United States Patent

Perry et al.

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[54] **SLITTED RESILIENT CLOSURE HAVING SUBSTANTIALLY RIGID CAP**

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[52] **U.S. Cl.** **222/212**

[51] **Int. Cl.** **B65d 35/08**

[58] **Field of Search** 222/490, 494, 562, 212, 213, 222/512, 107, 511, 558; 215/41

[56] **References Cited**

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[57] **ABSTRACT**

A dispenser tube having an elastically resilient closure at one end is described. This closure has a normally closed slit that elastically deforms into a marquise shape in response to internal pressure in the container to permit a viscous fluid therein to be dispensed through the slit. A rigid removable cap is provided over the closure. Detents on the side walls of the closure adjacent the slit hold the cap in place. The walls on which the detents are mounted are elastically resilient so as to be forced outwardly in response to internal pressure in the container for tightly retaining the cap, and are elastically deformable inwardly to permit cap removal when desired.

10 Claims, 8 Drawing Figures

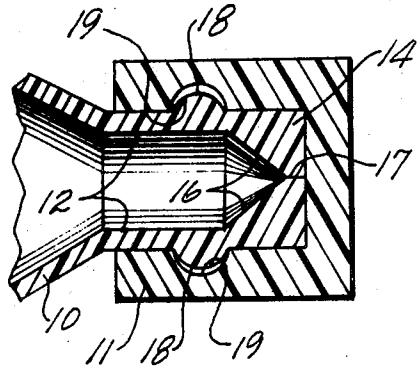


FIG. 1

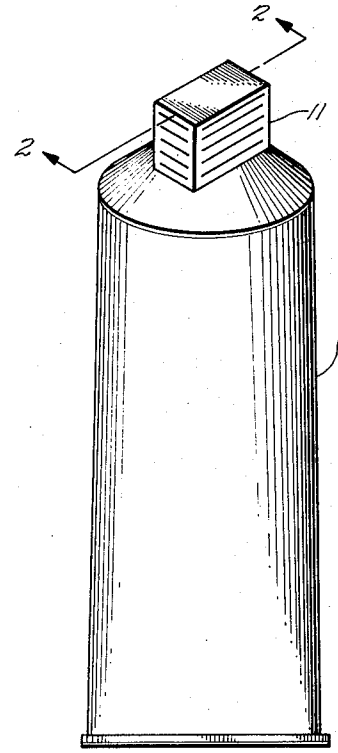


FIG. 2

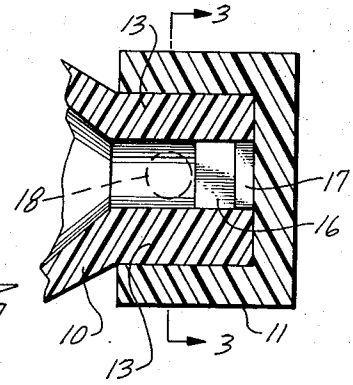


FIG. 3

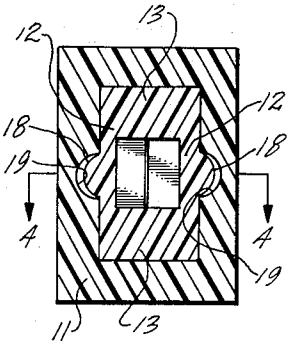


FIG. 4

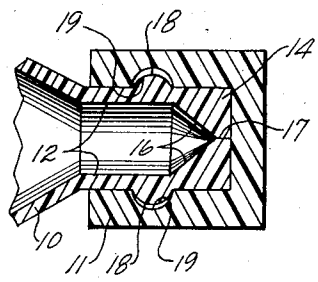


FIG. 6

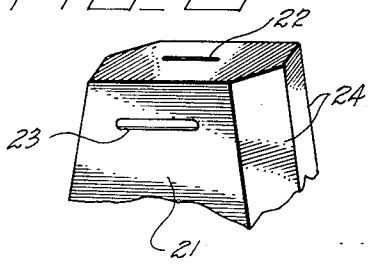


FIG. 7

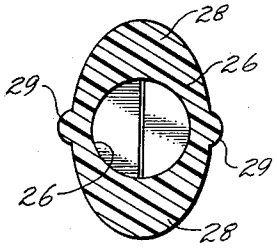


FIG. 5

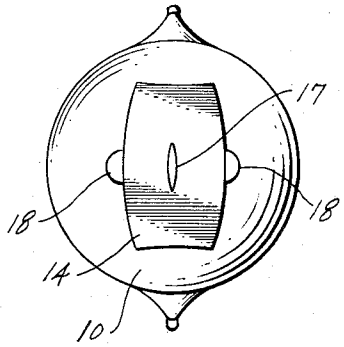
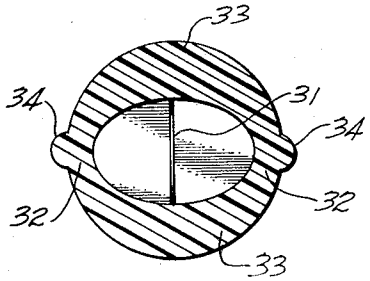


