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METHOD FOR PACKAGING PRESSURE FEED DEVICES

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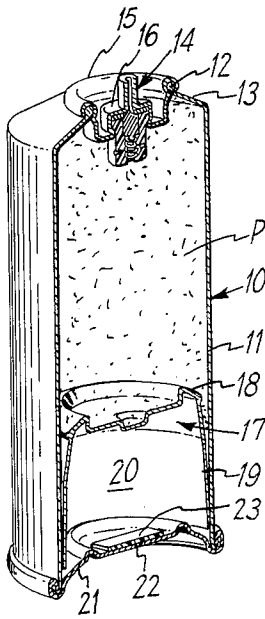


Fig. 1

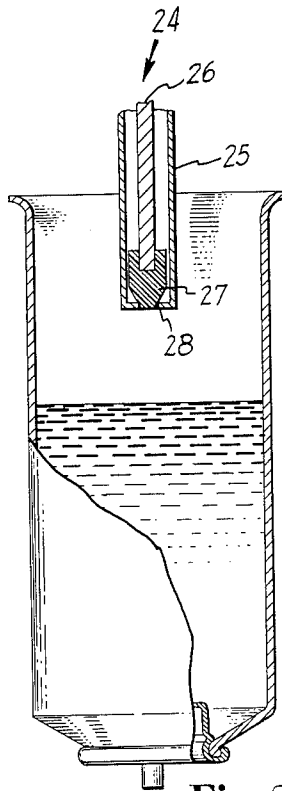


Fig. 2

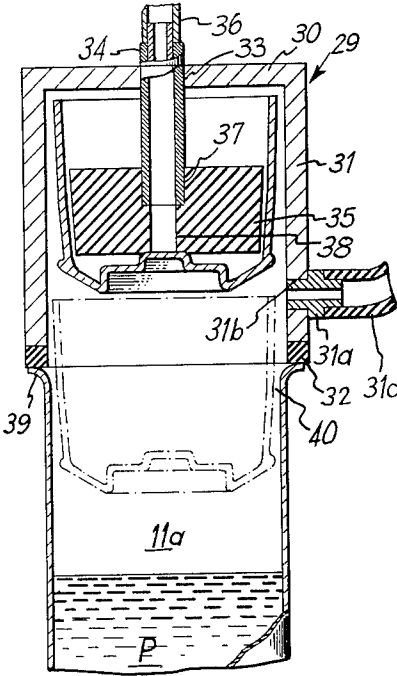


Fig. 3

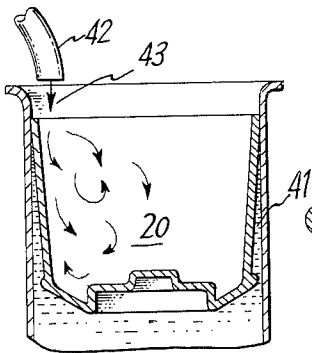


Fig. 4

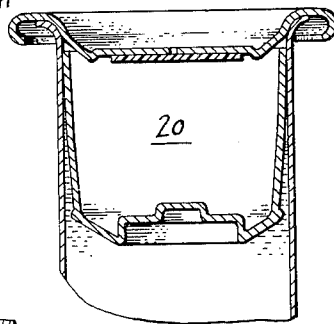


Fig. 5

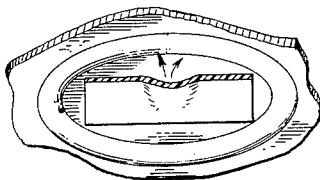


Fig. 6

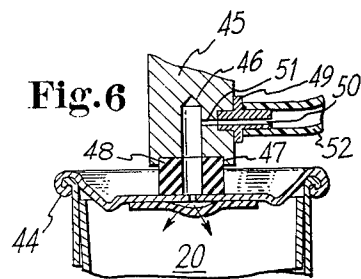


Fig. 7

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METHOD FOR PACKAGING PRESSURE FEED DEVICES

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5 Claims. (Cl. 53—22)

This invention relates to pressure feed devices and more particularly to a method used in filling and assembling a package adapted to dispense a product contained therein by means of a floating or free piston subjected on one side to the pressure exerted by a propellant.

