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54 Pressurized fluid dispensing container.

57 Pressurized fluid dispensing container (1) having an upper product chamber and diaphragm means (7) defining a lower propellant chamber, is filled through a propellant fill hole (6) in the bottom of the container. The propellant fill hole (6) is sealed with a closed end blind rivet (11). The diaphragm means (7) may be a piston, the side walls of which are provided with upper and lower resiliently flexible annular vanes (46 and 47) sealing between the side wall of the piston (7) and the inner side of the body (1). The upper vane (46) inclines upwardly away from the piston outwardly toward the body and the lower vane (47) inclines downwardly away from the piston outwardly toward the body. The vanes (46 and 47) increase the dispensing efficiency of the container, by guarding against mixing of the product with the propellant.

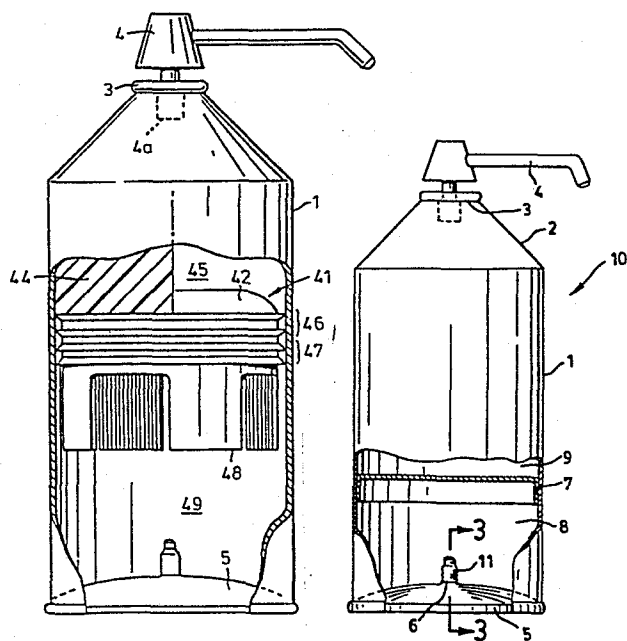


FIG. 1

FIG. 4

- 1 -

PRESSURIZED FLUID DISPENSING CONTAINER

This invention relates to pressurized fluid dispensing containers. The usual type of container is a rigid, cylindrical can filled with a liquid product to be dispensed and a propellant. The container is provided
5 with a valve, usually finger actuated, which, when operated, dispenses a mixture of the product and the propellant. The pressure of the propellant provides the dispensing force.

In the dispensing of some products, for example, edible
10 products, it is desirable to keep the propellant and product separate.

Several barrier-type containers have been proposed employing diaphragm means to separate the product and propellant. One such container utilizes a sliding piston,
15 snugly fitting the container body. Accordingly, the container is divided into two sections, an upper product chamber and a lower propellant chamber.

Another manner of separating product and propellant involves the use of a flexible inner container or bag
20 forming a barrier between the product and the pressure fluid. The product is contained in the flexible inner container while the propellant occupies the space between the inner container and the walls of the container.

The above noted containers have presented in some cases difficulties in manufacturing, evidenced by high package failure rates and excessive packaging costs. In particular, the containers utilizing a piston or flexible inner
5 container generally are characterized by a propellant fill hole situated at the bottom end wall of the container. Once the product is charged into the upper product chamber and the propellant into the lower propellant chamber, this opening must be sealed. Containers on the market today
10 utilize a plastic or rubber bung to seal the propellant fill hole at the bottom end wall. This manner of sealing has not proven to be highly successful particularly where the product is of a highly viscous nature, for example with a viscosity of 20 cp or more at 20°C. As such pro-
15 ducts require high pressure propellants, containers sealed in this manner are prone to leaking at the bung. Further they are vulnerable to tampering and vandalism, as the bung can be pried open with the fingers, releasing the propellant and rendering the container useless.

20 In one aspect the invention provides a pressurized fluid dispensing container having: a rigid, hollow cylindrical body, top and bottom end walls, a diaphragm means positioned between said end walls, thereby defining an upper fluid product chamber and a lower propellant charge
25 chamber, said top end wall having an opening provided with a dispensing valve, said bottom end wall defining a propellant fill opening and having a sealing means in said fill opening, said sealing means comprising a closed-end blind rivet having undergone radial expansion upon
30 actuation from the outside of the bottom end wall and thereby forcing the perimeter of the body and the head of said rivet into tight sealing arrangement with the bottom end wall. Use of a closed end blind rivet as sealing means offers a more secure seal than the plastic or rubber
35 type bungs.