FIG. 8



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SLITTED RESILIENT CLOSURE HAVING SUBSTANTIALLY RIGID CAP

BACKGROUND

Many viscous materials, such as toothpaste, shampoos, hand cream, lotions, shoe polish, and similar pastes and liquids, are packaged in collapsible tubes from which they are dispensed by squeezing the tube or collapsing the walls thereof. A broad variety of closures for such tubes have been proposed, and the most satisfactory to date has been a simple open aperture at one end with a screw cap over the aperture. This has proved satisfactory for many applications; however, in some circumstances it is desirable to leave a tube open for quick and repeated use without continually installing and removing the cap. If the material contained in the tube has volatile solvents, evaporation can be prevented only by keeping the cap in place. Similarly, if the liquid in the tube has low viscosity, it may flow from the tube when laid on its side unless the cap is kept in place.

It has been proposed to employ a slit rather than a large opening for closing such tubes, however, this alone is often unsatisfactory since long-term storage may permit solvent evaporation and consequent plugging of the small slit. A threaded cap can be placed over such a closure, and is useful in some arrangements. It is preferred, however, to employ the simpler arrangement if at all possible.

BRIEF SUMMARY OF THE INVENTION

There is, therefore, provided in practice of this invention according to a presently preferred embodiment a pressurizable dispenser for viscous fluids having an elastically resilient closure deformable from a normally closed position to an open position in response to internal pressure. A cap is provided for the closure, which also further comprises elastically resilient means for retaining the cap on the closure in response to internal pressure and enabling removal of the cap in the absence of internal pressure.

DRAWINGS

These and other features and advantages of the present invention will be appreciated as the same becomes better understood by reference to the following detailed description of a presently preferred embodiment when considered in connection with the accompanying drawings wherein:

FIG. 1 illustrates in perspective a collapsible tube having a closure constructed according to principles of this invention;

FIG. 2 is a longitudinal cross section through the closure portion of the tube of FIG. 1;

FIG. 3 is a transverse cross section through the closure portion of the tube of FIG. 1;

FIG. 4 is another longitudinal cross section through the closure portion of the tube of FIG. 1;

FIG. 5 is an end view of the closure portion of the tube of FIG. 1 elastically deformed for dispensing;

FIG. 6 illustrates in perspective a fragment of another embodiment of elastic closure;

FIG. 7 illustrates in transverse cross section another embodiment of container closure; and

FIG. 8 illustrates in transverse cross section another embodiment of elastic dispenser closure.

DESCRIPTION

FIG. 1 illustrates in perspective a typical collapsible tube **10** which may, for example, be made of aluminum or plastic material sufficiently flexible that the walls of the tube are collapsible for pressurizing the contents and squeezing them out of the end of the tube. Such tubes are commonly employed for toothpaste, shoe polish, shampoo, glue, lotions, and similar viscous liquids and pastes. The bottom end of the tube is closed in a conventional manner and the opposite end has a closure constructed according to principles of this invention and, as illustrated in FIG. 1, covered by a rectangular cap **11**. The cap **11** is preferably made of a substantially rigid plastic material. Note that in this context the term plastic refers to synthetic polymers and the like commonly known as plastics rather than the mechanical properties of material subject to non-elastic flow. Elastic, as used hereinafter, however, refers to the mechanical properties of the materials of construction even though these may be in the vernacular, "plastic" materials.

FIGS. 2, 4, and 3 illustrate in two longitudinal cross sections and one transverse cross section, respectively, the dispensing end of the tube **10** with the cap **11** in place. The dispensing end in this preferred embodiment has a rectangular external cross section and a rectangular internal cavity defined by a first pair of opposed side walls **12** and a second pair of opposed side walls **13** perpendicular to the other side walls **12**. The first pair of side walls **12** are relatively thinner than the second pair of side walls **13** for reasons that will become apparent hereinafter. The end of the closure is formed by an end wall **14** which is substantially flat on the exterior portion and has a V shape on the inside portion having diagonal surfaces **16** tapering from the thinner side wall **12** to an apex in the center of the end wall. A slit **17** extends from the interior apex between the diagonal walls **16** and the flat exterior surface of the end wall **14** for providing fluid communication between the interior of the tube **10** and the exterior. The slit **17** is formed so as to be normally closed with its two sides in tight engagement for inhibiting flow of fluids therefrom.