In its most familiar form, a pressurized dispensing device comprises a sealed can, the interior of which is filled with product and propellant. The can top is provided with a dispensing valve which is adapted to release the product in either the erect or inverted position, depending upon whether or not a dip tube is used. If the valve is opened when the container is in the incorrect position, the propellant will escape and the consumer will not be able to remove the balance of the product.

Other types of pressurized packages have been devised to avoid the intimate contact between product and propellant and to obviate the possibility of loss of propellant as mentioned above. For example, some devices have been proposed wherein the propellant is sealed within a flexible and expansible sack which is impervious to both product and propellant. With this type of package, as the valve is opened and product flows outwardly the product pressure drops, thereby permitting the sack to expand in order to equalize the product and propellant pressures, the expansion forces the displaced volume of product through the valve, at least until the valve is closed, whereupon expansion of the sack continues until both the pressures are in equilibrium. This device is not only expensive but in many cases fails to dispense substantially all of the product contained within it because of the sack blocking the means of product egress.

A more practical means for separating product and propellant in pressurized packages involves the use of a floating or free piston to divide the package interior into two chambers—a product and a propellant chamber. To date, however, the free piston pressure package has not gained commercial success due to the high cost of such a package and to the relatively high percentage of failures within each type of design tested. Some common types of failure are loss of propellant through corrosion or piston “blow-by” followed by escape through the product valve. It should be noted that in either of these cases the result would be a device which is inoperative.

The presently known piston type pressurized packages are usually assembled in this way: first, the piston is inserted in the bottom of the can; next, the bottom, containing a filling grommet, is seamed in place; third, the product is placed in the product chamber; fourth, a product dispensing valve is seamed in place; fifth, a filling needle introduces the propellant into its chamber by piercing the self-sealing grommet, injecting the propellant and then withdrawing from the grommet upon completion of the charging operation.

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The above-mentioned assembly method has been found to require, in some cases, means for placing the product under a higher pressure than the propellant (e.g., use of spring means pressing on the propellant side of the piston) in order to prevent propellant “blow-by.” Further, in many cases it has been found that it is not commercially feasible to produce such a package (utilizing the filling needle-grommet technique) at high speeds.

It is an object of the present invention to obviate the above difficulties.

Another object of the present invention is to provide an economical and commercially feasible method of packaging a product in a piston-type pressurized dispensing container, resulting in a package in which the propellant is securely confined within the propellant chamber and in which corrosion of the can interior, oxidation of the product and bacterial development within the package are inhibited.

Briefly stated, in accordance with one aspect of this invention, the method comprises placing the product in an open-bottom container body, drawing a vacuum upon the unfilled volume of the container body, inserting a piston in the open bottom while maintaining the vacuum, causing the piston to be forced into intimate contact with the product and to displace some product from its filled position to form a product seal between the piston and the container body, breaking the vacuum acting upon the container body, purging the propellant chamber constituting the remaining unfilled volume of the container body with a substantially inert gas, sealing a valve equipped container bottom to the container body and pressurizing the container by forcing a propellant into the propellant chamber through the valve in the container bottom.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the present invention, it is believed that the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view in section of a free piston type of container, the filling and assembling of which may be performed in accordance with the present invention;

FIGURE 2 is an elevation, partly in section, of the container body, following the filling operation;

FIGURE 3 is a fragmentary view in section illustrating one form of apparatus which may be used in inserting a piston into a filled container body;

FIGURE 4 is a fragmentary view in section disclosing a means for purging the propellant chamber;

FIGURE 5 is a fragmentary view in section of a product filled, piston-equipped, purged container body with a valve-equipped bottom wall placed thereon in position for seaming;

FIGURE 6 is a fragmentary view in section illustrating the manner in which the package of FIGURE 1 is pressurized following the seaming of the bottom wall; and

FIGURE 7 is an enlarged fragmentary view showing the action of the bottom wall valve while propellant is being forced into the container as in FIGURE 6.

