United States Patent

Kinney

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[54] COMBINED CONTAINER AND CLOSURE

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[73] Assignee: **Phillips Petroleum Company**

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[52] **U.S. Cl.** ..... **220/60 R**, 220/44 R, 220/97 C

[51] **Int. Cl.** **B65d 43/10**, B65d 51/16

[58] **Field of Search** ..... 220/60 R, 97 C, 97 F, 44 R; 229/1.5 B, 43

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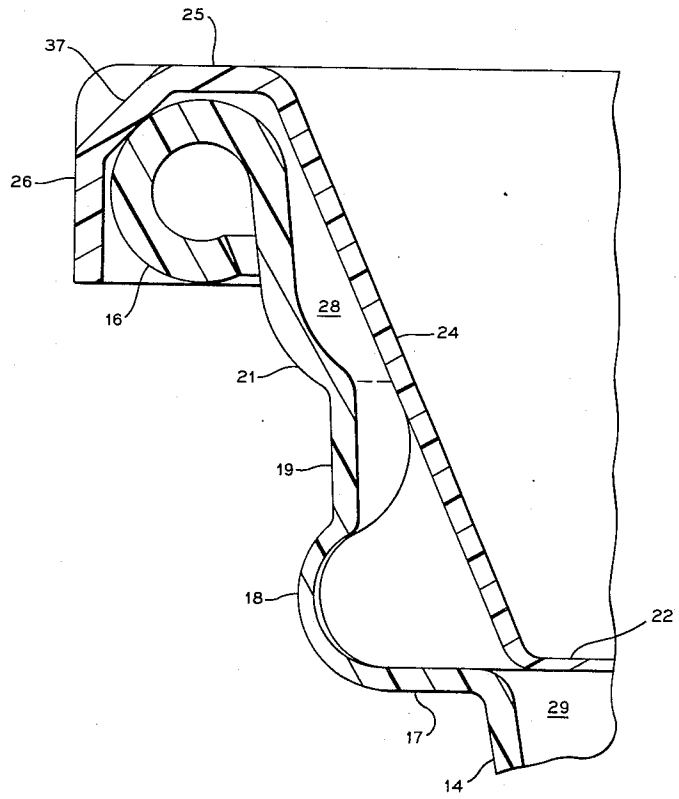
[57] **ABSTRACT**

A container having a closure retention groove is combined with a closure having a retention bead. The closure is formed so that the portion of the closure between the closure rim and the retention bead grips the portion of the container between the retention groove and the container rim to secure the closure to the container and to form a sanitary seal along the container rim. The retention bead can be interrupted at spaced locations to provide continuous fluid access between the packaging space and the annular space between the closure side wall and the corresponding portion of the container. Indentations can be formed at the junction of the rim and outer skirt of the closure to act as camming surfaces against the curvature of the container rim to raise the closure rim up from the container rim whenever excessive pressure occurs in the container, to thereby vent the container.

