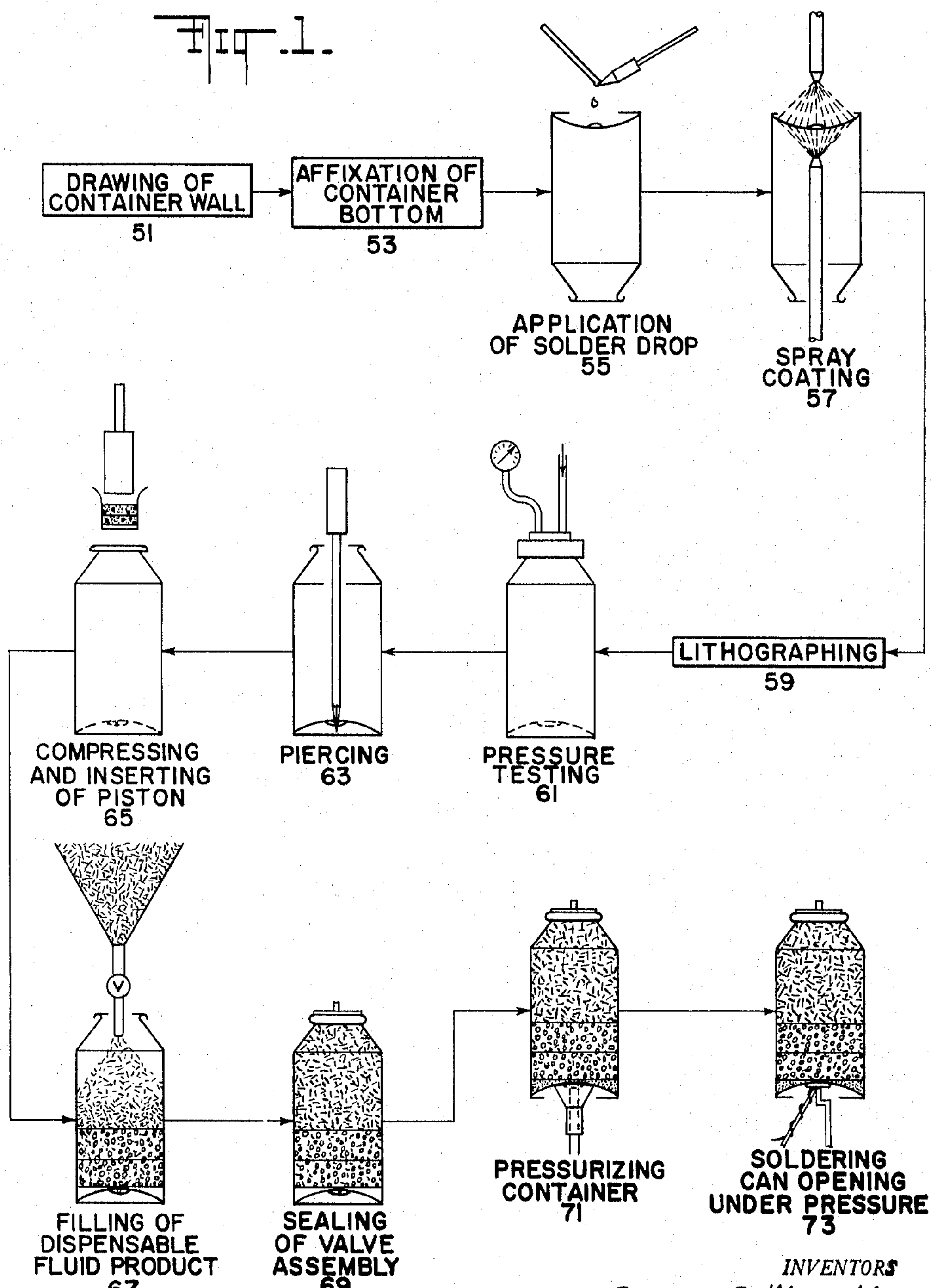
FILLING AEROSOL CONTAINERS

Original Filed June 6, 1960 2 Sheets-Sheet 1

FIG. 1.