Referring to FIGURE 1 of the drawing, a package 10 to be prepared according to the herein disclosed process

is shown as being constructed of a cylindrical body 11 having a neck portion 12 at the terminal end of cone-like top wall 13. A dispensing valve 14 is mounted upon the package 10 by seaming valve insert or cup 15 to neck portion 12. The valve 14 and valve cup 15 which are unitized by crimping the valve 14 within the valve chamber 16 of the valve cup 15 are commercially available units and the details of their structure will be fully understood by those skilled in the art.

Product P which could be toothpaste, mustard or any other type of product desired to be packaged for dispensing from a pressurized container is located in the upper portion of the container body 11 adjacent dispensing valve 14. A hollow piston 17 comprising contoured face 18 and tapered depending skirt 19 is found within the package 10 below the product P. The lower end of the tapered skirt 19 has an outside diameter which is substantially identical with the inside diameter of the cylindrical body 11 thereby providing a snug sliding fit for the piston within the package 10. The propellant chamber 20 formed by the hollow interior of piston 17 and bottom wall 21 seamed to the lower end of a cylindrical body 11 contains propellant adapted to move the piston 17 upwardly to discharge the product P upon actuation of the dispensing valve 14. The contours of face 18 closely match the combined interior surfaces of the container top wall 13, valve 14 and valve cup 15 thereby permitting substantially all of the product P to eventually be dispensed from the package 10 through dispensing valve 14 at the uppermost limit of piston 17 movement. The bottom wall 21 has an aperture 22 extending therethrough which is adapted to serve as a port for the introduction of propellant into the chamber 20. Overlying the aperture 22 and covering a continuous portion of the interior surface of bottom wall 21 surrounding aperture 22 is a valve element 23. While the present invention is not dependent upon the type of propellant valve used, the preferred type comprises valve element 23 which is an elastically distensible, substantially propellant-impermeable film coated on one side with a layer of pressure sensitive adhesive. It is well known that the pressure sensitive adhesives are composed of an elastomer plus a resin, the elastomer providing the internal strength and the resin the adhesion. Preferably, the film or backing may be made of polymerized vinylidene chloride or a modified polyethylene, although any material having the necessary elastomeric or impermeability properties would be suitable. The coating of pressure sensitive adhesive may also be varied depending upon the type of propellant to be used and the composition of other substances to which the adhesive must be exposed. The specific type of adhesive and backing best suited for a particular package or product is, of course, merely a matter of proper selection of many commercially available pressure sensitive tapes.

Referring again to aperture 22, it is extremely important that the aperture be free from sharp burrs where it terminates on the inner surface of the bottom wall 21 so as to avoid puncturing the valve element 23 and causing the valve to fail by leakage through the punctures. One method of avoiding such burrs is to punch the aperture through from the inner surfaces. It is also important that the aperture 22 diameter be small enough to prevent valve element 23 from being forced through the hole at pressures needed to operate the package. In this connection it has been found advantageous to size the aperture 22 in the range of $\frac{1}{32}$ " to $\frac{3}{64}$ ", which is large enough to permit the use of tools of sufficient strength to make production techniques in forming the aperture practical and yet small enough to prevent failure of the valve element 23 as noted above.

As is usually the case in the field, preferred materials to be used in constructing the container body and bottom wall of the package described above would be a metal such as aluminum or a tin plated steel. The piston 17 is

desirably constructed of a resilient, moldable plastic such as polyethylene.

