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[54] METHOD OF FILLING FLEXIBLE CONTAINERS

9 Claims, 2 Drawing Figs.

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[50] Field of Search 141/4, 5, 7, 8, 12, 67, 68, 116

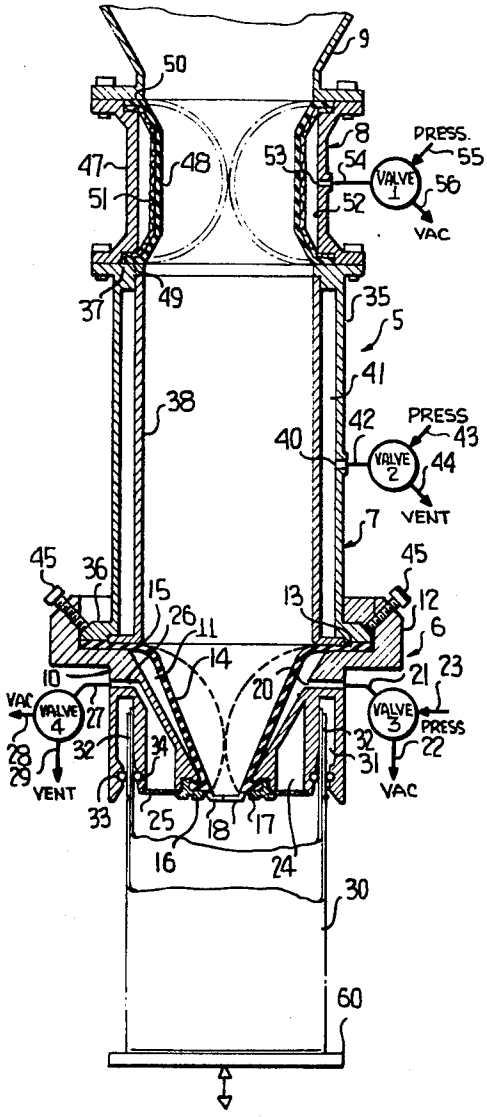
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ABSTRACT: This disclosure relates to the filling of flexible containers with a finely divided material utilizing a filler providing a pressure differential including a vacuum in excess of that which effects a prohibited collapsing of the containers. A flexible container is sealed relative to the filler and the material is initially directed into the container under pressure to provide for an initial pressurization of the container, followed by the application of a vacuum to the container so as to permit the compact filling of the container without the collapsing of the container.