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2 Sheets-Sheet 2

Fig. 2.

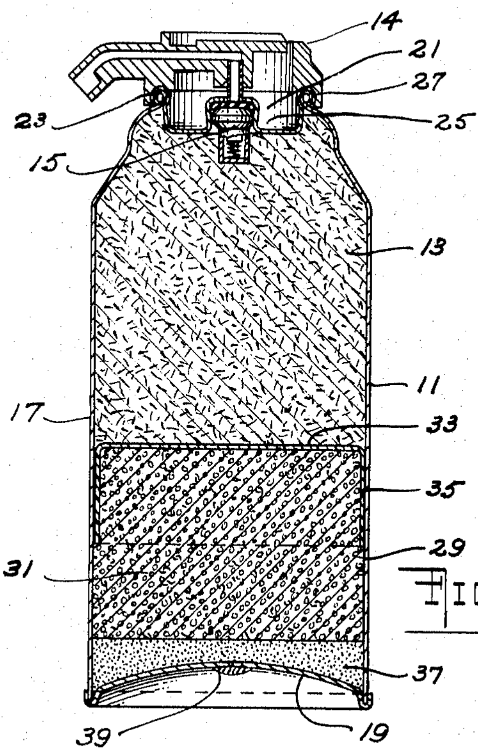


Fig. 3.

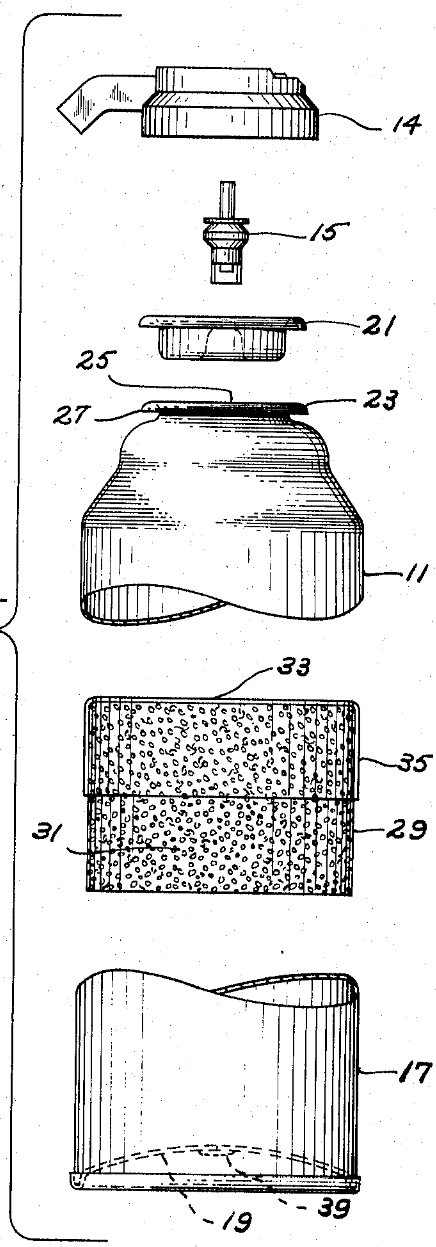


Fig. 4.

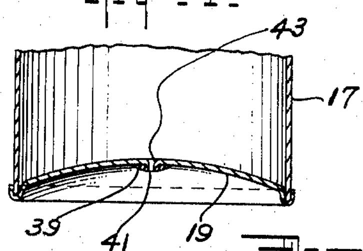


Fig. 5.

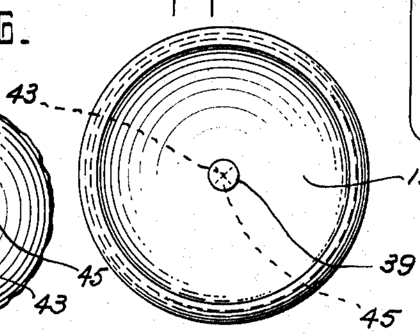
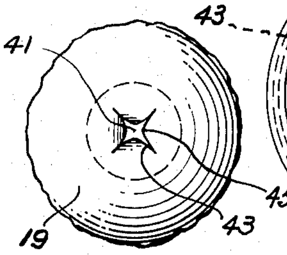


Fig. 6.



