United States Patent

Heffran

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[54] **VENTED CLOSURE**

[72] Inventor: **Vernon C. Heffran,** 541 Loomis Drive, Perrysburg, Ohio 43551

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[51] **Int. Cl.** **B65d 41/60**

[58] **Field of Search**.....220/44 R, 44 A, 44 C, 54; 215/40, 41, 42, 46 A, 56

[56] **References Cited**

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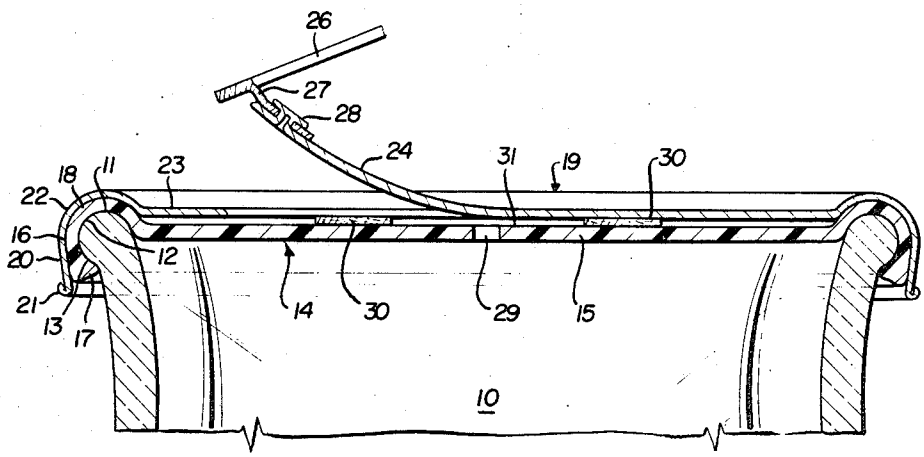
Primary Examiner—George E. Lowrance
Assistant Examiner—Stephen Marcus
Attorney—J. R. Nelson and E. J. Holler

[57] **ABSTRACT**

This disclosed invention is a composite closure for a hermetically sealed container consisting of an elastomeric liner cap and a metal convenience opening outer cap. The liner cap has a central vent aperture and surrounding the vent the outer surface of the liner cap is adhesively attached or bonded to the metal cap in an annularly banded area. In a pressure package, the sealed area around the vent is pressurized and upon opening, the tearing action of the tear strip device of the outer cap also separates the bond of the adhered band venting the container to atmosphere. In vacuum packages, the opposite is true, i.e. the area inside the bonded band is vacuumized and upon tear strip opening, the container is vented to atmosphere to release the vacuum.