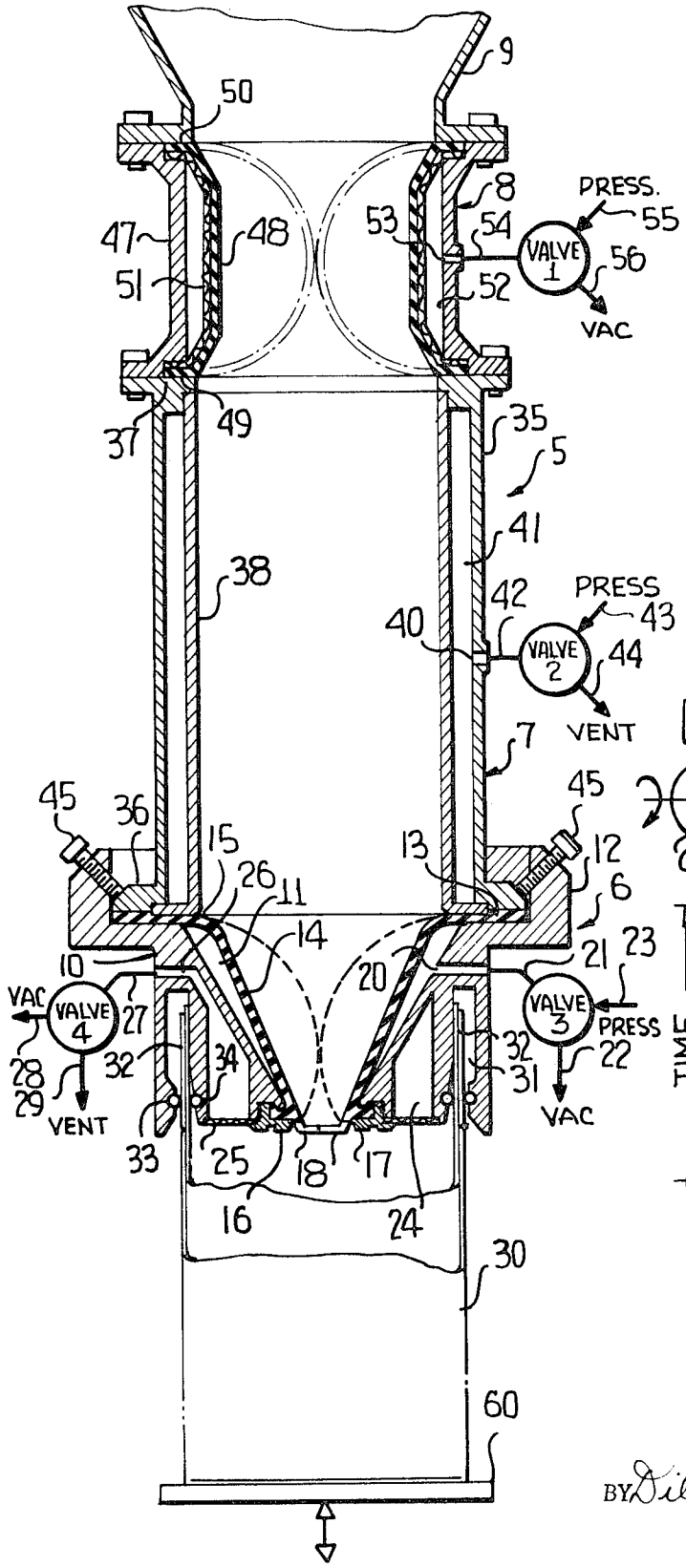


FIG.1

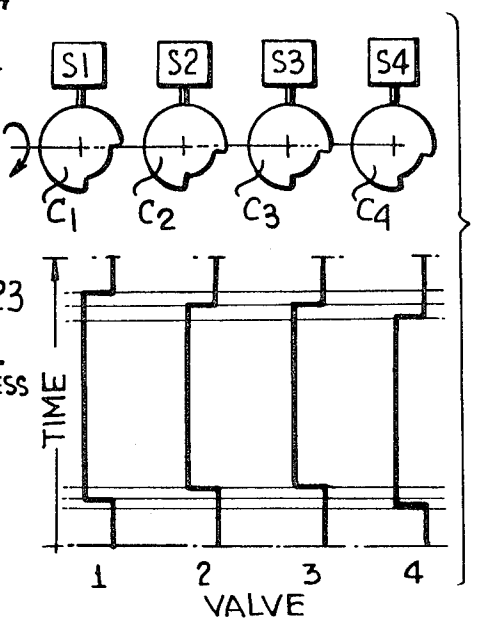


FIG.2

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METHOD OF FILLING FLEXIBLE CONTAINERS

This invention relates to the filling of flexible containers with a finely divided material in a manner wherein the normal entrained gases in the material are removed to a relatively great degree so that the container is compactly filled with the material. This is accomplished by utilizing a pressure differential filler.

Although pressure differential fillers are well known, in order to obtain the necessary compactness, it is required that the filler draw in the container a vacuum which is in excess of that which effects a prohibitive collapsing of the container. In the past, filling of such containers utilizing the aforementioned vacuum required the positioning of the containers within a shroud and the drawing of a vacuum around the containers so as to support the walls thereof.

A primary feature of this invention is to so fill a flexible container utilizing a differential pressure type filler wherein vacuum is applied to produce the desired compactness of material, but wherein the container is first pressurized and a certain amount of material is placed therein prior to the application of the vacuum and wherein the filling of the container is so rapid that the walls of the container become supported by the material deposited therein prior to the effect of the vacuum on the container walls tending to effect collapsing thereof.

The method of this invention particularly relates to the filling of a flexible container wherein an effective seal is provided between the container and a differential pressure filler, after which a supply of the material to be placed within the container has directed thereinto a gas under pressure so as to initiate the filling of the container under superatmospheric pressure with there being an internal pressurization of the container during the initial filling thereof, followed by an application of a vacuum to the upper part of the container so as to more effectively remove gases entrained within the material being placed with in the container, the materials initially deposited within the container acting to reinforce the walls of the container against inward distortion by the vacuum and the pressure being applied above the material substantially equalizing the vacuum wherein a maximum and uniform compaction of the material within the container is effected without an internal collapsing of the container walls.

Another feature of the invention is that the application of a vacuum to the upper part of the container is maintained at least as long as the filling process continues whereby there is no tendency for a blow out of the material under pressure at the conclusion of the container filling operation.