Known piston-equipped containers have suffered from the disadvantage that, on the introduction of the propellant, or subsequently, viscous product tends to work its way past the piston toward the propellant chamber and, conversely, propellant tends to migrate to the product chamber. This can render the operation of the piston inefficient, and can ultimately result in loss of the required pressurization in the propellant chamber, rendering the container useless for its dispensing purpose.

- 10 In a further aspect, the invention provides a pressurized fluid dispensing container having: a hollow cylindrical body; top and bottom end walls; said top end wall having an opening for a dispensing valve; and a free-floating piston slidable vertically within the body and having a
- 15 generally cylindrical relatively rigid side wall provided with upper and lower relatively resiliently flexible annular vanes sealing between the side wall of the piston and the inner side of the body, said vanes being relatively thin compared to the material of the cylindrical
- 20 side wall, and the upper vane inclining upwardly away from the piston outwardly toward the body and the lower vane inclining downwardly away from the piston outwardly toward the body.

With this arrangement, the upwardly and outwardly angled

- 25 vane reduces any tendency for the viscous product to travel downwardly toward the propellant chamber, while the downwardly and outwardly directed vane reduces any tendency for propellant to seep past the sides of the piston during the initial propellant-introduction step.

- 30 Such seepage of propellant into the upper, product chamber could tend to force a viscous product downwardly past the side of the piston. The arrangement also reduces the risk of intermixing of product and propellant as a result of displacement of the piston laterally within the container.

Further features of the invention will become apparent from the following description with reference to the accompanying drawings, in which:

Figure 1 is a cross sectional view of a pressurized fluid
5 dispensing container;

Figure 2 is an enlarged cross section of a closed end
blind rivet prior to actuation;

Figure 3 is an enlarged cross section of a closed end
blind rivet after actuation;

10 Figure 4 shows a side view, partly in vertical
cross-section, of a fluid dispensing container provided
with a piston in accordance with the present invention;

Figure 5 shows a perspective view of the piston employed
in the container of Figure 4; and

15 Figure 6 shows a partial cross-section through the piston
taken on the line VI-VI in Figure 5.

Referring to the drawings, wherein like reference numerals
indicate like parts, a pressurized fluid dispensing
container 10, illustrated in Figure 1 comprises a rigid
20 hollow cylindrical body 1 and a top end wall 2, having an
upper opening sealed with a conventional form of closure 3
provided with a dispensing valve arrangement 4. The
container has a bottom end wall 5, defining a propellant
fill opening 6. Positioned between end walls 2 and 5, is
25 a piston 7 shown somewhat schematically. Accordingly
there is a defined upper product chamber 9, and a lower
propellant chamber 8.

In filling and pressurizing the container 10 before applying the closure 3, and before the rivet 11 has been applied to the opening 6, a product e.g. a high viscosity product is injected through the upper opening in the top end wall 2, into the product chamber 9. Once the desired quantity is inserted, the closure 3 with the dispensing valve arrangement 4 is sealingly mated to the top end wall. The container is then pressurized by charging a propellant gas into the lower propellant chamber 8 with an appropriate propellant through opening 6. After charging, the propellant fill opening 6 is immediately sealed with a closed end blind rivet 11.

The closed end blind rivet 11, shown in Figure 1 is in the actuated position, namely, the perimeter of the body 12, and the head 13, of the rivet 11 are in tight sealing arrangement with the bottom end wall 5, of the container 10.

Figure 2 shows the detail of a typical closed end blind rivet inserted in opening 6 and before actuation. The closed end blind rivet shown is of a hollow-core type. Closed end blind rivets comprise a body 12, which in the present application projects up into the propellant chamber 8, a head 13, and a mandrel 14, which is used to actuate the rivet.

Figure 3 is an illustration of the actuated closed end blind rivet 11, inserted in the propellant fill opening 6. To actuate the rivet, the mandrel 14 is withdrawn from the body of the rivet in the direction shown by the arrow. As the mandrel is withdrawn from the outside of the container, a high degree of radial expansion is generated in the rivet body thus forcing the perimeter of the rivet body against the inner surface of the bottom end wall. At the same time the head of the rivet is forced in

tight sealing arrangement with the outside of the bottom-end wall, thus a hole filling seal which is gas and liquid tight is provided.