16 Claims, 3 Drawing Figures



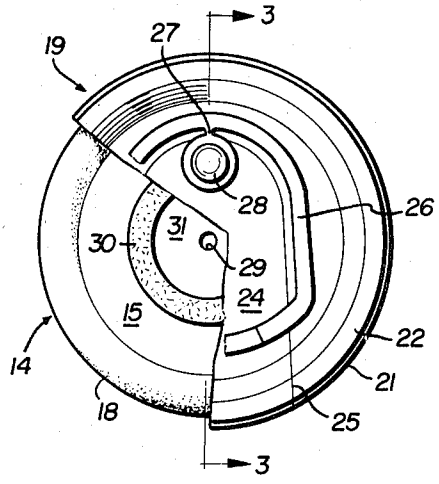


FIG. 1

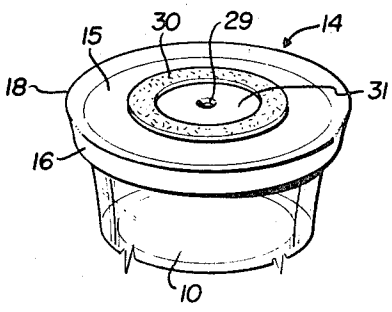


FIG. 2

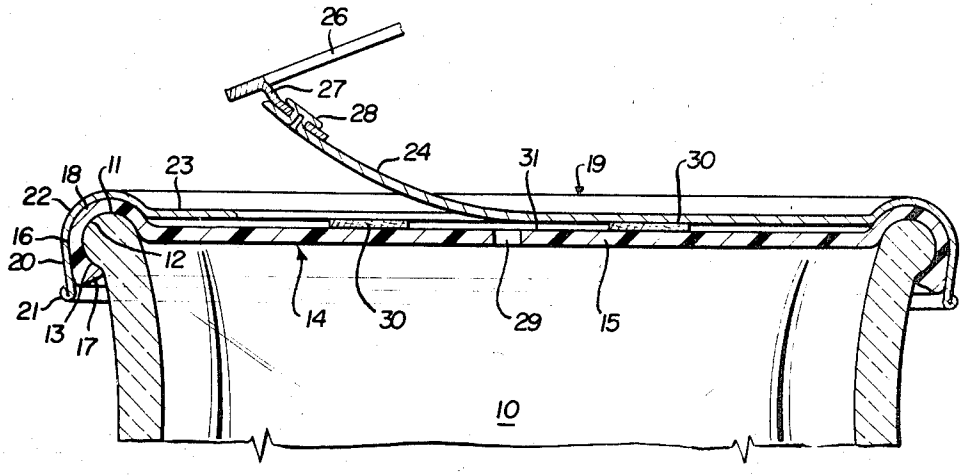


FIG. 3

INVENTOR.
VERNON C. HEFFRAN.
BY
J. R. Nelson and E. J. Haller
ATT'YS.

VENTED CLOSURE

BACKGROUND OF THE INVENTION

The invention relates to convenience type closures for hermetically sealed containers, sometimes called "easy-open" closures, wherein a pressure differential exists between exterior and interior of the container.

In closures for this type of packaging it is desirable to provide a means for venting the differential pressure to atmospheric pressure thereby equalizing internal and exterior pressures. The venting is most desirably and beneficially achieved at the initial stages of opening the closure on the package. Vent means have been provided on packages of this type, as exemplified in U. S. Pat. No. 3,480,173 to J. M. Wheaton; however the center vented liner cap is free of attachment of the outer cap in the top or mouth area of the cap and any fracture or imperfect seal of the metal outer cap on the container will result in premature venting (sometimes referred to as "leakers"). Also, the venting action is improved by the present invention, in that the differential in pressure is distributed over a wider area between liner and cap.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a convenience opening closure having an outer cap and liner cap with a vent aperture in the liner and means surrounding the vent aperture and spaced therefrom sealingly attaching the liner to the underside of the outer cap. This structure overcomes the premature venting problem and provides improved venting action especially for pressurizable products in the container.

Another object of the invention is to physically unite the liner cap and outer cap for unitary handling and assembly of the closure.

A further object of the invention is to provide an improved vented closure in a unitary assembly that is simple, easy to manufacture and assemble and reliable in sealing the container for its intended packaging usage.

Other objects will be apparent to persons skilled in the art from the drawings in the disclosure of the invention and the detailed description thereof which follows.

DESCRIPTION OF THE DRAWINGS

On the drawings:

FIG. 1 is a top plan view, partly broken away, of the closure of the invention.

FIG. 2 is a perspective view of the liner cap portion of the closure assembled on a mouth finish of a glass container.

FIG. 3 is a sectional elevational view taken along line 3—3 on FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the closure assembly according to the present invention is illustrated as employed on a glass container **10**. A mouth of the container is defined by a top rim or bead **11** having an enlarged side wall flange portion **12** that is tapered downwardly and inwardly along the underside surface **13**.

The inner part of the closure comprises an inner liner cap **14** made of a plastic material, preferably a thermoplastic such as polyvinyl chloride (PVC), polystyrene, polypropylene, A.B.S. plastic, and polyethylene. Liner cap **14** includes a disc-like top panel portion **15** covering the mouth area inside of rim **11**. Liner cap **14** is retained on the finish bead **11** by a radial skirt portion **16** that has its smallest internal diameter somewhat less than the exterior diameter under the bead **11** (such as at surface **13**) by the enlarged flange portion **17**. The flange **17** will seal against the bead undersurface **13** and along the rim **11**. Skirt **16** of the liner cap is integrally joined with the periphery of the top panel portion **15** at corner radius portion **18**, and, as is illustrated on FIG. **3**, the combination of skirt **16** and corner radius **18** forms a groove receiving the rim bead **11** of the container finish in hermetically sealing the mouth area of the container **10** along the aforementioned top and side sealing surfaces **11** and **13**. Sealing is achieved by retaining forces of the capped outer cap, to be presently described.