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FILLING AEROSOL CONTAINERS

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Continuation of application Ser. No. 34,173, June 6, 1960. This application June 4, 1963, Ser. No. 287,172
6 Claims. (Cl. 53—37)

This application is a continuation of Serial No. 34,173 filed June 6, 1960, and now abandoned.

This invention relates to the production of pressurized containers. More particularly, it is of a method in which pressurized fluid is added to a container through a perforation therein which is subsequently sealed.

In recent years, the pressurized dispensing of a wide variety of fluid and fluidizable products from small portable disposable containers has become commonplace. Such products have been given the popular designation "aerosols," although they should be referred to more accurately as pressurized dispensers.

Pressurized products include true aerosols, which are sprayed in fine liquid droplets or solid particle form, as well as various liquids, solutions, emulsions, gels, suspensions and pastes which are forced through manually opened dispensing valves by fluid pressure of a propellant material inside the container.

To spray-dispense fluid materials it is customary to mix them with or dissolve them in one or more of the liquefied gas propellants, such as the lower hydrocarbons or their halogenated derivatives. These propellants exert a relatively constant vapor pressure, causing the dispensed product to be sprayed in uniform manner throughout the useful life thereof, whether a large quantity or only a small amount of liquefied gas is present in the container. The propellant assists in atomizing the product when it flashes into vapor upon release of pressure when expelled from the container. In those instances in which it is not necessary or desirable to spray a product or where the contamination of material with liquefied gas propellant must be avoided, the propellant fluid, usually a gas, is maintained in a different phase from the product to be dispensed or in a separate part of the container and acts primarily as a propulsion force to dispense the contents without affecting their appearance or other properties. In one method for promoting efficient and substantially complete discharge of product from pressurized containers, a floating piston is employed between product and propellant sections of the container. In other arrangements film barriers, such as plastic sacs, are used. In still other cases the insolubility of the gaseous propellant in the product is sufficient to prevent contamination and no artificial separators are found necessary. Despite the utility of the plastic sac and direct contact methods for pressurized dispensing of fluids, the floating piston apparatus appears to be much superior for many applications and will be becoming of even more significance as increasing public demands for additional improved pressurized products is met by manufacturers. For this reason, and because the present invention is especially useful when applied to the filling of dispensers incorporating floating pistons, the invented method will be described with particular reference to such dispensers although it may often also be of significant advantage in improving the production of other types of pressurized packages.

In the production of pressurized products in which a barrier is intermediate product and propellant chambers of a container, certain filling problems are encountered which are not present when filling conventional products. With commercially available aerosol container

designs a cylindrical bottomed can is supplied, together with a valve to be fastened to the container top. In the cold filling of conventional packages, product is usually added through the open top of the container followed by pre-cooled, liquefied propellant at atmospheric pressure. Upon sealing the container and allowing its temperature to rise, the liquefied gas vaporizes to an extent and the internal container pressure rises to the super-atmospheric vapor pressure exerted by the gas at the higher temperature. In pressure filling, product is added to the open container followed by sealing and addition of propellant either as a liquid or gas, through the opened dispensing valve. When desired, other variations of these techniques may be employed in which the can is purged of non-condensable gases by vacuum or by displacement with soluble or condensable gas or in which the various components are cooled or otherwise treated to promote efficient filling and operation and to prevent product loss. From the preceding outline of the most common commercial filling methods now in use, it will be clear that they are not directly applicable to the manufacture of pressurized products in which floating separatory pistons are employed. The required provision of two chambers, the lower of which preferably contains pressurized gas propellant, makes the well-known filling methods impracticable. By means of this invention these pressurized dispensers now can be filled efficiently and neatly, at economical production line speeds.