A wide range of rivets is available in various sizes, materials, and manner of construction. For example, a
5 closed end POP (registered trade mark) rivet as available from USM Limited, fastener Division, Montreal, Quebec, Canada, and consisting of an aluminum body and a carbon steel mandrel may be employed. Typically, a tight sealing
10 arrangement is obtained when the body of the closed end blind rivet comprises a substance, for example aluminum, which is softer than and flows plastically at a lower stress than the steel used for the bottom wall 5, so that
15 as the rivet is shortened longitudinally and swelled radially, as shown in Figure 3, the steel bottom wall 5 bites into and embeds itself in the rivet, forming a tight seal.

In applying the rivet 11, a cup-shaped enclosure may be positioned below the bottom wall of the can. The rim of the cup is provided with an O-ring gasket. A blind rivet
20 actuating gun of conventional type is supported for vertical reciprocation in the cup, and is controlled by control lines, e.g. compressed air lines, passing in gas-tight manner through the wall of the cup. There is an inlet in the wall of the cup through which pressurizing
25 gas, e.g. nitrogen, can be supplied. In operation, a blind rivet is introduced into the gun, the container 1 is clamped in position, the cup is pressed upwardly so that its O-ring gasket forms a gas-tight seal with the wall 5, and pressurizing gas is passed into the cup until a
30 desired quantity enters the propellant chamber of the container through the hole 6. The rivet actuating gun is then moved upwardly within the cup to introduce the body 12 of the rivet into the hole 6 and to press the head 13 of the rivet tightly against the wall 5. The mandrel 14

is then pulled down by jaws within the gun, to actuate the rivet to the radially swelled condition shown in Figure 3. The cup and gun are then lowered, the mandrel 14 is removed, the pressurized container is released and
5 removed, and then the above-described operation may be repeated with a fresh container.

In order to achieve an improved gas-tight seal between the rivet and the bottom wall 5 of the container in the finished container, the body of the rivet 12 may be coated
10 with a curable liquid resin composition before the rivet is pushed into the hole 6. The coating may cover the top surface of the rivet body 12, and may extend some way downwardly over the sides. On insertion of the rivet through the hole 6, a thin film of the resin becomes
15 smeared over the contacting surfaces of the rivet 12 and the periphery of the hole 6 and cures after the actuation of the rivet to provide a seal. The coating may be, for example, flowable curable mixture of an epoxy resin and a hardener therefor.

20 Figures 4 to 6 show a piston 41 formed as a one piece moulding from resiliently flexible plastic e.g. high density polyethylene. The piston 41 is in the form of a hollow cylindrical cup with a domed upper side 42 provided with an integrally-formed central depression 43 which
25 accommodates the lower portion 4a of the dispensing valve 4 when the piston 41 is driven upwardly in dispensing the last of the product 44 indicated somewhat schematically in the left hand half of Figure 4. The product 44 is contained within an upper product chamber 45 defined above
30 the piston 41.

The outer cylindrical wall of the piston 41 is provided adjacent its upper end with a set of two vertically spaced upwardly and outwardly inclining annular vanes 46.

Spaced downwardly from the upper set of vanes, but upwardly from a lower edge 48 of the piston, is a lower set of two annular vanes 47 also integrally formed with the side wall of the piston 41 and inclining downwardly and outwardly therefrom. The vanes 46 and 47 are each moulded integrally with the side wall of the piston, and are moulded as annular membranes. As best seen in Figure 6, the vanes 46 and 47 are moulded with a lesser thickness than the side wall of the piston 41, so that they are relatively more flexible. Preferably the side wall of the piston 41 above, below and between the vanes is of constant diameter.

The length of the side wall of the piston 41 contacting the body 1 is preferably at least half the width or diameter of the piston, thus making it more stable when positioned within the container body 1, and less liable to tip or tilt to one side when propellant gas is introduced into a propellant chamber 49 defined between the piston 41 and the lower wall 5. In order to reduce the quantity of plastic needed to manufacture the piston, the cylindrical skirt portion of the piston below the lower set of vanes 47 is formed with apertures. In the example illustrated, the apertures take the form of vertically-extending slots 50 extending upwardly from the lower edge.

