within the shroud 10 exteriorly of the container being filled. As shown in Figure 2, a vacuum line 20 communicates through the housing 12 of shroud 10 and leads to a suitable source of vacuum (not shown). A pneumatic diaphragm valve 21 is interposed in vacuum line 20 to enable selective control of the application or vacuum or

low pressure to the shroud interior. Also, as shown more clearly in Figure 2, a relief valve 22 is provided to control communication of the shroud interior with atmospheric pressure exterior of the shroud. This valve preferably is of the pneumatic diaphragm type, similar to valve 21.

The internal structure of the pneumatic diaphragm valves illustrated on the drawings has not been illustrated since it forms no part of the instant invention. From the standpoint of the invention involved herein, any suitable form of valve may be employed which can be operated to effectively regulate the flow of a gaseous fluid therethrough.

The top wall of housing 12 which forms a portion of shroud 10 has mounted thereon a hanger 25 which extends downwardly into the shroud interior to cooperate with the lifting ring on the container to be filled so that such container will be suspended within the shroud during filling, as will be described in detail hereinafter.

The top wall of housing 12 is also provided with apertures through which a material supply tube 26 and a pair of air withdrawal conduits 27 and 28 extend. Tube 26 and conduits 27 and 28 are yieldably mounted with reference to shroud 10 so as to be movable to a limited degree with the container as it is filled.

Figure 3 illustrates the details of the mounting of tube 26 and conduit 27. Thus, on tube 26 a resilient sleeve 30 is held by a ring 31 in airtight engagement with the exterior of the tube while the lower end of sleeve 30 engages the exterior of a tubular projection 32 mounted on housing 12. Similarly, as to conduit 27, there is provided a resilient sleeve 35 held on the exterior of the conduit by ring 36 and engaging with the exterior of a tubular projection 37 which, in turn, is secured on housing 12. It will be appreciated that a similar yieldable mounting of conduit 28 relative to housing 12 is provided.

Referring further to Figure 3, there is shown thereon a pneumatic cut-off valve 40 mounted within material supply tube 26. This valve may take the form as disclosed in my prior Patent 2,687,145, and includes a rubber sleeve 41 centrally mounted within the tube 26 and expandible by application of fluid pressure internally thereof. This fluid pressure is applied through a pipe 42 so that sleeve 41 will expand to engage with the inner wall of the tube 26, thereby completely closing the tube.

The exterior of the downwardly facing outlet of tube 26, through which the particulate material is dispensed into the container being filled, is provided with a seal element 45. This element is made up of a resilient sleeve 46 held in a groove 47 formed in the exterior surface of tube 26 by a rigid ring 48. Ring 48 is apertured at 49 to provide communication between the underside of sleeve 46 and passage 50 through which air under pressure is applied from a pipe 51 to expand sleeve 46 in performing its sealing function as will be described.

Both air withdrawal conduits 27 and 28 are provided with screens at the lower open ends thereof, the screen of conduit 27 being shown at 60 on Figure 3. Conduits 27 and 28 are also provided with seal elements similar to that shown on tube 26 at 45. Again referring to Figure 3, the seal element 65 on the air withdrawal conduits includes a resilient sleeve 66 held in a groove 67 formed in the exterior of the conduit with the resilient sleeve being held in place by a rigid ring 68. Ring 68 is apertured at 69 to communicate with a passage 70 so that air pressure applied through a pipe 71 will expand sleeve 66 to perform its sealing function.

As shown more clearly on Figure 2, conduits 27 and 28 are connected to a suitable source of vacuum with a pneumatic diaphragm valve 75 provided to control the application of vacuum through conduit 27 and a pneumatic diaphragm valve 76 mounted to enable regulation of vacuum applied through conduit 28. Also, a pneumatic diaphragm valve 77 is provided to control communication of conduit 27 with atmospheric pressure and a pneumatic diaphragm valve 78 similarly disposed with respect to conduit 28 to control communication between such conduit and atmospheric pressure.

Reference will now be had to the construction of the collapsible container for the filling of which the instant invention is particularly adapted. The collapsible container identified at C on Figure 2 is constructed of laminations of synthetic rubber and cord fabric united much in the manner as employed in the manufacture of automobile tire casings. As shown on the drawing, a D-ring 80 is mounted at the top of the container to facilitate handling of the container. Flexible cables 81 are connected to D-ring 80 and extend downwardly through the interior of the container C with the lower ends thereof connected to fasteners 82 secured to the bottom of the container C. A material outlet opening 83 is provided at the bottom of the container so that such container may be readily emptied by suspending the container from D-ring 80 and removing the plug from outlet opening 83 to permit the contents to drain by gravity from the container. In emptying containers which are filled with either liquids or particulate material, the flexible walled container may be allowed to collapse as the material flows therefrom or, if desired, one of the openings in the top of the container may be opened to provide a vent admitting air as the contents drain from the container.