It is an object of the present invention to manufacture pressurized products by the addition of pressurized fluid to a dispensing container through an opening therein other than the filling opening. Another object is to provide a method by which a container may be readily sealed after pressurizing with propellant fluid. It is also an aim of this invention to produce a pressurized dispenser, which may include a floating piston, from commercially available containers and fitting valves, in the usual manufacturing procedures, so that this method may be used to produce various types of aerosol packages, utilizing much of the same basic equipment employed for making other types of aerosol packages. Another object is to produce a "piston-aerosol" dispenser from standard aerosol containers by a method which requires only relatively minor modifications in the container manufacturing procedures. Still other objectives will be apparent from the following description of the invention and its preferred elements and components, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic plan of the operations undertaken in accordance with the invention;

FIG. 2 is a sectional view of a dispensing container filled and pressurized by the invented method;

FIG. 3 is a disassembled view of the parts of such a dispensing container;

FIG. 4 is a sectional elevation showing the bottom wall of a dispensing container which has been pierced through a previously laid deposit of fusible material;

FIG. 5 is a bottom plan of the dispensing container bottom of FIG. 4, but with the opening closed; and

FIG. 6 is an enlarged top plan view of that bottom before sealing.

FIGS. 2 and 3 illustrate a self-propelling package of material **13** to be dispensed through normally closed valve **15** which may be opened by manual depression when discharge of contents is desired. Dispensing container **11** comprises a cylindrical wall **17**, a concave bottom **19**, sealed to the preferably seamless wall by means of a rolled peripheral seam, a valve fitment **21**, which is staked to valve **15** and sealed to top **23** of the container, covering its centrally located filling opening **25** which is bounded by rim **27**. A dispensing spout member **14** fits over valve **15** and directs product during discharge.

Inside the container is a floating piston 29 comprising an open celled sponge cylinder 31, an imperforate, substantially impermeable top face 33 and side portion or skirt 35. Propellant fluid, preferably a non-condensable gas 37, such as nitrogen, under pressure, which also permeates the porous sponge piston body, serves to provide the force on material 13 to dispense it through spout 14 when valve 15 is opened.

The concave bottom 19 of dispensing container 11 has a spot or deposit of fusible material, e.g., tin-lead solder, at the upper central portion thereof, on the cylinder axis. The solder 39 serves to close off a small perforation 41 at the can bottom, through which propellant fluid is added to the container. The presence of the special perforation mentioned and the packaging process, comprising making such a perforation, filling a pressurized container and sealing the opening lie at the heart of the present invention and contribute to its advantages over prior structures and processes.

FIGS. 4 and 5 show the container bottom and special pressurizing perforation as they appear shortly before addition of the pressurizing fluid. In the illustration given, solder 39 was applied to the exterior (concave) side of the container bottom wall, allowed to harden and then the container bottom was lanced or pierced through the solder to make an opening 41 through which pressurized fluid could be added. It will be seen from the appearance of the container edges that the lance or piercing instrument (not illustrated) employed entered the container bottom from the upper side thereof, causing the edges 43 of the perforation 41 to be pressed downwardly. The small hole made, usually more than .03 in. and preferably less than about .09 in. is readily sealed by the application of fusing means. If fusion is accompanied by an upward force against the container, tongues 45 of the perforation are soldered back into substantially their original position, substantially completely reclosing the lanced opening and making the fused seal even stronger.

In the schematic plan of FIG. 1 numeral 51 represents a tube drawing machine which shapes a container to a seamless crowned cylinder having a filling opening at the top and having a bottom adapted to be filled by application of a circular bottom wall which may be seamed to the container by a conventional can sealing equipment. Such a sealer is at 53 where a concave bottom is fastened to the crowned cylinder container. At 55 a droplet of solder is applied to the inverted can at the central exterior surface of the container bottom. If desired, the bottom curvature of the can may be exaggerated somewhat, or a well may be formed in it, to better hold the solder in place. The container is next coated with protective resin film at 57, if desired, and is then lithographed at 59. The covering or painting may be done adjacent to or even over the solder without interfering with this process. At 61 the bottomed container is pressure tested for fluid tightness by applying air pressure to the container through the filling opening and those cans which leak are rejected.