9 Claims, 8 Drawing Figures



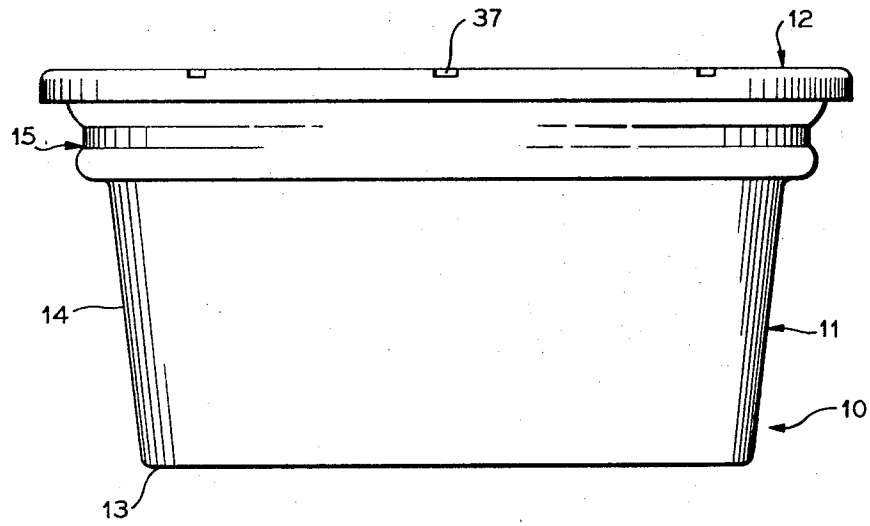


FIG. 1

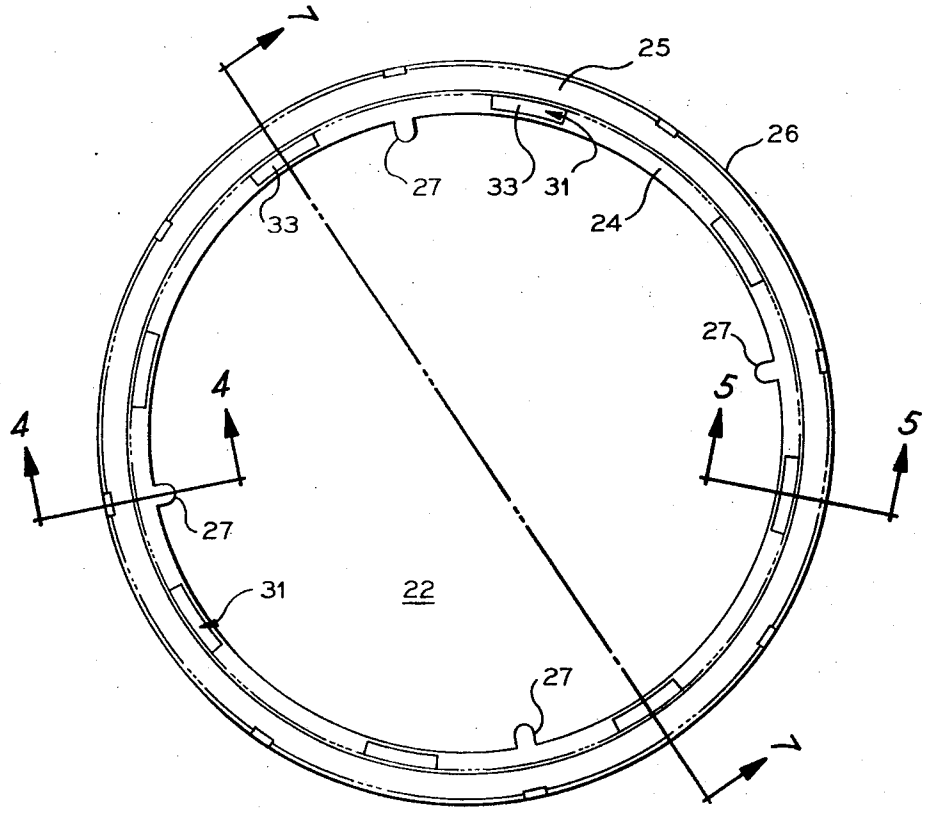


FIG. 2

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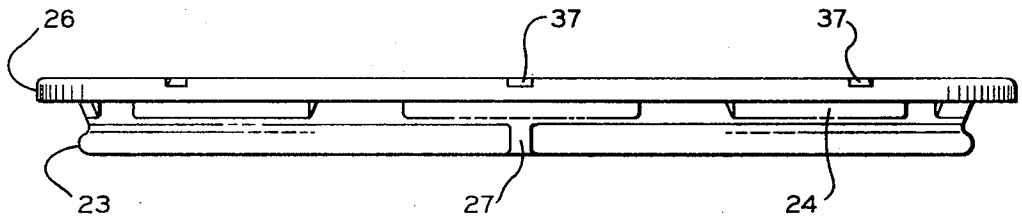