In the embodiment as shown on the drawings, the top of container C is provided with three openings which are generally sealed by suitable plugs during handling and shipping of the container. The largest of such openings provides a material inlet and is provided, as shown on Figure 3, with a fitting 84 through which the downwardly facing outlet end of tube 26 extends when the container is mounted in position for filling. The other two openings in the top of the container are provided with similar fittings 85 which receive the air withdrawal conduits 27 and 28.

The position of a collapsible container for filling by utilization of the hereinabove described apparatus will be appreciated by reference to Figures 2 and 3 of the drawings. In positioning the container within the shroud for filling, the container is generally provided with about one-half pound per square inch inflating pressure to maintain it in its fully opened condition. In this state, plugs are engaged with the fittings 84 and 85 to retain the inflating air within the container.

With the shroud access door 13 open, the D-ring 80 of the container is engaged with hanger 25 to suspend the container within the shroud. The plugs are removed from fittings 84 and 85 and such fittings positioned so that tube 26 and conduits 27 and 28 extend therethrough in the manner as shown in Figure 3. The seal elements 45 and 65 are then actuated by the application of air pressure through pipes 51 and 71 so that such elements will sealingly engage with the respective fittings 84 and 85. Thus, the annular spaces intermediate the respective tube 26 and conduits 27 and 28, and fittings 84 and 85 are closed to provide an air-tight seal at the points of entry of tube 26 and conduits 27 and 28 into container C. With the container C so mounted within the shroud, shroud access door 13 is closed and fastened by latch 50.

To effect the actual filling, by dispensing the particulate material into the container, shroud relief valve 22 is closed and valve 21 opened to create a vacuum within the shroud and exteriorly of the container C. The valve 75 in conduit 27 is opened, with relief valve 77 closed, to evacuate the container C, withdrawing air through screen 60. At the initial instance of commencing withdrawal of air through conduit 27, relief valve 78 is maintained open with valve 76 closed to permit a surge of air to flow through conduit 28 and clean the screen in the conduit which may have become clogged with particulate material during the preceding container filling operation. Material supply valve 40 is opened by release of pressure

through pipe 42 so that rubber sleeve 41 contracts. Valve 78 is then closed and, as the pressure within the container is reduced, the material is induced to flow from a supply hopper (not shown) through tube 26 and into container C. Upon completion of the filling of container C, vacuum valve 75 is closed and relief valve 77 may be momentarily opened to allow an inrush of air through conduit 27 and its screen 60 to clean such screen preparatory to the next succeeding filling operation.

Particularly in the larger sized containers and/or where finely divided particulate material is being dispensed, it may be desirable to fill each container by dispensing thereinto a series of increments. In carrying out the filling operation in accordance with this increment filling concept, valve 75 will be maintained open for a period sufficient to draw an increment of material into the container which will partially fill such container. Then valve 75 will be closed and valve 76 opened, accompanied by momentary opening and closing of relief valve 77. The vacuum within the container is momentarily diminished by an inrush of air through valve 77, such air serving to clean screen 60 of any particulate material which may have become lodged thereon in drawing the initial increment of material into the container. The vacuum within the container will be maintained by withdrawal of air through conduit 28 and valve 76 so that after closure of relief valve 77 a second increment of material will be drawn into the container. After the second increment has been drawn in, valve 76 will be closed and valve 75 reopened, accompanied by momentary opening of relief valve 78. Thus, air flowing in through valve 78 will clean the screen of conduit 28 and only momentarily diminish the vacuum within container C as air is continuously withdrawn through conduit 27 and valve 75.

This cycle of operations is repeated for the requisite number of times until the total of the increments discharged into the container completely fill the container. In each cycle of operations switching over from air withdrawal conduit 27 to air withdrawl conduit 28 or vice versa, preferably the material supply valve 40 is closed to positively terminate the flow of material into the container for each fill increment. More specific details of an incremental filling method which may be employed in connection with the instant invention are disclosed in my co-pending application Serial No. 504,488, filed April 28, 1955.