FIGURE 2 illustrates the condition of the package at the beginning of the process performed in accordance with the present invention. It will be noted that an open-bottomed container body 11 having seamed thereon a dispensing valve and valve cap unit is presented in inverted condition to a filling mechanism 24. Filling mechanisms such as is illustrated by 24 are well known in the art and for this reason no detailed disclosure of means which may be utilized in holding the container in the inverted position and metering and timing means for injecting the product to be filled is shown. In the illustration a filler nozzle 25 is shown in its filling position, the lowermost in its cycle, in the interior of the container body 11 whereat it is possible to avoid splashing and spattering of product during the filling operation. A valve stem 26 is telescoped within the interior of filler nozzle 25 and by means not shown, reciprocated along the lengthwise axis of the filler nozzle in proper timing with the filling cycle, thereby intermittently and alternately withdrawing and returning stem tip 27 from sealing engagement with nozzle orifice 28. Thus, it will be seen that the empty container is placed in the filling mechanism, the filler nozzle and the therein contained valve stem and tip are lowered into the interior of the container body 11, the stem tip is raised thereby unsealing nozzle orifice 28, a measured amount of product P is permitted to flow through nozzle orifice 28 into the container body 11. Thereafter, the stem tip 27 is brought back into sealing engagement with nozzle orifice 28 and the filler nozzle removed from the container interior.

Following the filling operation, the inverted product-containing body 11 has inserted therein the piston 17. One means by which such insertion may be accomplished is illustrated in FIGURE 3. As shown, the apparatus comprises a vacuum chamber 29 which is adapted to move along a vertical path. The chamber 29 is substantially cup-shaped, with an apertured top wall 30 and cylindrical side wall 31. Along the bottom edge of the side wall 31 is attached, by adhesives or otherwise, a gasket member 32 formed from a resilient elastomeric material. A hose fitting 31a is engaged within an aperture 31b in the side wall 31. Attached to the protruding portion of the fitting 31a, is a hose 31c extending to a two position valve connected to a source of vacuum and an atmospheric vent, none of which are shown. Thus, with the valve in one position the hose 31c is vented to the atmosphere and in the alternate position the hose 31c is in communication with the vacuum source. The aperture 33 of top wall 30 functions as a guide for and is in sliding engagement with the tube 34 extending from a plunger head 35 located within the vacuum chamber 29. The tube 34 is hollow and cylindrical and attached to the top thereof is a hose 36. The hose 36 is connected to means for selectively establishing communication with a pressurized inert gas supply or to a source of vacuum. The specific structural details of the gas and vacuum pulling system as well as the means for selectively integrating such systems with a machine cycle so as to result in the proper timing and synchronization therewith are not critical and many variations thereof are well known in the art.

The plunger head 35 is engaged with the lower end of tube 34 which is pressed into counterbore 37 of passageway 38 extending through the plunger head 35 in a vertical direction. The plunger head may be trapezoidal in vertical cross-sectional configuration and cylindrical in horizontal cross-section, as shown, thus taking on the appearance of a large bottle stopper. The size of the plunger head 35 is slightly smaller than the piston 17 interior. Alternatively, where the piston 17 is constructed of thin materials or where distortion of the piston 17 is otherwise a problem, the plunger head 35 may be made to conform with the shape of the piston 17 interior.

In performing the insertion process, the partially completed package is placed in vertical alignment with the vacuum chamber 29. While the vacuum chamber and the plunger head contained therein are in the raised position, the piston 17 which is to be inserted in the package is placed upon the plunger head 35. It will be noted that the plunger head 35 is adapted to telescope within the interior of the piston 17 and that its lower surface along an area thereof surrounding aperture 38 contacts the contoured face 18 of the piston interior. At the time of placement of the piston 17 on the plunger head 35, a vacuum is pulled through the interior of hose 36, tube 34 and passageway 38, therewith causing atmospheric pressure to secure the piston 17 against the plunger head 35 and maintain it in mounted position thereon.

Following the above, the vacuum chamber 29 along with the plunger head 35 and the vacuum secured piston 17 are lowered as a unit until the gasket member 32 engages with the outwardly flaring portion 39 of the container body 11, making a hermetic seal therewith. Then the tube 34 and the attached plunger head 35 are lowered, by means not shown, until the piston 17 assumes the position shown by phantom lines in FIGURE 3, at which point the tube 34 may, by a latching mechanism, be temporarily locked in place.