FIG. 3

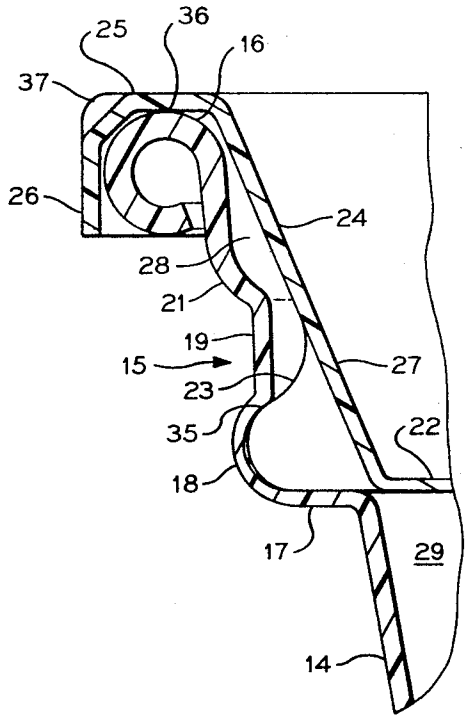

FIG. 4

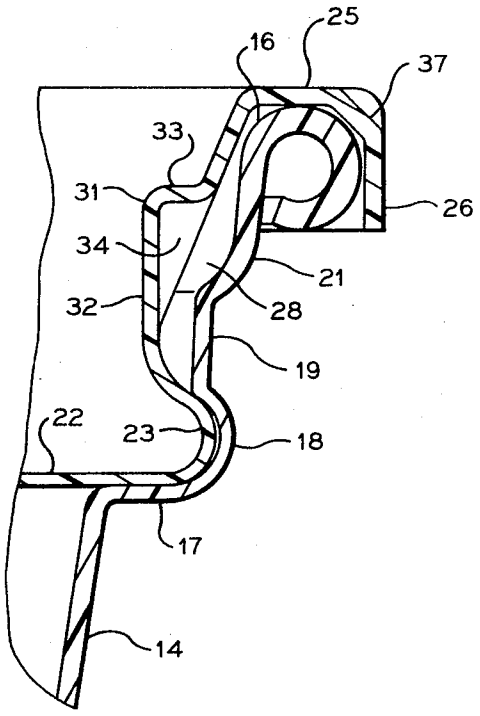

FIG. 5

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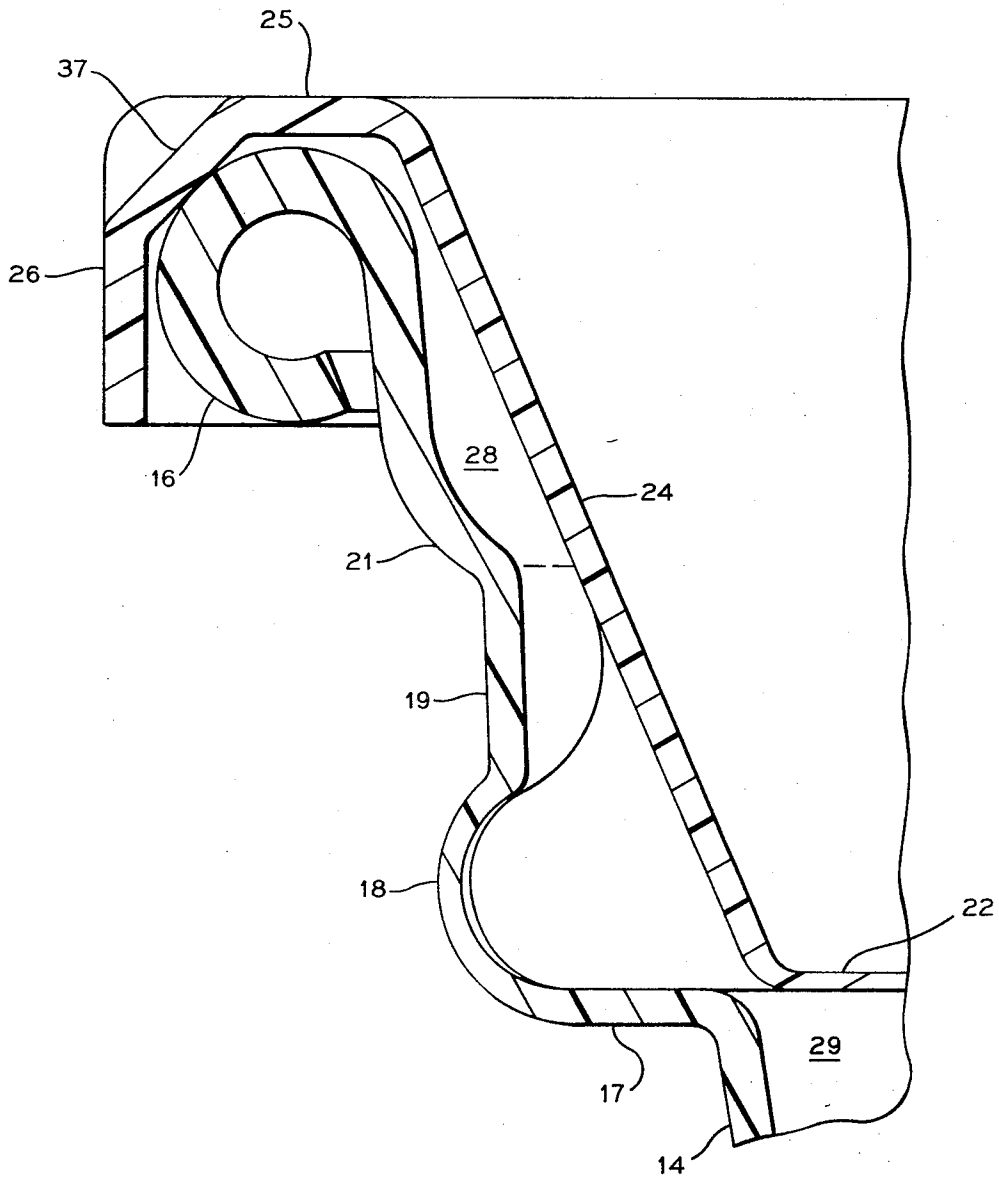

FIG. 6

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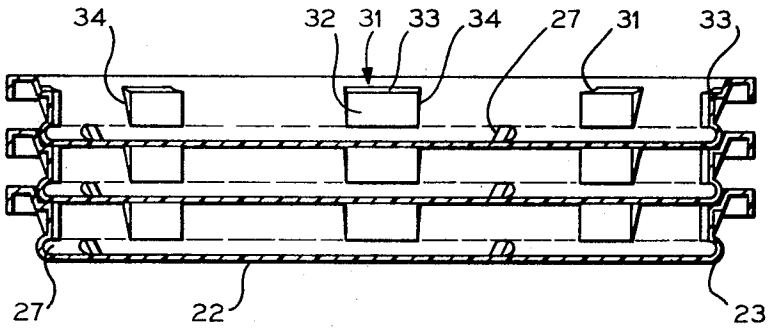

FIG. 7

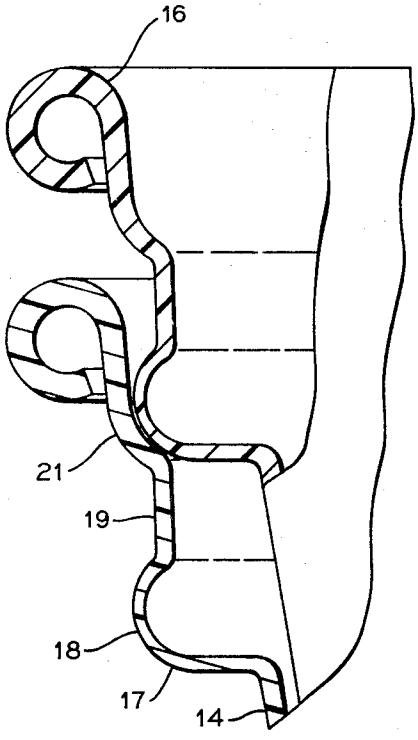

FIG. 8

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COMBINED CONTAINER AND CLOSURE

This invention relates to improvements in packaging containers and closures therefor.