During the pressurizing procedure, the piston 41 is driven upwardly, compressing the viscous product 44 trapped in the product chamber 45. Any tendency for the product to be displaced downwardly past the side of the piston 41 is prevented by the upwardly and outwardly inclining vanes 46 which tend to be flexed radially outwardly by their reaction with the viscous product, thus tending to resiliently expand or flex them outwardly and thus improving the sealing contact between the vanes and the inside of the wall of the body 1. Similarly, the pressure

exerted by the propellant gas on the lower vanes 47 tends to resiliently expand or flex them outwardly into more effective sealing contact with the wall of the body 1. This avoids any tendency for mixing of the propellant and product, which would lead to loss of the capability of the propellant gas fill to sustain a pressure differential between the propellant and product chambers 49 and 45.

As will be noted, in the preferred form as shown, a plurality of vertically spaced vanes is provided in each set 46 and 47. In the event that the wall of the body 1 is damaged or dented and permanently deformed inwardly, there would be a tendency for the side wall of the piston 41 to be deflected inwardly, as the side wall may be unable to withstand the inwardly-directed pressure such as might be exerted on it by a deformed region of the wall of the body 1. With the preferred arrangement, an upper vane in the set 46 or 47 which happens to be adjacent the deformed portion of the body wall 1 can form a seal with the body wall at a point spaced above the inwardly-deflected or dented zone of the wall, and a lower vane a seal at a point spaced below this zone, thus forming a seal which in effect bridges over any damaged or dented zone of the side wall, and thus reducing or avoiding any tendency for mixing of the product and propellant gas to take place. Desirably, each set of vanes 46 and 47 comprises at least two vertically spaced vanes. A larger number of vanes in each set may be employed if desired.

The use of a plurality of vanes provides a further advantage that if, owing to severe damage to the wall of the container or because of some other failure, some viscous product forces its way past the uppermost vane of the set of vanes 46 or some propellant forces its way upwardly past the lowermost vane of the lower set 47, so that a pressure differential is no longer maintained

tending to force the uppermost vane downwardly and outwardly and the lowermost vane upwardly and outwardly, the other vanes in each set 46 or 47 may act as a back-up resisting any tendency for failure of the seal.

- 5 In use, on actuation of the dispensing valve 4, a positive pressure differential exists between the propellant space 49 and the upper product space 45 as product leaves the container, relieving the pressure in the upper chamber 45. Any tendency for propellant to pass upwardly from the
10 lower chamber to the upper chamber is resisted by the seal effected by the lower vanes 47.

Owing to changes in the ambient temperature to which the container is exposed during storage or transportation, and owing to the difference in the volume coefficients of the
15 gaseous propellant and of the viscous product, a negative pressure differential may tend to be created between the lower chamber 49 and the upper chamber 45, such as would tend to result in product moving downwardly from chamber 45 to chamber 49. Any such tendency is resisted by the
20 upwardly and outwardly inclining set of vanes 46.

As will be appreciated, for the sake of clarity, in Figure 4 the spacing between the side wall of the piston 41 and the inner side of the wall of the container 1 is shown somewhat exaggeratedly. Typically, the spacing will be
25 very small in relation to the inside diameter of the body 1. Merely by way of example, it may be mentioned that, in the case of a can having a body 1 of diameter about 54 mm, the clearance between the outer side of the piston 41 and the inner side of the wall of the body 1 will be no more
30 than about 1 mm at all points on the circumference.

Preferably, each vane in the sets 46 and 47 is moulded so that, in the as-moulded condition, it defines an acute angle with the adjacent portion of the side wall of the

piston 41 of from about 30° to about 50°, more preferably about 40°. Desirably, each of the vanes in the sets 46 and 47 is moulded so that it is slightly oversize as compared with the inside diameter or bore of the container body 1 i.e. when inserted in the body 1, it reacts with the inner surface of the side wall of the body 1, and is under a slight inwardly-directed compressive stress.

Typical examples of viscous fluids 44 to be dispensed include caulking materials. The product will usually have a viscosity of at least 20 cp at 20°C, more usually greater than 50 cp. Viscosities of 2000 cp and above are contemplated for some of the more viscous caulking materials which may be dispensable with the preferred arrangements.

Claims

1. A pressurized fluid dispensing container having a rigid, hollow cylindrical body, top and bottom end walls, a diaphragm means positioned between said end walls, thereby defining an upper fluid product chamber and a lower propellant charge chamber, said top end wall having an opening provided with a dispensing valve, said bottom end wall defining a propellant fill opening and having a sealing means in said fill opening, said sealing means comprising a closed-end blind rivet having undergone radial expansion upon actuation from the outside of the bottom end wall and thereby forcing the perimeter of the body and the head of said rivet into tight sealing arrangement with the bottom end wall.