Next, the two position valve is actuated to place it in a position permitting a vacuum to be pulled by the vacuum source through hose 31c and the passageway in hose fitting 31b, withdrawing air from within the vacuum chamber 29 and from the unfilled bottom portion (11a as shown in FIGURE 3) of container body 11. In this connection, it will be noted that the evacuation of the bottom portion 11a of container 11 is accomplished through an annular space 40 intermediate the periphery of piston 17 and the interior surface of container body 11 with the piston in the phantom position of FIGURE 3. With respect to the desirability of the positioning of the piston so as to create the annular space 40, it should be realized that when subjected to a sudden high vacuum many products will expand to occupy several times their initial volume due to entrapped or otherwise free air in the product. While a slowly increasing vacuum taken over an extended period would eliminate such problems, such a process would prevent high speed, efficient production. In the present invention the problem has been solved by affording a relatively narrow escape passageway (annular space 40) through which air may egress from unfilled bottom portion 11a and from the product itself. The space 40 is too narrow to permit bubbles of product to escape and consequently the bubbles break as they move into its confines, freeing the entrapped air and permitting the use of a high vacuum surge for evacuating at high speed production rates. The preferable range of separation of the periphery of piston 17 and the interior surface of the container body 11 at the point at which the two are most closely adjacent (i.e. the thickness of space 40) for a product will vary according to the viscosity of that particular product, but it has been found that such thicknesses in the range of from about .001" to about .020" is highly satisfactory for most products.

When the vacuum within the chamber and container reaches a predetermined value or following the lapse of an equivalent interval of time, the tube 34 and plunger head 35 are lowered to force the piston 17 further into the container to the point where the piston 17 displaces sufficient material to form a solid wedge-shaped annular seal such as is illustrated at 41 of FIGURE 4. Such a function can be performed, for example, by unlatching the tube 34 and utilizing gravitational forces acting on a weighted means attached to tube 34 and having sufficient mass to cause such displacement and ultimate relocation of displaced material in the product seal area 41. Alternatively, mechanical means could be adapted to lower the piston 17 a predetermined amount to thus

cause a similar result. It has also been determined possible to achieve the seal by means of a pressure blow system wherein the piston 17 is propelled by high pressure or high velocity gas emanating from passageway 38.

Following the placement of the piston 17 within the container body 11 and the formation of the product seal 41, the selective control system to which hose 36 is connected places the hose 36 in communication with a supply of inert gas having the pressure in excess of atmospheric. Thus the vacuum engagement of plunger head 35 and piston 17 is released. Simultaneously, the two position valve connected to hose 31c is switched to its alternate position and the vacuum chamber vented, thereby raising the gas pressure within the vacuum chamber 29 to atmospheric condition. Next, the tube 34 and the attached plunger head 35 are raised into position within the enclosure formed by the vacuum chamber 29 and these elements raised as a unit away from the outwardly flaring portion 39 of container body 11 permitting the partially formed package to be removed.

At this point the remaining unfilled volume of the partially formed package, the propellant chamber 20 which lies within the piston member 17, is filled with a mixture of air and the inert gas utilized in breaking the suction engagement between the plunger head 35 and the piston 17. If the package were to be sealed in such a condition the oxygen and moisture contained therein would provide conditions conducive to corrosion of the can interior, oxidation of product and development of bacterial colonies. In order to eliminate such an undesirable environment, the piston 17 interior is purged by means of an inert gas. This operation may be performed as illustrated in FIGURE 4 wherein a gas nozzle 42 directs a stream of gas 43 downwardly into the piston interior, displacing any air contained therein. Alternatively of course, this same operation could be performed by the apparatus of FIGURE 3 so as to occur subsequent to the piston insertion step, utilizing the inert gas system previously described in connection with disengagement of the piston 17 and plunger head 35. Immediately thereafter, the bottom wall 21 is placed in position with its seaming flange properly aligned with the outwardly flaring portion 39 of the container body 11. In this manner the inert gas is maintained within the confines of the package until by standard operations a bottom seam 44 is obtained.