Variations in the outer diameter of the retention bead on a closure and variations in the maximum inner diameter of the closure retention groove in the container have caused numerous problems with such packages. If the retention bead is too large for the retention groove, the closure can be distorted with unsightly buckling and the closure can be difficult to remove from the container. If the retention bead is too small, the closure fits loosely in the container and can be inadvertently dislodged from the container, exposing the contents of the package. With some products, it is desirable that the package be provided with a reclosable venting means. Numerous closures have been designed utilizing venting grooves in the closure retention bead which open into the packaging space of the container only when a pressure buildup causes a distortion of the closure. If the closure retention bead fits too tightly in the retention groove of the container, the venting action may be impaired or even prevented. If the closure fits loosely in the container, the venting grooves may be open continuously, eliminating any sanitary seal.

While the problem of dimensional accuracy is acute with paper containers and closures, it is also serious with thermoplastic containers and closures, particularly of the thermoformed type. The retention groove in thermoformed containers and the retention bead of thermoformed closures are customarily formed in an undercut in a female mold wall, which causes localized variations in the reduction in thickness of the thermoplastic sheet in these particular areas during the thermoforming operation. The location of these areas a significant distance below the rim of the mold also results in the sheet thickness being reduced to a substantially greater extent than in the rim portions of the container or closure.

In accordance with the invention it has been discovered that an improved sanitary seal can be effected at the container rim by dimensioning the container and closure so that the portion of the closure between the retention bead and the rim acts as a C-clamp to grip the mating portion of the container. In addition an improved reclosable venting action can be achieved by forming venting cams at the junction of the closure rim and depending skirt and by forming continuously open venting ports through the retention bead. These cams move against the curvature of the container rim during contortion of the closure by a pressure buildup to lift the closure rim off of the container rim, thereby venting the container.

Accordingly, it is an object of the invention to provide an improved package. It is an object of the invention to provide an improved closure and container structure whereby the closure grips the container to secure the closure thereon. Another object of the invention is to provide an improved reclosable venting structure for a combined container and closure. Another object of the invention is to minimize the effect of dimensional variations on the fit of a closure and container.

Other objects, aspects and advantages of the invention will be apparent from a study of the specification, the drawings and the appended claims to the invention.

In the drawings FIG. 1 is a side elevational view of a container and closure constructed in accordance with the present invention;

FIG. 2 is a top plan view of the container and closure of FIG. 1;

FIG. 3 is a side elevational view of the closure of FIG. 1;

FIG. 4 is a fragmentary cross-sectional view taken along line 4—4 in FIG. 2 when the package is in a static or non-venting condition;

FIG. 5 is a fragmentary cross-sectional view taken along line 5—5 in FIG. 2;

FIG. 6 is a fragmentary cross-sectional view taken along line 4—4 in FIG. 2 when the package is in a venting condition;

FIG. 7 is an elevational view in cross section of a stack of the closures of FIG. 2, the cross section of each closure being along a line corresponding to line 7—7 in FIG. 2; and

FIG. 8 is a fragmentary cross-sectional view of a stack of the containers of FIG. 1.