2. A pressurized fluid dispensing container as claimed in claim 1 wherein the diaphragm means comprise a piston, snugly fitting the cylindrical body of said container.

3. A container as claimed in claim 1 or 2 wherein the bottom end wall is of steel and the closed-end blind rivet body comprises a substance softer than steel, (preferably aluminium).

4. A container as claimed in any preceding claim including a thin film of cured resin forming a seal between the rivet and the propellant fill opening.

5. Method for manufacturing the container of claim 1 wherein a cup-shaped sealing enclosure is applied with its rim forming a gas-tight seal to the bottom end wall of the container, propellant is passed through the enclosure to the propellant chamber through the fill opening, and a rivet gun supported within the enclosure is moved upwardly to introduce the rivet into the fill opening and is operated to actuate the rivet.

6. A pressurized fluid dispensing container having: a hollow cylindrical body; top and bottom end walls; said top end wall having an opening for a dispensing valve; and a free-floating piston slidable vertically within the body having a generally cylindrical relatively rigid side wall provided with upper and lower relatively resiliently flexible annular vanes sealing between the side wall of the piston and the inner side of the body, said vanes being relatively thin compared to the material of the cylindrical side wall, the upper vane inclining upwardly away from the piston outwardly toward the body and the lower vane inclining downwardly away from the piston outwardly toward the body, the length of the side wall of the piston engaging the container body preferably being at least half the diameter of the piston.

7. A container as claimed in claim 6, wherein the upper and lower vanes are each adjacent the upper end of the piston, the side wall of the piston below the vanes preferably having apertures through it.

8. A container as claimed in claim 6 or 7 having said valve secured in the opening in the top wall and the space between the top wall and the piston filled with a fluid product (preferably of viscosity of at least 20 cp at 20°C) dispensible through the valve.

9. A container as claimed in any of claims 6 to 8, having a pressurized fluid propellant entrapped in the space between the piston and the bottom end wall, and capable of dispensing the product through the valve on actuation thereof.

10. A container as claimed in any of claims 6 to 9, wherein each vane defines an angle of about 30°C to about 50° (preferably about 40°) with the adjacent portion of the piston side wall.

11. A container as claimed in any of claims 6 to 10, wherein the piston has a second resiliently flexible upper vane adjacent and parallel to the first mentioned upper vane and a second resiliently flexible lower vane adjacent and parallel to the first mentioned lower vane.

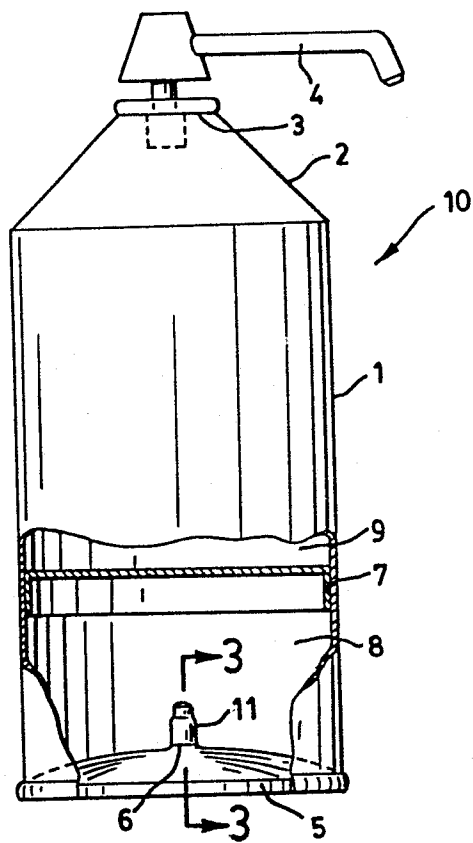


FIG. 1

FIG. 2

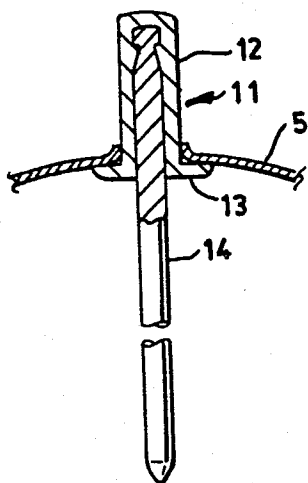


FIG. 3