Formed on the exterior of the thinner side walls **12** are a pair of raised detents **18**. Each of the detents **18** fits into a complementary detent dimple **19** on the interior surface of the rigid cap **11**.

FIG. 5 illustrates in end view the closure of the tube **10**, with the cap removed, and in a situation where the tube is squeezed to raise the internal pressure therein and within the internal cavity of the closure. This internal pressure causes the relatively thinner sides **12** to bulge outwardly thereby opening the slit **17** into a marquise shape for permitting flow of the liquid or paste within the tube to the exterior. In the absence of pressure within the tube, the relatively thicker side walls **13**, combined with the elastic forces of the relatively thinner side walls **12**, close the slit **17** so that evaporation of solvents is greatly inhibited and flow of liquids or pastes through the slit is prevented.

When the cap **11** is in place on the dispenser, squeezing of the tube **10** tends to bulge the relatively thinner side walls **12** outwardly; however, they engage the rigid cap and are prevented from moving any substantial distance and the slit **17** is thereby maintained in a closed position. The outward pressure on the thinner

side walls **12** effectively retains the raised detents **18** in the complementary dimples or detents **19** so that removal of the cap off of the end of the closure is prevented.

When it is desired to install or remove the cap **11**, it is merely pressed on or pulled off, and the relatively thinner side walls **12** elastically deflect inwardly to permit the detents **18** to pass out of the dimples **19** in the cap. Here again, the relatively thicker end walls **13** are advantageous for inhibiting bulging of the walls perpendicular to the slit, which might bind the cap in place.

Thus, it is seen that when the cap **11** is in place, accidental pressure on the tube **10** more tightly locks the cap in place because of the elastically resilient side walls on which the detents are mounted. This provides a positive prevention of extrusion of the tube contents in case of accidental pressure on the tube. The elastically resilient relatively thinner side walls **12** also permit a substantially rigid cap to be installed and removed with facility. In the absence of the pressure responsive detents for holding the cap in place increasing pressure within the tube would eventually force the cap off. In the illustrated embodiment, on the other hand, increasing pressure within the tube actually serves to hold the cap on more securely and thereby effectively prevent accidental discharge of fluids.

Many modifications and variations can be made in the illustrated embodiment as will be apparent to one skilled in the art. Thus, the thicknesses and sizes of the various elements of the closure can be adjusted to accommodate different elastic properties in the materials of construction, and different properties of the fluid or paste contained in the tube. The closure need not be used on a collapsible tube but can be employed on any pressurizable dispensing vessel or conduit. The size, that is, length and thickness from the exterior of the tube to the interior of the slit **17**, can also be adjusted for proper operation with materials of differing elastic properties and viscosities. In the embodiment hereinabove described and illustrated the outside of the end wall is maintained substantially flat; however, it will be apparent that this end wall may be crowned in a prism shape, a truncated cone, or other convenient shape as may be desired.

FIG. **6** illustrates in perspective a fragment of a closure constructed according to principles of this invention, and having some variations from the embodiment illustrated in FIG. **1**. In the embodiment illustrated in FIG. **6**, the closure has opposed relatively thinner side walls **21** on sides thereof parallel to a dispensing slit **22** on the end of the closure. A ridge **23** on the relatively thinner side wall **21** serves as a detent for retaining a cap (not shown) in place over the closure. Opposite the ends of the slit **22** are side walls **24** which are each formed of a pair of faces so that a cross section through the closure has an elongated hexagonal shape. This is advantageous in requiring less material than a rectangular cross section without sacrificing any substantial elastic deformation properties of the tube closure. It will also be noted that the side walls **21** and **24** diverge slightly so that the closure is relatively narrow near its tip and relatively broader near its base, and with such construction, gradual tapering into the end of a tube can readily be provided. Despite these modifications in the shape of the elastically resilient closure, the operating characteristics are substantially the same as those in the hereinabove described embodiment.

FIG. **7** illustrates in transverse cross section another embodiment of elastically deformable dispenser closure. As illustrated in this arrangement, the exterior of the elastic closure has an elliptical cross section, and the interior has a substantially circular cross section. The slit **27** is parallel to the major axis of the external elliptical cross section. The cooperation of these two interior and exterior cross sections results in a pair of opposed relatively thinner side walls **26** approximately parallel to a dispensing slit **27** in the end wall of the dispenser. In addition to the relatively thinner side walls **26** the two cross sections form relatively thicker side walls **28** adjacent the ends of the slit. A pair of domed detents **29** on the relatively thinner side walls **26** are pressure responsive for retaining or releasing a cap in the same manner as hereinabove described.