The outer cap member **19** of the closure is constructed of metal, such as aluminum or tin plate of appropriate gauge or thickness, adapted to be crimped or secured around bead **11** of the container finish and sealingly attach the liner cap **14** and cap member **19** together about the container mouth. Outer cap **19** has a peripheral skirt **20** ending in an rolled lower edge or wire **21**. The upper part of skirt **20** blends with corner radius portion **22** and it in turn is integrally joined with the periphery of top panel **23**. An integral tear strip **24** is formed in top panel **23**, extending across corner radius **22** and skirt **20** by a continuous score line **25** (see FIG. **1**), such as in the illustrated looped or U-shaped configuration. Score line **25** is formed by working the metal to reduce the thickness along a line, or the score may be made by any means that will otherwise enhance shear properties of the metal along the line such that tear strip **24** may be peeled off the outer closure by an opening pull ring or tab **26**. The score line is usually formed by a die while the metal of the closure is in flat blank form. Also, while in flat or sheet form, various coatings and decoration or printing is made to the metal. One of these coatings of a polymer composition is placed on the underside surface of the metal blank for cap **19**. This coating in the function of the present invention will be presently described.

Score line **25** extends from the base of skirt **20** across the corner radius **22** in two spaced legs or lines which merge beyond the center of the top panel **23** of the cap. A ring pull member **26** has a yoke portion **27** fastened to the inner end of tear strip **24** by the integral rivet **28** in the segment of the metal within the score line **25**. The integral rivet **28** in the top panel **23** is flattened (riveted) over yoke **27** of the pull ring.

The inner liner cap **14** has a central vent means at aperture **29**. Spaced radially from aperture **29** is an annular band area **30** encircling vent **29** in which the upper surface of top portion **15** of the plastic liner cap is sealingly attached or bonded to the underside surface of the top panel portion **23** of the outer metal cap **19**. This means of attaching or bonding the two panel portions **15** and **23** to each other will be further discussed in connection with the exampies appearing hereinafter. It should be understood that for purposes of illustration the thickness of the band area seal **30** is distorted relative to the thickness of the other adjacent parts of the

cap. The inner and outer caps of the closure are sealed in the encircling band area about the vent to provide a volume or space **31** for equalization of pressure from inside the container to an area under the top of the outer cap. The bond between the plastic top portion **15** and the overlying metal top portion **23** should be low in peel strength and high in shear strength. This allows a good seal around the band area **30** and accomodates the function of tearing or peeling the metal tear strip **24** of the outer cap upon opening of the closure. As the tear strip is initially ruptured in the outer cap **19**, pressure condition (either positive pressure or vacuum) is retained inside space **31** and in the head space of container **10** below liner cap **14**. As the intersecting tear strip progresses its severance through the circular band area **30**, the space **31** is gradually and progressively vented to atmosphere. Almost instantaneously, the remainder of the container space (head space above the packaged product) is suitably vented to atmosphere so that during tear strip removal the vapor pressure of hermetically sealed containers is equalized. Premature venting in the opening and leakers are overcome by the described concepts of the closure of this invention.

The following are some examples of construction of the bonded band area **30** in the closure.