A further advantage of the invention, when applied to paperboard containers, is that the initial internal pressure applied to the container results in a minute stretching thereof wherein like containers, which may be of different volumes due to different moisture contents in the paperboard material thereof, are automatically stretched to a uniform size during the initial phase of the filling operation so that uniformity of volume of the containers is more effectively controlled and it is feasible to fill the containers with a uniform weight of material without weighing the material due to both the uniform volume of the containers, after stretching, and the uniform compaction of the material within the container.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings: In the drawings

FIG. 1 is a vertical sectional view taken through a differential pressure filling apparatus utilized in accordance with this invention.

FIG. 2 is a schematic combined cam and switch arrangement and timing chart.

Referring now to FIG. 1 in particular, it will be seen that there is illustrated a differential pressure type filler which is

generally referred to by the numeral 5. The filler 5 is of the type invented by Clarence W. Vogt and generally disclosed in numerous of his patents, including U.S. Pat. No. 3,260,285, entitled Apparatus and Method For Filling Containers for Pulverulent Material, issued July 12, 1966.

The filler 5 includes a valve assembly, generally identified by the numeral 6, a magazine, generally identified by the numeral 7, a shut-off valve, generally identified by the numeral 8, and a hopper 9. Basically, the filler 5 functions by filling the magazine 7 through the opening of the valve 8 and the flow of material from the hopper 9 into the magazine 7. Then, the upper end of the magazine 7 is closed by closing the valve 8. Thereafter, the valve assembly 6 is actuated so as to dispense the material from within the magazine 7 into a container to be filled.

The valve assembly 6 includes a housing 10 having generally a conical opening 11 therethrough. The upper end of the housing 10 terminates in a generally L-shaped cross section annular flange 12 which defines an upwardly facing seat 13 surrounding the opening 11.

A resilient, one-piece, valve member 14 is positioned within the opening 11. The valve member 14 is generally conical in outline and is provided at the upper end thereof with a flange 15 which is seated on the seat 13 and releaseably clamped thereto in a manner to be described hereinafter. Adjacent the lower end thereof, the valve member 14 is provided with a mounting flange 16 which is clamped against the lower central portion of the housing 10 by means of a clamping ring 17 which is threadedly engaged with the housing 10.

It is preferred that the lower end of the valve member 14 be in the form of a transverse flange defined by a plurality of resilient tabs 18. The tabs 18 have sufficient resiliency so as to return to a planar position when a container being filled has reached the filled condition and to remain in that planar condition until the valve 14 is again actuated to effect a filling operation.

It is also to be noted that the valve 14 is spaced from the portion of the housing 10 defining the opening 11 so that there is a clearance entirely around the main portion of the valve 14. The housing 10 has a passage 20 extending therethrough into the opening 11 and a line 21 is connected to the passage 20. A valve, valve 3, is connected to the line 21, a vacuum source 22 and a pressure source 23. When the valve 3 is connected to the vacuum source 22, the valve member 14 is in the solid line position thereof, and when the valve 3 is connected to the pressure source 23, the valve member 14 will be distorted to its closed position, as is shown in phantom lines.

The housing 10 is also provided with an annular passage 24 surrounding the lower portion of the valve member 14. The annular passage 24 is closed by a removable filter 25 which is suitably clamped in place by any desired fastening means, including the clamping ring 17.

The annular passage 24 has communicated therewith a passage 26 extending through the housing 10. A line 27 is connected to the passage 26 with the line 27, in turn, being connected to a valve, valve 4. The valve 4 is connected to a vacuum source 28 and to a vent line 29.

At this time it is pointed out that the housing 10 will be configurated so as to provide a seal with a container to be filled. The illustrated housing 10 is particularly adapted for forming a seal with a paperboard carton, such as the carton 30, and the lower outer portion of the housing 10 is particularly configurated to define a peripheral recess 31 of a configuration to receive the normal closure flaps 32 of the carton 30. It is to be noted that the lower portion of the recess 31 is flared to facilitate the entry of the closure flaps 32. It is also to be noted that slightly recessed above the extreme lower end of the recess 31 are inner and outer sealing member 33 and 34. These members may simply be O-rings or could be in the form of inflatable tubing. The effect of the sealing rings 33 and 34, immaterial of the construction thereof, is to form a seal between the housing 10 and the carton 30.

The magazine 7 includes an outer housing 35 which is provided with a lower mounting flange 36 and an upper mounting flange 37. The housing 35 is provided with a porous liner 38 which is spaced from the housing 35 for substantially the entire length thereof. It is to be understood that the line 38 is sealed relative to the housing 35 at the upper and lower ends thereof.