Referring now to the drawings in detail, and to FIGS. 1, 4, 5 and 8 in particular, the package 10 comprises a container or cup 11 and a closure 12. The container 11 is a one-piece integral structure, and can be fabricated by thermoforming a sheet of thermoplastic material. Container 11 comprises a bottom wall 13 of any suitable configuration; an outwardly inclined, circumferentially continuous side wall 14 extending upwardly from the periphery of bottom wall 13; stacking ring 15; and rim 16. Where container 11 has a substantially circular horizontal cross section, side wall 14 will have a substantially frustoconical configuration. The rim 16 is preferably in the form of a rolled rim having at least 270° curvature, as illustrated. However, a rim having a generally U-shaped configuration can be utilized. Stacking ring 15 comprises flange 17, closure retention groove section 18, spacer section 19, and upper stacking shoulder 21. Annular flange 17 is circumferentially continuous and extends outwardly in a substantially horizontal direction from the upper extent of side wall 14 to the lower extent of closure retention groove section 18. Spacer section 19 is circumferentially continuous and extends substantially vertically from the upper extent of closure retention groove section 18 to the inner extent of upper stacking shoulder 21. In the illustrated container 11, the spacer section 19 has a substantially cylindrical configuration. Closure retention groove section 18 is circumferentially continuous and is in the form of an inwardly opening, concavely contoured wall section extending substantially vertically from the outer periphery of flange 17 to the lower edge of spacer section 19. The lower portion of groove section 18 serves as the lower stacking shoulder. The upper stacking shoulder 21 curves outwardly and upwardly from the upper extent of spacer section 19 to rim 16. The inner diameter of spacer section 19 is less than the outer diameter of groove section 18 while the inner diameter of rim 16 is greater than the outer diameter of groove section 18. As illustrated in FIG. 8, the lower portion of stacking shoulder 21 can be contoured to mate with the lower portion of groove section 18 to provide a band of contact between the outer surface of the lower stacking shoulder of one container and the inner surface of the upper stacking shoulder of the next lower container in a nested stack of superimposed containers, or the lower portion of stacking shoulder 21 can be contoured to provide only a line of contact between adjacent containers in a stack thereof.

Referring now to FIGS. 2, 3, 4 and 5, closure 12 is a one-piece thermoformed structure having substantially circular horizontal cross sections and comprises a circular closure disc or diaphragm 22, a retention bead 23, upwardly and outwardly sloping wall section 24, rim 25 and depending flange or skirt 26. Disc 22 is illustrated as being planar, but can be bowed upwardly or dished downwardly and/or provided with an annular expansion groove, if desired. The retention bead 23 is an inwardly opening, outwardly directed, concavely shaped groove section extending generally upwardly between the periphery of disc 22 and the lower extent of wall section 24. Retention bead 23 is interrupted at circumferentially spaced locations by a plurality of inwardly directed, outwardly opening notches or venting grooves 27. Each notch 27 will generally be disposed with the elongated axis thereon in a substantially vertical plane. The innermost wall portion of each notch 27 extends downwardly and inwardly from wall section 24 to a point on disc 22 which has a significantly smaller diameter than the inner diameter of flange 17. Wall 24 of closure 12 is spaced inwardly from the wall formed by spacer section 19 and stacking shoulder 21 of container 11 to form a continuous annular space 28. The upper portion of each notch 27 opens into the annular space 28. This provides continuous fluid access between the annular space 28 and the packaging space 29 within wall 14 of container 11 below disc 22.

Stacking lugs 31 are provided at circumferentially spaced positions in side wall 24. The stacking lugs 31 are inwardly directed, outwardly opening embossments. Each lug 31 has a substantially vertical or upwardly and slightly inwardly inclined back wall 32, a generally horizontal shoulder 33 and substantially vertical side walls 34. Shoulder 33 extends out-

wardly in a generally horizontal direction from the upper extent of back or inner wall **32** to wall **24**. Shoulder **33** can be curved outwardly and upwardly in conformance with the contour of the lower portion of bead **23**. As shown in FIG. **7**, the outer diameter of shoulder **33** is at least equal to the outer diameter of the corresponding portion of bead **23** so that the bead **23** of one closure rests upon the shoulder **33** of the next lower closure in a nested stack of superimposed closures. The circumferential discontinuity of the stacking shoulders **33** readily permits air to flow out of or into the space between superimposed closures during stacking or denesting operations.