At 63 the acceptable containers are then pierced from above by a piercing mechanism such as a lance or prick which extends through the filling opening. The piercing operation causes a downward displacement of the torn edges of the container about the hole made and into the solder without incurring a removal of metal from the container. It also tends to force a small amount of fusible material against the side walls of the hole in the container. At 65 the sponge piston, including imperforate cover and skirt, is inserted into the can through the filling opening, followed at 67 by addition of product to be dispensed. The valve assembly, comprising valve 15 and valve fitment 21, staked to it, is then fastened to the container at 69, leaving it sealed with the exception of the piercing hole through the container bottom. With the container upright gas under pressure is formed through

the pierced opening at 71 and, while maintaining the external pressure, the fusible material is caused to close the opening, hermetically sealing the container. Usually the fusion is accompanied by the application of heat to a fusible material which will melt when hot and subsequently solidify to a covering sufficiently strong to withstand the container internal pressure. The finished package of pressurized product is subjected to the standard tests and is then packaged for shipment. Testing and packaging operations are standard and are not represented in the drawing.

The invented process is for use with various types of aerosol package parts currently available but also will be applicable to less frequently employed and novel elements. It is expected that most frequently the container will be of sheet steel, normally about 28 gauge (.015 in.). Instead of coated black iron one may use tinned sheet. These are presently the most important container construction materials but aluminum, various plastics and even special glasses may sometimes be used for the containers. Usually, to facilitate the easy movement of the piston through the container and to prevent leakage between propellant and product chambers, seamless tubes will be employed, but with intelligent choice of piston material and construction the use of side seamed containerse is also feasible. The container and its crowned top can be one piece of formed metal or a conventional straight walled can can be surmounted with a shaped top, having the required opening for the dispensing valve or valve fitment. As with the container walls, the can bottom can also be made of any of a number of suitable materials and shapes, so long as the fusible material will adhere to it. It may be flat or concave, with or without either interior or exterior formed wells for fusible material.

The fusible substance mentioned should be one which can readily be fused and solidified and preferably should be such as to require little preparatory treatment of the container to promote strong adhesion or bonding. The most convenient method of fusion for commercial applications is the melting of a low-melting metal or alloy such as those of tin, lead, bismuth and antimony or cadmium. Those alloys melt at temperatures well below 1,000° F., some, such as Wood's metal, melting at about 150° F. The tin-lead alloys (solder) are preferred because they melt at comparatively low temperatures, are inexpensive and form strong bonds to clean steel. Instead of solder other fusible materials, even plastics may find use.

The fusible material can be applied to the container bottom at any convenient part thereof, although it is usually preferable to place it in the center of the concave bottomed cans. If it were desired, the side walls of the container near the bottom would be a suitable position at which to affix the solder bead but usually such position is disadvantageous because the application of heat to the fusible metal will adversely affect any package decoration which might previously have been applied. Instead of a small spot of solder covering only a very minor proportion of the container bottom, substantially all the bottom being uncoated with solder, a larger deposit may be employed but with no advantage. To facilitate quick and efficient sealing of the container after pressurizing it is usually best to apply the solder on the exterior of the can bottom but this is not necessary, cans which have had an internal deposit also being sealable by external heat.

After the application of solder to the can bottom and testing of the sealing seam the bottom is pierced through the solder deposit to make a small opening which is of sufficient size to allow quick pressurizing by passing propellant fluid through the opening after dispensable product has been charged to the container. Although it is preferred to pierce the bottom from above so that the edges of the opening project downward, the reverse method may also be used but in the soldering operation the edges will not be forced back into place, as will happen with the preferred method. Instead of puncturing through the metal bottom and solder deposit one could first perforate the bottom, apply solder and then pierce or punch through the solder but this method would require additional operations and would be less advantageous than that process which is most preferred.

Piercing of the can bottom and fusible deposit can be effected immediately after decorating, coating and pressure testing of the container in the can manufacturer's plant. Alternatively, this step may be deferred until the aerosol can is to be pressurized. Following the latter procedure may be preferable because, if the containers are inverted during shipment and storage they will have no upper opening through which dirt or dust might enter.