After the container has been filled to the desired degree the material supply valve 40 will be closed. The shroud vacuum valve 21 is then closed and relief valve 22 opened to return the shroud pressure to atmosphere. Access door 13 may then be opened and, with the pressure seal elements 45 and 65 released, the container C removed from the shroud by disengaging D-ring 80 from hanger 25.

Having thus described my invention, what I claim is:

1. A machine for filling collapsible containers comprising a container enclosing shroud having an access door to permit introduction into the shroud of the container to be filled, valve means connected with said shroud to enable placing said shroud in communication with a source of vacuum or atmospheric pressure, a material supply tube extending through an opening in the top of said shroud, yieldable coupling means between said tube and the shroud opening to provide a fluid-tight joint therebetween while permitting limited movement of said tube relative to said shroud, a material supply valve in said tube, a seal element encircling the discharge end of said tube and operable to sealingly engage with the material inlet opening of a container positioned in said shroud for filling, an air withdrawal conduit extending through a second opening in the top of said shroud and having a screen member disposed across the outlet end thereof, yieldable coupling means between said conduit and the shroud opening through which it extends to provide a fluid-tight joint therebetween while permitting limited movement of said conduit relative to said shroud, a seal element encircling the outlet end of said conduit and operable to sealingly engage with an air withdrawal opening of a container positioned in said shroud for filling, and valve means connected with said conduit to enable placing said conduit in communication with a source of vacuum or atmospheric pressure.

2. A machine for filling collapsible containers as recited in claim 1 wherein each of said seal elements includes a resilient sleeve and a passage communicating with the underside of said sleeve whereby air under pressure applied through said passage will inflate said sleeve.

3. A machine for filling collapsible containers comprising a container enclosing shroud having an access door to permit introduction into the shroud of the container to be filled, valve means connected with said shroud to enable placing said shroud in communication with a source of vacuum or atmospheric pressure, a material supply tube extending through an opening in the top of said shroud, yieldable coupling means between said tube and the shroud opening to provide a fluid-tight joint therebetween while permitting limited movement of said tube relative to said shroud, a material supply valve in said tube, a seal element encircling the discharge end of said tube and operable to sealingly engage with the material inlet opening of a container positioned in said shroud for filling, air withdrawal conduits extending through other openings in the top of said shroud and each having a screen member disposed across the outlet end thereof, yieldable coupling means between each of said conduits and the shroud opening through which it extends to provide a fluid-tight joint therebetween while permitting limited movement of said conduits relative to said shroud, a seal element encircling the outlet end of each of said conduits and operable to sealingly engage with air withdrawal openings of a container positioned in said shroud for filling, and valve means connected with said conduit to enable placing said conduit in communication with a source of vacuum or atmospheric pressure.

4. A machine for filling flexible walled containers of the type having separate material inlet, material outlet and air withdrawal openings and a lifting ring mounted at the top thereof comprising a container enclosing shroud having an access door to permit introduction of the container to be filled into the shroud, hanger means secured to the top wall of said shroud to engage with the lifting ring on the container for suspending the container within the shroud during filling, a material supply tube extending into said shroud and having a downwardly facing outlet portion, a screened conduit extending into said shroud and having a downwardly facing outlet portion, said supply tube and said conduit each having a seal element encircling the downwardly facing outlet portion thereof to cooperate with the inlet and air withdrawal openings of the container, means for actuating the seal elements to seal the points of entry of said tube and said conduit into a container suspended within said shroud, means to selectively connect said shroud with a source of vacuum for evacuating said shroud, and means for applying a vacuum through said conduit to evacuate the interior of the container and withdraw air from the material discharged thereinto through said material supply tube.

5. A machine for filling flexible walled containers of the type having separate material inlet, material outlet and air withdrawal openings and a lifting ring mounted at the top thereof comprising a container enclosing shroud having an access door for introduction of the container to be filled into the shroud, hanger means secured to the top wall of said shroud to engage with the lifting ring on the container for suspending the container within the shroud during filling, a material supply tube extending into said shroud and having a downwardly facing outlet portion, a pair of screened conduits extending into said shroud and having downwardly facing outlet portions, said supply tube and said conduits each having a seal

element encircling the downwardly facing outlet portion thereof to cooperate with the inlet and air withdrawal openings of the container, means for actuating the seal elements to seal the points of entry of said tube and said conduits into a container suspended within said shroud, means to selectively connect said shroud with a source

of vacuum for evacuating said shroud, and means for applying a vacuum through said conduits to evacuate the interior of the container and withdraw air from the material discharged thereinto through said material supply tube.

No references cited.