EXAMPLE I

The outer cap **19** shown on the drawings is formed from a sheet of aluminum which has pre-coated on the under surface a layer of emulsion of a vinyl copolymer adhesive. The adhesive is a vinyl chloride, vinyl acetate solution type copolymer which after it is applied as a coating is cured to a film on the metal surface. The closure is next blanked, scored and the pull ring **26** is attached after forming the integral rivet in a series of dies. The closure is then shaped in dies to the form shown on the drawings. The inner liner cap **14** is molded from a polyvinyl chloride (PVC) plastic to the shape shown on the drawings. Liner cap **14** is nested inside outer metal cap **19** held in a base die and a sealing shoe plunger is moved into contact with the inner or under surface of the liner cap. The shoe plunger has a raised die surface corresponding to the location and area of the annular band area **30** (see FIG. **2**). This area of the plunger is pressed onto the liner panel **15** holding it firmly and intimately in contact with the metal cap, i.e., the outer surface at top portion **15** in this area (like **30**) is firmly in contact with the coating layer on the inside surface of the metal in top panel **23**, **24**. The base die is heated to a temperature in the 350°–370° F range and this pressing contact by plunger and die is maintained on the order of one second. This thermally activates the copolymer film in the area where heat is intimately applied with the shoe pressure and thereat forms an adhesive bond between metal and plastic. The plunger pressure (press) is on the order of 30 p.s.i. (line pressure for plunger actuator). The resultant of this procedure produces a firmly bonded area between liner and metal cap corresponding to area **30** on the drawings which in tests indicate a bond having characteristics of high shear strength and relatively low peel strength for purposes of pressure retention and tear strip removal function. Sealed containers in test indicated hermetic seal of the closure at 120 p.s.i. internal pressure.

EXAMPLE II

The liner cap **14** and the metal outer cap **19** of Example I are formed in the manner described and a band area as **30** on the drawings of a pressure sensitive adhesive material is applied to the liner cap **14** prior to assembly. The liner cap **14** is nested and assembled and pressed by the die and plunger of Example I, except that this being a pressure sensitive adhesive, the heat of the base die was not utilized, i.e., the base die left at approximately room temperature. The resultant closure indicated a firmly bonded seal in the area **30** of the drawings (see FIG. **2**) that retains a hermetic seal under pressure.

EXAMPLE III

The liner cap **14** and outer metal cap **19** of Example I are used, except that the coating of polymer on the metal cap was not applied. Instead, an annular band, like **30** on FIG. **2**, of a hot melt adhesive composition is printed onto the liner cap top surface **15**. (Alternatively, the band could be printed on the underside of metal outer cap **19**). The liner cap **14** is nested in outer cap **19** and supported by a base die. The shoe plunger is lowered into liner cap **14** so as to press the annular area corresponding to **30** on the drawings in the liner cap and the base die is heated to the order of 280°–300° F. In the resultant closure, the annular band of hot melt adhesive is activated to intimately bond the liner and outer caps in the area **30**.

EXAMPLE IV

The liner caps are molded, respectively, from polyethylene, polypropylene, polystyrene and A.B.S. plastics. Outer caps **19** are fabricated in accordance with Example I, except that the underside coating used is an ionomer, duPont's Surlyn "A," applied as an emulsion. The Surlyn "A" is a form of adhesive forming thermoplastic, and more specifically is an alkali-metal containing ionic copolymer that is the reaction product of 80–99 mole per cent of ethylene and 1–20 mole per cent of an unsaturated monocarboxylic acid, i.e., an acrylic acid or methacrylic acid, in which at least about 10 mole per cent of the carboxyl groups are neutralized with an alkali metal ion, preferably sodium; more preferably, an ionic copolymer with about 1–10 mole per cent (for example, about 4 mole per cent) of the unsaturated carboxylic acid in which 35–40 mole per cent of the carboxyl groups are neutralized.

Another form of adhesive forming thermoplastic material is the hot melt adhesives of well known varieties.

The liner caps of each of the mentioned materials are processed in assembly in the same manner as described under Example I. The resultant products indicated a firm heat bonded area between plastic and metal in the band area **30** shown on the drawings, and which retain an hermetic seal under pressure.

The various Examples illustrate the closure of the present invention may be assembled and produced readily using a wide range of plastic materials in the liner cap, and the encircling seal attachment of the liner cap and metal cap about the vent aperture may be accomplished by a number of means, i.e. pressure sensitive adhesives, hot melt adhesives or heat bonding via several different coatings or laminate compositions.

While a number of specific examples of the invention have been described, it should be apparent that various other modifications could readily be made. Further, specific elements of the described embodiments could readily be combined in different configurations than those illustrated without departing from the spirit of the invention.