Referring now to FIG. **4**, upon insertion of closure **12** into container **11**, bead **23** cams inwardly on the curved upper shoulder **21** and then snaps into closure retention groove **18**. Notches **27** permit continuous outflow of air from the interior of the package during the insertion of closure **12** into container **11**, thereby preventing a buildup of excessive pressure in the package during the capping operation. The upper surface of bead **23** contacts the inner surface of the upper portion of retention groove **18** at point **35**. The underside of rim **25** contacts the top of rim **16** at point **36**. This results from the formation of closure **12** in such a manner that the distance between points **35** and **36** in the unstressed closure is less than the distance between points **35** and **36** on the uncapped container. Thus, the upper portion of bead **23**, wall **24** and rim **25** act as a C-clamp to grip the mating surfaces of container **11** to thereby removably secure the closure **12** to the container **11**. The contact of closure rim **25** and container rim **16** is circumferentially continuous and serves as a seal for the capped container. In contrast to containers which provide a sealing surface at the top or bottom of the closure retention bead, the present configuration provides a seal at the top of the container rim to insure sanitary conditions for the entire interior of the container.

Closure **12** is provided with a plurality of circumferentially spaced venting cams **37**, bridging rim **25** and depending flange **26**. Cams **37** project inwardly from flange **26** and downwardly from rim **25** to form a camming surface which is inclined downwardly at an acute angle to the horizontal reference. The cams **37** are positioned at least closely adjacent the outwardly and downwardly curving portion of rim **16**, and camming contact therebetween occurs during venting of the package. Preferably this contact is made in the first 45° of curvature of rim **16** outwardly and downwardly from the horizontal. When the pressure in packaging space **29** and annular space **28** is not excessive, the relationship of the closure **12** and the container **11** is illustrated in FIG. **4**. Upon the occurrence of excessive pressure in packaging space **29** and annular space **28**, the upstanding wall **24** of closure **12** is forced inwardly, causing the cams **37** to contact and slide on the upper half of the upper and outer quadrant of rim **16**. The camming action causes rim **25** of the closure **12** to move upwardly from rim **16** to the position shown in FIG. **6**, thereby providing a continuous passageway to the atmosphere from packaging space **29** through annular space **28** and through the space between rim **16** and rim **25** and depending flange **26**. The inner diameter of depending flange **26** is sufficiently greater than the outer diameter of rim **16** to provide a clearance therebetween even when the closure is contorted to the venting condition. Upon the release of the excessive pressure, the closure and container return to the relationship shown in FIG. **4**.

Thermoformed containers and thermoformed closures are customarily formed in female molds. This has the advantage that the outside dimensions of the containers are substantially constant; however, the wall thickness varies within each container. The retention bead **23** of closure **12** is relatively thin because of the double stretching to which the thermoplastic sheet material is subjected. The sheet is initially stretched as it is drawn downwardly into the main mold cavity, and then a portion thereof is additionally stretched as that portion is drawn into the mold groove which forms bead **23**. A similar double stretching action occurs in the formation of closure retention groove **18** in container **11**. The increased resiliency of the thinner wall of bead **23** assists in the insertion of the closure **12** into container **11** as the bead **23** will flex inwardly to pass the spacer section **19** of container **11** and then snap outwardly into groove **18**. However, the thinner wall of bead **23** is more subject to a stress fold than rim **25**, which could prevent a normally closed venting groove from being opened or which could result in the formation of an undesired continuously open venting passageway.

The rim **25** and depending skirt **26** will normally have the greatest thicknesses of any part of a thermoformed closure **12**. Similarly, the rim **16** will normally have the greatest thickness of any part of a thermoformed container **11**. These greater thicknesses also normally result in the greatest rigidity and dimensional accuracy for any portion of the container or closure. This results in a more effective seal where the seal is between the container rim and the closure rim than where the seal is between the retention bead and the retention groove. The location of the venting cams at the junction of the rim **25** and shirt **26** also takes advantage of the greater rigidity and dimensionai accuracy to provide a more effective reclosable venting action than would be obtained with reclosable vents in the retention bead or in the retention groove.

While the invention has been illustrated with a container and closure having substantially circular horizontal cross sections, other configurations can be utilized, for example, oval, rectangular with at least the corners being rounded and more preferably with the sides being bowed outwardly, and the like. Other reasonable variations and modifications are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention.