After the bottom seam is made, the product filled package is completely assembled and ready for pressurization. One form of apparatus adapted to perform this function is shown in FIGURE 6 and comprises a metallic plunger 45 with a blind coaxial hole 46 and a counter-bore 47 within which is retained a resilient sealing insert 48, preferably a cylindrical rubber tube. A fitting 49, which is fastened to the side wall of the plunger 45 by means which are well known in the art, has a bore 50 therethrough aligned with a passageway 51 communicating with hole 46. A tube 52 which is telescoped over the protruding end of fitting 49 is connected with a source of pressurized propellant and with a valve and control arrangement to regulate the flow of propellant, neither of which is shown in the drawing.

The propellant can be metered or otherwise controlled by volumetric measurement or possibly maintained at a pressure desired in the propellant chamber and the charging controlled by merely balancing the pressures. Of course many other methods of regulating the quantity of propellant to be introduced into the chamber may be used and it is not implied that the methods disclosed herein are the only ones suitable for use with such equipment.

It is seen in FIGURE 6 that the package to be pressurized is inverted and held in a relatively fixed relationship with the plunger 45 by means not shown on the drawing. The plunger 45 is then lowered so that sealing insert 48 encompasses the outer surface of bottom wall 21 surrounding aperture 22. Sufficient pressure is

applied to plunger 45 to provide a tight seal between the sealing insert 48 and the bottom wall 21. At this point the valve and control arrangement is actuated causing the propellant to flow into tube 52 through bore 50, passageway 51, hole 46 and the interior of sealing insert 48. When the propellant reaches aperture 22 it is forced therethrough and the pressure acts upon the underside of the valve element 23 which overlies aperture 22. The pressure acting upon the valve element 23 forces the area acted upon to bulge inwardly as shown in FIGURES 6 and 7 stretching the elastic film and causing a portion of the element 23 to become separated from the bottom wall 21 along a narrow vent line interconnecting the aperture 22 with the propellant chamber 20. The portion of element 23 thus separated from the bottom wall to form the vent is also permitted to be distended inwardly by means of the elastic properties of the film. The bulge under aperture 22 and along the vent line continues to be present until the source of pressurization is removed or until the pressure of the propellant within the propellant chamber 20 approximately balances that within the sealing insert 48, at which point the elastic properties of the valve element 23 cause the vent to close, sealing the propellant within the chamber 20 and causing the pressure sensitive adhesive to become reattached to the bottom wall 21 along the vent line.

As soon as the sealing insert 48 is removed from sealing contact with the outer surface of bottom wall 21, thus venting the aperture 22 to the atmosphere, the pressure of the propellant within the chamber 20 causes a tight seal between the valve element 23 and the portions of the bottom wall surrounding the aperture 22.

Any number of propellants might be suitable for use in packages such as above described; however, for simplicity, economy and general use, nitrogen with an initial pressure of about 100 p.s.i.g. is preferred.

While the above-described valve element 23 comprised a tape valve, it will be understood that any type of re-sealable valve which is also capable of maintaining the inert gas 43 within the propellant chamber 20 prior to pressurization would be suitable if production rates were not critical. In this connection a self-sealing grommet-injection needle system would be adapted to use on containers to be processed according to the subject invention.

By the above-described process there is economically obtained a free piston package which is not susceptible to interior corrosion, product oxidation or propellant piston blowby. It is a process which is capable of high speed performance on modern machines. While the above description mentioned a single vacuum chamber 29 it will be understood that a battery of such equivalent chambers could be mounted about the periphery of rotary packaging equipment to conform with the high speed requirements of modern packaging concerns. Many other modifications of the above invention may be used and it is not intended to hereby limit it to the particular embodiment shown or described. The terms used in describing the invention are used in their descriptive sense and not as terms of limitation it being intended that all equivalents thereof being included within the scope of the appended claims.