Among the principal advantages of the invented packaging method, the primary one is that the invention allows efficent commercial manufacturing of these products by utilizing to a very great extent the presently employed machinery and equipment. It will not be necessary to completely redesign time-tested and costly manufacturing equipment. The special filling procedures required to make the new aerosol packages can be effected with little or no added cost. Thus, container manufacturing is still undertaken as before with only the addition of the solder deposit on the can bottom. The solder is applied before the bottom is coated with protective resin or other film designed to safeguard the container against corrosion. Applied at this stage, there is no problem in obtaining a good bond. The amount of flux used may be minimal and when the deposit is fused to close the filling opening, because only a small quantity of solder needs to be fused to make a good seal, there is no undesirable smoking or charring of the container coating which would render it unsightly, and possibly, ineffective to prevent corrosion of the can.

After leak testing, the container is coated and, if desired, lithographed. During baking of the coating coolant may be applied to the fusible material to prevent its melting but usually this is unnecessary because with the short heating period the body of the solder will not usually become hot enough to cause flow from the desired position. Should the solder melt, maintenance of the can in inverted position or provision of a recession in which it may be retained will allow the surface tension of the molten metal to hold it in place.

It will be noted that these containers can be painted or otherwise coated with resinous material right over the spot where the pressurizing opening is made. The painting, being carried out before puncturing, does not coat the edges of the solder which will coalesce when heat is applied. Therefore, the clean cut edges of the opening are uninsulated and uncontaminated with paint and readily fuse together upon the application of heating means. It is evident that the piercing of the container bottom is a very simply effected operation which can be carried out with elementary machinery. Automatic filling of contents after insertion of the piston and automatic valve application and sealing can be done according the methods which are well known in the industry. Machines have been designed for pressurizing the container and soldering while under pressure and by using such equipment these operations may be successfully completed without any difficulty. Such machines have a filling head which includes a chamber having a movable heating or other fusion means which may be brought into contact with the container after pressurizing and which may afterward be withdrawn from contact with heat or other stimulus, while maintaining pressure until the container is sealed.

The following example illustrates a preferred form of the invention.

Example

From a suitable disk of cold-rolled steel there is drawn a seamless cylindrical side wall for an aerosol container, with a stepped top of reduced diameter. The side wall thickness of the container is 0.012 inch, its height is 4½ inches and it is about 2⅛ inches in outside diameter. Such a container is known as a 6-oz. Crown can. It is provided with top and bottom beaded rims for affixation of closures. A concave bottom is pressed from sheet cold-rolled steel of 0.012 inch thickness. Both container wall and bottom are plated to ½ lb. tin plate equivalent. A flow-in gasket is applied to the convex side of the container bottom about its edge and the bottom is rolled and sealed hermetically tight to the container wall.

With the bottom facing upwardly, a droplet of solder, approximately half lead and half tin, is fused to the central portion of the concave (exterior) side of the can bottom. Prior to placement of the solder the area concerned is thoroughly cleaned and a flux is applied. The weight of the solder used is about 0.3 gram and at the central part of the bottom concavity it forms a circular deposit approximately ¼ inch in diameter and 0.030 inch thick.

After application of the solder, the can interior may be lacquered and the outer wall surface may be enameled and lithographed. Even if the temperature is accidentally raised too high during the baking of the enamel, the solder will remain in place, held in the concave depression or well by surface tension and gravity (the can being maintained inverted during this operation). The container may then be tested for leakage with air at a suitable pressure, e.g., 100 lbs./sq. in. The air-tight containers are next punctured through the central portion of the bottom wall and through the solder deposit by a sharp pointed piercing instrument of square cross section. The piercing device passes first through the container wall, then through the solder, leaving a hole of distinctly square shape with 4 tongue-like sides projecting outwardly. This opening, through which pressurizing gas is subsequently admitted to the container, is approximately 0.050 inch on a side. The pierced containers may then be packed for shipment to an aerosol filler.