The housing 35 is provided with a passage 40 which opens into the space 41 between the housing 35 and the liner 38. The passage 40 has a line 42 connected thereto which line, in turn, has valve, valve 2, connected thereto. Valve 2 is connected to a pressure source 43 and is vented to the atmosphere through vent line 44.

It is to be noted that the lower mounting flange 36 of the housing 35 is utilized to clamp the upper flange 15 of the valve member 14 against the seat 13. When the valve assembly 6 is secured to the magazine 7, this clamping action takes place. The valve assembly 6 is releaseably secured to the magazine 7 by means of a plurality of downwardly and inwardly directed clamping fasteners 45.

The shutoff valve 8 may be of any desired construction. However, the illustrated valve 8 includes a housing 47 in which there is mounted a resilient valve member 48. The valve member 48 includes a lower mounting flange 49 which is clamped between the flange 37 of the housing 35 and the lower part of the housing 47. The valve member 48 also includes an upper mounting flange 50 which is clamped between the housing 47 and the hopper 9.

The shutoff valve 8 also includes a screen member 51 which surrounds the valve member 48 and limits the opening thereof. The screen member 51 always defines a space 52 between the housing 47 and the valve member 48. The housing 47 has a passage opening into the opening 52. A line 54 is connected to the passage 53 and, in turn, is connected to valve, valve 1. The valve 1 is connected to a pressure source 55 and a vacuum source 56.

It is to be understood that all of the valves, valve 1, valve 2, valve 3 and valve 4, are of a conventional type which may be electrically actuated. In accordance with this invention, the positions of these valves are controlled by means of switches which may be microswitches.

Valve 1 is normally connected to the vacuum source 56 so that the shut-off valve 8 is in an open position whereby to assure the filling of the magazine 7 at the end of each filling operation. Valve 1 is controlled by switch S1 which, in turn, is controlled by means of cam C1.

Valve 2 is normally vented to the atmosphere. Valve 2 is positioned by means of switch S2 which, in turn, is controlled by means of cam C2.

Valve 3 is normally connected to the pressure source 23 so as to normally hold the valve member 14 in its closed position. Valve 3 is positioned by means of a switch S3, which, in turn, is controlled by cam C3.

Valve 4 is normally vented to the atmosphere. Valve 4 is positioned by means of switch S4 which is controlled by cam C4.

In accordance with this invention, a container to be filled, such as the carton 30, is seated on a pad 60 and then lifted by the pad 60 to the position shown in FIG. 1 with the upper portion of the carton 30 sealed relative to the housing 10 and the carton 30 accurately vertically positioned. A shaft 61, on which the cams C1, C2, C3 and C4 are positioned for simultaneous rotation, is then rotated at a predetermined speed. As in clearly shown in the timing diagram, switch S1 is first actuated to connect valve 1 to the pressure source 55 and close the shutoff valve 8. Thereafter, switches S2 and S3 are actuated, generally simultaneously. Valve 2 connects the interior of the magazine 7 to the pressure source 43 so as to direct air or other gaseous medium into the interior of the magazine 7, forcing the material disposed therein downwardly. Valve 3 is coupled to the vacuum source 22 to open the valve member 14. This results in the downward flow of material from within the magazine 7 into the carton 30. Thus, the initial phase of the filling of the carton 30 is one of pressure filling. This results in the slight internal pressurization of the carton 30. The initial pressurization of the carton 30, coupled with an initial partial filling thereof provides sufficient stability for the carton for the second filling phase wherein the filling is in a combination of pressure and vacuum.

Shortly after the switch S3 is actuated, the switch S4 is actuated to connect valve 4 to the vacuum source 28, and thus drawing a vacuum in the carton 30 at the upper end thereof. This not only greatly facilitates the flow of material from the magazine 7 down into the carton 30, but also results in an effective removal of entrapped gases, including air, from the material being placed in the carton 30. In this manner a uniform compaction is obtained.

During the combined pressure and vacuum phase of the filling operation, the carton 30 is never submitted to a sufficient vacuum so as to result in the internal collapse thereof. Thus, the configuration of the carton 30 is maintained even though a vacuum is being utilized for the filling thereof and the carton does not have sufficient strength to resist internal deformation under the vacuum.