I claim:

1. A package comprising a container and a closure therefor;

said container comprising a bottom wall, an upstanding wall extending generally upwardly from the periphery of said bottom wall, a rim forming the mouth of said container and having an outwardly and downwardly curving peripheral portion, and a ring section extending generally upwardly from the upper extent of said upstanding wall to said rim and having a closure retention groove formed therein;

said closure comprising a diaphragm, a side wall, an outwardly directed, inwardly opening retention bead extending upwardly from the periphery of said diaphragm to the lower extent of said side wall, and a rim extending outwardly from the upper extent of said side wall;

said retention bead being dimensioned to snap into said closure retention groove; said rim of said closure extending outwardly over said rim of said container and in contact therewith; the distance between the point of contact of said rim of said container and the rim of said closure and the point of contact of said retention bead and said closure retention groove being greater than the distance between the same points in the unstressed closure before the unstressed closure is applied to said container, so that the portion of said closure between said points of contact serves as a C-clamp to grip the mating portion of said container to thereby secure said closure to said container;

said retention bead being interrupted by at least one venting groove which extends to a point on said diaphragm which is spaced inwardly a significant distance from the inner surface of said ring section to provide a continuously open fluid communication between the packaging space within said container below said diaphragm and the annular space between said side wall and the laterally adjacent portion of said container; and camming means formed in said rim of said closure to contact said outwardly and downwardly curving peripheral portion of said rim of said container to effect a lifting of the closure rim from the container rim upon the occurrence of excessive pressure in said packaging space to thereby vent said packaging space.

2. A package in accordance with claim **1** wherein said container and said closure have substantially circular horizontal

cross sections, said upstanding wall extends upwardly and outwardly from the periphery of said bottom wall, and said side wall of said closure extends upwardly and outwardly from the upper extent of said retention bead.

3. A package in accordance with claim 2 wherein said ring section comprises an annular flange extending outwardly from the upper extent of said upstanding wall, an inwardly opening closure retention groove section extending generally upwardly from the outer periphery of said annular flange, a spacer section extending upwardly substantially vertically from the upper extent of said closure retention groove section, and an upper stacking shoulder extending generally outwardly and upwardly from the upper extent of said spacer section to the inner extent of said rim.

4. A package in accordance with claim 3 wherein said container is a one-piece integral thermoformed structure; wherein said upstanding wall and said ring section are circumferentially continuous; wherein said closure retention groove section is an inwardly opening, concavely contoured wall section extending substantially vertically from the outer periphery of said flange to the lower extent of said spacer section; and wherein said upper shoulder is curved outwardly and upwardly in a contour conforming to the contour of the lower portion of said concavely contoured wall section so that the lower portion of the concavely contoured wall section of one container will rest upon the upper stacking shoulder of the next lower container in a stack of superimposed identical containers.

5. A package in accordance with claim 4 wherein said closure is a one-piece integral thermoformed structure; wherein said retention bead is an inwardly opening, outwardly directed, concavely shaped groove section; and wherein said side wall has a plurality of stacking lugs formed therein.

6. A package in accordance with claim 5 wherein said retention bead is interrupted at circumferentially spaced locations by a plurality of said venting grooves; wherein said closure further comprises a skirt depending from the outer periphery of the rim of said closure; and wherein said camming means comprises inwardly directed camming grooves formed at the junction of said rim of said closure and said depending skirt, said camming grooves contacting said outwardly and downwardly curved peripheral portion of said rim of said container to effect a lifting of the closure rim from the container rim upon the occurrence of excessive pressure in said packaging space to thereby vent said packaging space.

7. A package in accordance with claim 1 wherein said closure further comprises a continuous skirt depending from the outer periphery of the rim of said closure and wherein said camming means comprises a plurality of downwardly and inwardly directed indentations formed at the junction of said closure rim and said depending skirt.

8. A package in accordance with claim 7 wherein said retention bead is interrupted at circumferentially spaced locations by a plurality of said venting grooves.

9. A package in accordance with claim 8 wherein said indentations contact said outwardly and downwardly curving peripheral portion of said container rim in the first 45° of curvature of said curving portion from the horizontal.

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