After unpacking and cleaning the containers, the filler inserts a resilient sponge piston through the top opening of the container and then fills material to be dispensed, in this case dental cream, through the opening until it fills the container space above the piston. Next, the dispensing valve and attached valve fitment are rolled and staked into place. The can is then inverted, a chamber capable of being maintained under pressure and adapted to seal against the can is brought into contact with the bottom of the container about the opening therein and pressurizing nitrogen gas at 100 lbs./sq. in. is charged into the container. While maintaining the container under pressure, a heating element, also in the pressure chamber, is moved into contact with the solder. Initially, this contact is made without application of heat, the force of application being enough to force back into place the projecting tongues about the pierced opening in the can. The heater is then activated, fusing the solder. The heat is then turned off, while still maintaining physical contact between the heater and can bottom and after a few seconds, in which time the solder hardens sufficiently, the heater is removed, chamber pressure is released and the filled can is withdrawn. The container may then be subjected to the usual tests and the dispensing spout is fastened in place, after which the product is ready for packing and shipment.

The above process is an efficient and speedy way to manufacture pressurized dispensers, especially those which include two separated volumes, one for material to be dispensed and the other for propellant fluid. The solder seal at the orifice for filling propellant is of sufficient strength to withstand the usual physical and thermal shocks to which the container might be subjected.

The above invention has been described with respect to illustrations of preferred embodiments thereof. It is not limited to such methods and articles only, the scope of the invention being as recited in the claims.

What is claimed is:

1. A method for producing a pressurized product in a dispensing container which comprises applying a fusible material to an outside wall of a walled metal container having a filling opening, lancing the said wall and fusible material thereon from the inside of the container before pressurizing to make a pressurizing opening, thereby causing the edges of the opening made in said metal wall to project outwardly into said fusible material as tongue-like sides, adding to the container through the filling opening a separatory piston, adding material to be dispensed to the container through the filling opening, affixing dispensing means to the container and sealing the filling opening so that the container is closed, with the exception of the lanced opening through said wall and the fused material thereon, pressurizing the container by flowing propellant material into it through the said lanced opening and melting said fusible material thereby causing said fusible material to flow around said tongue-like sides to hermetically seal the lanced opening.

2. A method for producing a pressurized product in a dispensing container which comprises applying a fusible material to an outside wall of a walled metal container having a filling opening, coating said wall on the outside thereof with resinous protective material, lancing the said wall and fusible material thereon from the inside of the container before pressurizing to make a pressurizing opening, thereby causing the edges of the opening made in said metal wall to project outwardly into said fusible material as tongue-like sides, adding to the container through the filling opening a separatory piston, adding material to be dispensed to the container through the filling opening, affixing dispensing means to the container and sealing the filling opening so that the container is closed, with the exception of the lanced opening through said wall and the fused material thereon, pressurizing the container by flowing propellant material into it through the said lanced opening, and melting said fusible material, thereby causing said fusible material to flow around said tongue-like sides to hermetically seal the lanced opening.

3. A method for producing a pressurized fluid product in a dispensing container which comprises forming a sheet metal container bottom, applying to the lower face of the bottom a small deposit of low melting metal alloy which fuses at a temperature substantially lower than the fusion point of the container bottom, affixing the container bottom to container side walls, thereby making a container having a filling opening at the top, lancing the container bottom from above and from inside the container, by movement of a thin lance through said filling opening and through the sheet metal container bottom and the low melting fusible metal deposit thereon before pressurizing, thereby causing torn edges of the opening made in the sheet metal bottom to project downwardly as tongue-like sides, adding to the container through the filling opening a separatory piston, adding fluid material to be dispensed to the container through the filling opening, affixing a normally closed dispensing valve and valve fitment to the container and sealing the filling opening so that, with the exception of the lanced opening through the container bottom and fusible metal deposit, the container is tightly closed, pressurizing the container by flowing propellant fluid into it through said lanced opening and, while maintaining the pressure in the container, and melting said fusible metal thereby causing said fusible metal to flow around said tongue-like sides and then cooling and solidifying said fusible metal so that it is bonded firmly to the sheet metal container bottom and closes and hermetically seals the hole lanced therein.