What is claimed is:

1. The method of packaging a piston-type pressurized product dispensing container which comprises:

- (A) filling an open-bottom container body having a product dispensing valve mounted at the top thereof with a quantity of the product to be dispensed, said filling being accomplished through said open-bottom with the container body in an inverted position;
- (B) drawing a vacuum upon the unfilled volume of said container body while inserting a tapered piston in said open bottom;

(C) causing the piston to be forced into intimate contact with said product along its lower face and to displace some product from its filled position into a continuous wedge-shaped annular product seal between the tapered outer peripheral surface of said piston and the adjacent interior surface of said container body;

(D) breaking the vacuum acting upon the container body;

(E) purging substantially all of the oxygen from the propellant chamber constituting the piston interior and the remaining unfilled volume of the container body by displacement of air with a substantially inert gas;

(F) applying a valve equipped container bottom and seaming it to the lower edge of the container body, and

(G) pressurizing the container by forcing a propellant into the propellant chamber through the valve in said container bottom.

2. In the process of packaging a pressurized package utilizing a tapered piston for exerting propellant pressure upon the product to be dispensed, the steps which comprise:

(A) filling an open-bottom container body through said open bottom with a quantity of said product,

(B) drawing a vacuum upon the unfilled volume of said container body while maintaining said tapered piston in a position whereby exhaustion of any gas within the said unfilled volume is accomplished by gas-flow through a narrow annular passageway formed between the interior container body wall and the exterior wall of said piston,

(C) forcing the piston into intimate contact with said product and displacing some of said product from its filled position into a continuous wedge-shaped annular product seal between the exterior wall of said piston and the adjacent interior container body wall,

(D) breaking the vacuum acting upon the container body,

(E) applying a valve equipped container bottom and seaming it to the lower edge of the container body, and

(F) pressurizing the container by introducing propellant into the propellant chamber through the valve in said container bottom.

3. The process of claim 2 in which the thickness of said annular passage lies in the range of from .001 to .020 inch.

4. In the process of packaging a pressurized package utilizing a tapered piston for exerting propellant pressure upon the product to be dispensed, the steps which comprise:

(A) filling an open-bottom container body through said open bottom with a quantity of said product,

(B) drawing a vacuum upon the unfilled volume of said container body while maintaining said tapered piston in a position whereby exhaustion of any gas within the said unfilled volume is accomplished by gas-flow through a narrow annular passageway formed between the interior container body wall and the exterior wall of said piston,

(C) forcing the piston into intimate contact with said product and displacing some of said product from its filled position into a continuous wedge-shaped annular product seal between the exterior wall of said piston and the adjacent interior container body wall,

(D) breaking the vacuum acting upon the container body,

(E) purging substantially all of the oxygen from the propellant chamber formed by the piston interior and the remaining unfilled volume of the container body by displacement of air with a substantially inert gas, and

- (F) applying a container bottom and placing a propellant in said propellant chamber.
5. The method of packaging a piston-type pressurized product dispensing container which comprises:
- (A) filling an open-bottom container body having a product dispensing valve mounted at the top thereof with a quantity of the product to be dispensed, said filling being accomplished through said open-bottom with the container body in an inverted position; 5
- (B) drawing a vacuum upon the unfilled volume of said container body while inserting a tapered piston in said open bottom; 10
- (C) causing the piston to be forced into intimate contact with said product along its lower face and to displace some product from its filled position into a continuous wedge-shaped annular product seal between the tapered outer peripheral surface of said piston and the adjacent interior surface of said container body; 15

- (D) breaking the vacuum acting upon the container body;
- (E) applying a valve equipped container bottom and seaming it to the lower edge of the container body, and
- (F) pressurizing the container by forcing a propellant into the propellant chamber through the valve in said container bottom.

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