FIG. **8** illustrates still another embodiment of elastically resilient closure constructed according to principles of this invention. As illustrated in this embodiment, the closure has an external shape in the form of a circle, and an internal shape in the form of an ellipse. A dispensing slit **31** is provided in the direction of the minor axis of the ellipse. The external circle and internal ellipse cooperate to define a pair of opposed relatively thinner side walls **32** on the sides approximately parallel to the principal extent of the slit **31**. These shapes also cooperate to define a pair of relatively thicker side walls **33** at the ends of the slit. A pair of domed detents **34** are formed on the relatively thinner side walls **32** for cooperation with a cap (not shown) in the same manner as hereinabove described. The embodiment illustrated in FIG. **8** having a circular external shape has one advantage over the other embodiments hereinabove described and illustrated. With a circular shape, the cap can be provided with an internal groove for meeting with the detents **34**, and thereby the cap is made insensitive to orientation and can be snapped into position with a simple ON-OFF motion without regard to alignment with the closure.

Although limited embodiments of elastically resilient closure having pressure responsive means for retaining a cap have been described and illustrated herein, many modifications and variations will be apparent to one skilled in the art. Thus, for example, such a tip may be employed in conjunction with a pressurized container such as commonly referred to as an aerosol dispenser. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

WHAT IS CLAIMED IS:

1. A combination comprising:

a pressurizable container for viscous fluids;

an elastically resilient closure on said container deformable from a normally closed position to an open position in response to internal pressure in the container comprising

an end wall;

a normally closed elongated slit in the end wall;

a pair of opposed relatively thicker side walls adjacent ends of the slit; and

a pair of relatively thinner side walls adjacent sides of the slit, said side and end walls being formed of elastically resilient material;

a substantially rigid cap for said closure; and

elastically resilient means for retaining the cap on the closure in response to internal pressure in the container and enabling cap removal in absence of internal pressure comprising:

detent means on the relatively thinner side walls; and

complementary detent means in the cap for engagement with the detent means on the side walls.

2. A combination as defined in claim 1 wherein the side walls cooperate to define a substantially rectangular exterior for the closure and wherein the cap has a substantially rectangular interior portion to fit thereover.

3. A combination as defined in claim 1 wherein the side walls cooperate to define a substantially elliptical exterior on the closure and a substantially circular interior on the closure, the major axis of the ellipse being parallel to the slit.

4. A combination as defined in claim 1 wherein the side walls cooperate to define a substantially circular exterior on the closure and a substantially elliptical interior on the closure, the minor axis of the ellipse being parallel to the slit.

5. A dispenser closure comprising:

an elastically resilient container closure having an interior cavity in fluid communication with a container comprising:

first and second sidewall portions on opposite sides of the interior cavity;

third and fourth side wall portions on opposite sides of the interior cavity and sufficiently thin to be elastically deformable in response to fluid pressure in the container;

an end wall portion at an end of the cavity, said four side walls and end wall cooperating to form a closure, said end wall comprising a normally closed elongated slit extending through the end wall from the interior cavity to the exterior of the closure and elongated in a direction transverse to the first and second side wall portions; and

detent means on the third and fourth wall portions; and

a substantially rigid cap fitable sufficiently closely over the exterior of the wall portions to prevent substantial outward elastic deformation of the third and fourth side wall portions and including detent means complementary to the detent means on the closure for inhibiting removal of the cap from the container closure.

6. A dispenser closure comprising:

an elastically resilient container closure having an interior cavity in fluid communication with a container comprising:

first and second sidewall portions on opposite sides of the interior cavity;

third and fourth side wall portions relatively thinner than the first and second side wall portions on opposite sides of the interior cavity and sufficiently thin to be elastically deformable in response to fluid pressure in the container;

an end wall portion at an end of the cavity, said four side walls and end wall cooperating to form a closure, said end wall comprising a normally closed elongated slit extending through the end wall from the interior cavity to the exterior of the closure and elongated in a direction transverse to the first and second side wall portions; and

detent means on the third and fourth wall portions; and

a substantially rigid cap fittable sufficiently closely over the exterior of the wall portions to prevent substantial outward elastic deformation of the third and fourth side wall portions and including detent means complementary to the detent means on the closure for inhibiting removal of the cap from the container closure.

7. A dispenser closure as defined in claim 6 wherein the first, second, third and fourth side wall portions form a substantially rectangular exterior on the closure.

8. A dispenser closure as defined in claim 6 wherein the first, second, third and fourth wall portions define a substantially circular interior cavity and a non-circular exterior on the closure.

9. A dispenser closure as defined in claim 6 wherein the first, second, third and fourth wall portions form a substantially circular exterior on the closure and a non-circular interior cavity.

10. A dispenser closure as defined in claim 6 wherein the detent means comprises a raised region on each of the third and fourth wall portions and the detent means in the cap comprises a recessed region complementary with the raised regions on the wall portions.

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