4. A method of making, filling and sealing a dispensing container of pressurized fluid product which comprises forming a circular container bottom of sheet steel free of resinous protective coating material, applying to the lower face of the bottom a small deposit of low melting metal alloy which fuses at a temperature substantially lower than the fusion point of steel and which bonds to it, the small deposit of fusible metal being so located as to leave substantially all the container bottom free of such metal, affixing the container bottom to cylindrical side walls, piercing the container bottom from above and from inside the container by movement of a thin piercing element through the steel container bottom and low melting fusible metal deposit thereon before pressurizing, thereby causing the edges of the opening made in the sheet steel bottom to form downwardly projecting metal tongues, adding to the container through a top filling opening a separatory piston, adding fluid material to be dispensed to the container through the top filling opening, affixing a normally closed dispensing valve and valve fitment to the container and sealing the filling opening so that, with the exception of the pierced opening through the container bottom and fusible metal deposit, the container is tightly closed, pressurizing the container by flowing propellant fluid into it through said pierced opening and, while maintaining the pressure in the container, sealing the opening by applying heat and upward pressure to the fusible metal and downwardly projecting tongues sufficient respectively to fuse said fusible material and return said tongues substantially to their original position, and withdrawing said application of heat to allow cooling and solidification of said fusible material while said upward pressure is applied thereto, and withdrawing said upward pressure after solidification of said fusible material has occurred so that the metal is bonded firmly to the sheet steel container bottom and closes and hermetically seals the hole pierced therein.

5. A method for making, filling and sealing a dispensing container of pressurized fluid product which comprises forming a concave circular container bottom of sheet steel free of resinous protective coating material, applying to the concave lower face of the bottom, at the center thereof, a small deposit of low melting solder which fuses at a temperature substantially lower than that of steel and which bonds firmly to it, the small deposit of fusible metal being so concentrated as to leave substantially all of the container bottom uncovered by such metal, affixing the container bottom to side walls of a crowned cylinder having a filling opening at its top, coating the container side walls and interior with resinous protective material, pressurizing the container by forcing air under pressure into it through the filling opening, releasing the pressure, piercing the bottom of a pressure retaining container from above by movement of a thin piercing element through the steel and solder deposit thereon, causing the edges of the opening made in the sheet steel bottom to project downwardly, adding to the container through a top opening a separatory floating piston, adding fluid material to be dispensed to the container through the top filling opening, affixing a normally closed dispensing valve and attached valve fitment to the container and sealing the filling opening so that, with the exception of the pierced opening through the container bottom and fusible metal deposit, the container is tightly closed, pressurizing the container by flowing propellant gas into it through said opening and, while maintaining the pressure in the container, sealing the opening by applying heat to the solder and withdrawing heating means to allow cooling and solidification of the solder so that it is bonded firmly to the sheet steel container bottom and closes and hermetically seals the pierced hole therein.

6. In a method for producing a pressurized fluid product in a dispensing container by forming a metallic con-

tainer bottom, applying to the bottom a small deposit of metal which fuses at a temperature lower than the container bottom, affixing the container bottom to container side walls filling the container with product to be dispensed, affixing a normally closed dispensing valve to the container and pressurizing the container, the improvement which comprises piercing the container through the fusible metal before filling the container with product to be dispensed and before pressurizing the container inserting through an upper filling opening of the container a piston which separates product and propellant in the container, adding fluid product to be dispensed atop the piston through the same filling opening, affixing a normally closed dispensing valve to the container and sealing the filling opening so that, with the exception of the pierced opening through the fusible metal, the container is closed, pressurizing the container by flowing propellant fluid into it through said opening and sealing the opening by melting the fusible metal and pressing edges of the pierced hole back to original shape, and withdrawing heating to cool and solidify the fusible metal so that it is bonded firmly to the container bottom and closes and hermetically seals the pierced hole therein.

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