Accordingly, while preferred embodiments have been illustrated, it should be understood that it is not intended the invention be necessarily restricted solely thereto, but I intend to include all embodiments thereof which would be apparent to those skilled in the art, and which come within the spirit of the scope of my invention set forth in the appended claims.

I claim:

1. A closure for sealing the mouth opening of a container for a pressurizable product, said mouth being formed by a finish rim of the container, comprising a liner cap having a disc-like portion covering the mouth opening of the container, said liner being comprised of an elastomeric material, a vent means in the central area of said disc-like portion for conducting pressurized media from within the container, an outer cap having a top portion overlying the disc-like portion of said liner cap and a radial annular integral skirt portion surrounding the finish rim and securing the closure on the container, means sealing the outer surface of said disc-like portion to the underside of the outer cap in an endless configuration extending around said vent means, and a rupturable, convenience-opening tear strip formed in said top portion of the cap and extending through said ring of the attaching means for liner and outer caps.

2. The closure defined in claim 1, wherein said sealing means comprises a ring pattern of adhesive encircling the vent means in the disc-like portion of said liner cap.

3. The closure defined in claim 2, wherein the liner cap elastomeric material is a polymer and the outer cap is comprised of aluminum.

4. The closure defined in claim 3, wherein the adhesive comprises a vinyl chloride, vinyl acetate copolymer.

5. The closure defined in claim 4, wherein the copolymer adhesive is a coating on the underside of the aluminum outer cap top portion and said ring pattern encircling the vent means is a ring band of said copolymer that is activated by heat to sealingly bond an annular band area of the metal top portion and liner cap disc-like portion together, said bonded area being relatively high in shear strength and relatively low in peel strength.

6. The closure defined in claim 5, wherein said polymer is poly vinyl chloride.

7. A closure for sealing the mouth opening of a container for a pressurizable product, said mouth being formed by a finish rim of the container, comprising a liner cap having a disc-like portion covering the mouth opening of the container, said liner being comprised of an elastomeric material, a vent means in the central area of said disc-like portion for conducting pressurized media, an outer cap having a top portion overlying the disc-like portion of said liner cap and a radial annular integral skirt portion surrounding the finish rim and securing the closure on the container, an adhesive forming thermosplastic bonding the outer surface of said disc-like portion and the underside of the outer cap in an endless, band-like configuration around said vent means, and a rupturable, convenience-opening tear strip formed in said top portion of the outer cap and extending through said band of the bonding adhesive.

8. The closure defined in claim 7, wherein said adhesive forming thermoplastic comprises an alkali-metal containing ionic copolymer.

9. The closure defined in claim 8, wherein the liner cap elastomeric material is a polymer and the outer cap is comprised of aluminum.

10. The closure defined in claim 9, wherein said polymer is polyethylene.

11. The closure defined in claim 9, wherein said polymer is polypropelene.

12. The closure defined in claim 9, in which a coating of said copolymer is applied to the undersurface of the outer cap and heat bonded to seal the outer cap and liner cap together throughout said band-like configuration and encircling the vent means of said liner cap.

13. The closure defined in claim 8, wherein said elastomeric material is A.B.S. plastic.

14. A closure for sealing the mouth opening of a container pressurizable to a differential pressure, said mouth being defined by an annular rim, comprising a metal outer cap having a mouth covering portion and a radial integral skirt portion surrounding said rim and securing the closure on the container, a tear strip removal device formed in said metal cap and extending through at least a part of said mouth covering portion, a liner cap of plastic material adapted to telescope over said rim and underlying the metal outer cap, said liner cap having a top portion covering said rim and an annular, integral, radial skirt, a vent aperture through said top portion, and an annular band of an adhesive forming thermosplastic bonding the outer surface of said top portion and the underside of said mouth covering portion disposed around said vent aperture, the tear strip in said latter-mentioned portion extending across said band, said band area providing a sealed space around said aperture receiving pressure from said aperture equal to pressure in the closed container, whereby removal of the tear strip progressively vents said space and said aperture to atmosphere.

15. The closure defined in claim 14, wherein the adhesive forming thermoplastic is a vinyl chloride, vinyl acetate copolymer.

16. The closure defined in claim 14, wherein the adhesive forming thermoplastic is an alkali-metal containing ionic copolymer.

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