It will be readily apparent from the timing diagram that the filling operation continues to be a combination pressure and vacuum filling operation until the carton 30 is completely filled and the flaps 18 at the lower end of the valve member 14 are moved upwardly by the material so as to generally close the valve member 14. Thereafter, the switches S2 and S3 are deenergized with the result that valve 2 is again connected to the atmosphere through the vent passage 44, hereby relieving internal pressure within the magazine 7, and valve 3 is again connected to the pressure source 23 so as to effectively distort and close the valve member 14. At this time pressure is still being drawn through the filter 25 whereby there is no possibility of a blow out between the carton 30 and the housing 10 due to pressure from within the magazine 7. After the valve member 14 is moved to its closed position, the shutoff valve 8 is moved to its open position by deenergizing switch S1 and connecting valve 1 to the vacuum source 56. This permits flow of material from within the hopper 9 down into the magazine 7.

At about the same time as or shortly after the deenergization of the switch S1, switch S4 is deenergized and valve 4 is again vented to the atmosphere. The carton 30 is now ready to be lowered and removed.

At this time it is pointed out that in lieu of connecting valve 4 to the atmosphere through the vent line 29, it may be connected to a low pressure source so as to provide for a slight back flow through the filter 25 and thus the cleaning of the filter 25 after each filling operation.

It is pointed out here that the values of the vacuum source 28 and the pressure source 43 are the only critical pressures although it is quite apparent that the values of the other vacuum sources and pressure sources will have to be sufficient to effect the proper operation of the valve member 14 and the shutoff valve 8. It has been found that the greatest compaction may be obtained with the greatest vacuum being provided by the vacuum source 28. From a practical standpoint, the vacuum source 28 should be on the order of 15 to 18 inches mercury. In order to compensate for the vacuum being drawn within the carton 30, the pressure source 43 should be on the order of 15 to 20 p.s.i. above atmospheric pressure.

It will be readily apparent that the filling method set forth above is readily applicable to all types of flexible containers. However, it has a particular attribute with respect to the filling of paperboard cartons, such as the carton 30. Although cartons are accurately die cut, the cartons will vary in volume depending upon the moisture content thereof when die cut in the blank stage and when filled. It has been found, however, that when the carton 30 is initially pressurized during the filling thereof, it is stretched slightly. This slight stretching is within the limits of the paperboard material and compensates for variations in moisture content of the carton. In this manner, accurately formed cartons, when filled, will have substantially

equal volumes. This is also true even when the carton is provided with a liner inasmuch as the liner contains only a certain volume of material and when the carton is initially internally pressurized, the liner is stretched out against the interior of the carton, thereby eliminating any voids between the liner and the carton.

Because the containers, including the carton **30**, have equal volumes among like containers, and because equal compaction can be repeatedly obtained, containers, although they are flexible containers, may be accurately filled as to weight without weighing the same.

Although the method has been specifically disclosed with respect to a specific filling apparatus, it is to be understood that the method is not so limited and may be equally as well practiced with similar filling apparatus. In addition, it is to be understood that the specific configuration and the relationship of the various cams and the timing of the operation of the various switches as disclosed herein may be varied in accordance with the product being placed within the container and the specific container being filled.

I claim:

1. A method of filling flexible containers with a finely divided material utilizing a filler providing a pressure differential including a vacuum in excess of that which effects a prohibited collapsing of the containers, said method comprising the steps of connecting a container to the filler in sealed relation to a discharge portion thereof, applying an above atmospheric gaseous pressure to the material to be placed in the container and pressure filling the container until the container is partially filled and is internally pressurized, and then while continuing to apply said above atmospheric gaseous pressure applying said vacuum to the interior of the container to accelerate filling and remove gases from the material entering the container.

2. The method of claim **1** wherein the application of gaseous pressure is terminated at least at the time of termination of the vacuum.

3. The method of claim **1** wherein termination of the vacuum occurs after the filling of the container.

4. The method of claim **1** wherein the application of gaseous pressure is terminated prior to the termination of the vacuum.

5. The method of claim **1** wherein the material to be placed within the container is disposed in a porous wall magazine and the gaseous pressure is applied to the material through the magazine wall.

6. The method of claim **1** wherein the gaseous pressure is at least as great as the vacuum to balance the vacuum.

7. The method of claim **1** wherein the gaseous pressure is on the order of 15 to 20 p.s.i. above atmospheric pressure.

8. The method of claim **1** wherein the gaseous pressure is on the order of 15 to 20 p.s.i. above atmospheric pressure and the vacuum is on the order of 15 to 28 inches of mercury.

9. The method of claim **1** wherein the container is a paperboard container and the pressure applied within the container is sufficient to stretch the container to a uniform size notwithstanding variations in size thereof due to variations in moisture content.