United States Patent

Kinney et al.

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[54] CONTAINER AND CLOSURE THEREFOR

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

[51] **Int. Cl.**.....**B65d 43/10**, B65d 21/02, B65d 51/16

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

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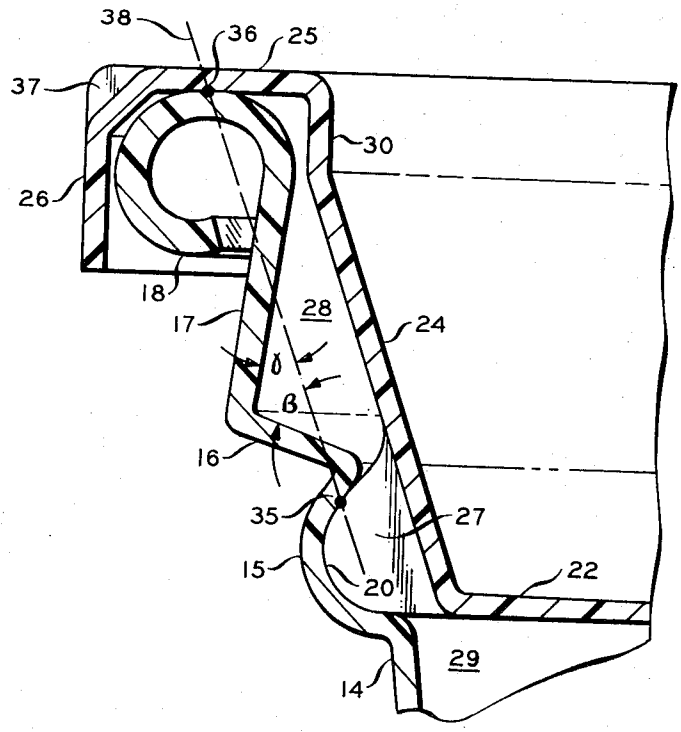
[57] **ABSTRACT**

A container having a closure retention groove is combined with a closure having a retention bead. The closure is formed so that the portion thereof 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. The container wall section between the points on the rim and retention groove comprises two intersecting substantially straight sidewall sections, each being inclined at an acute angle to a line through the points of contact of the container and closure. One of the substantially straight sidewall sections also serves as a lower stacking shoulder which rests upon the rim of the next lower container in a stack of identical containers.

7 Claims, 6 Drawing Figures



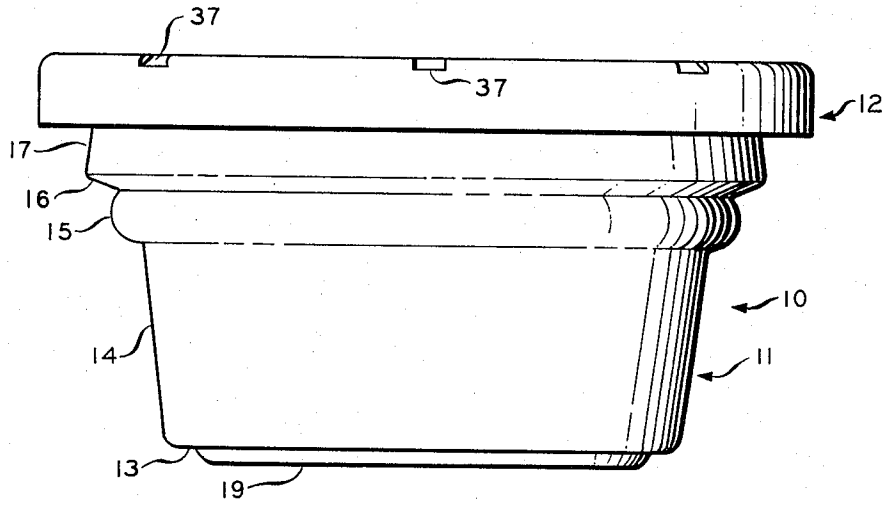


FIG. 1

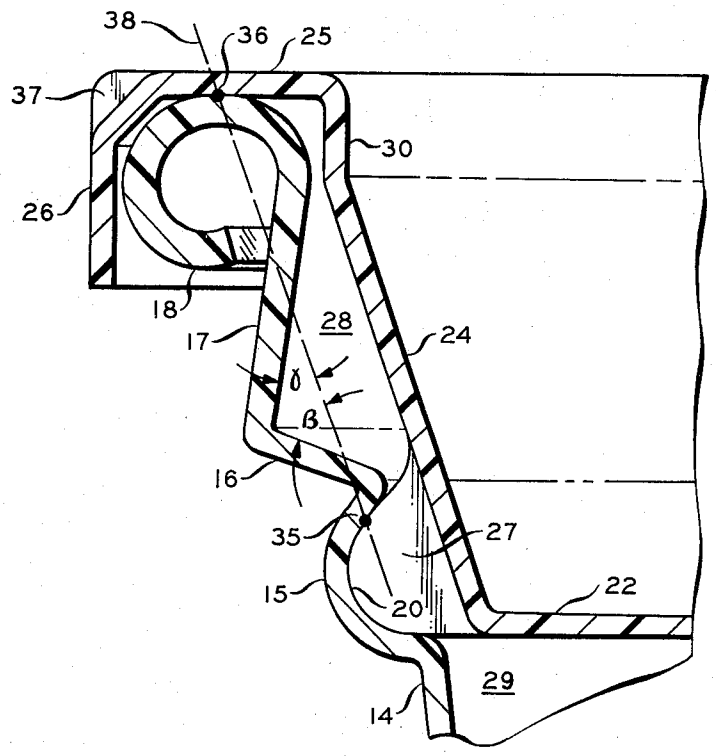


FIG. 3

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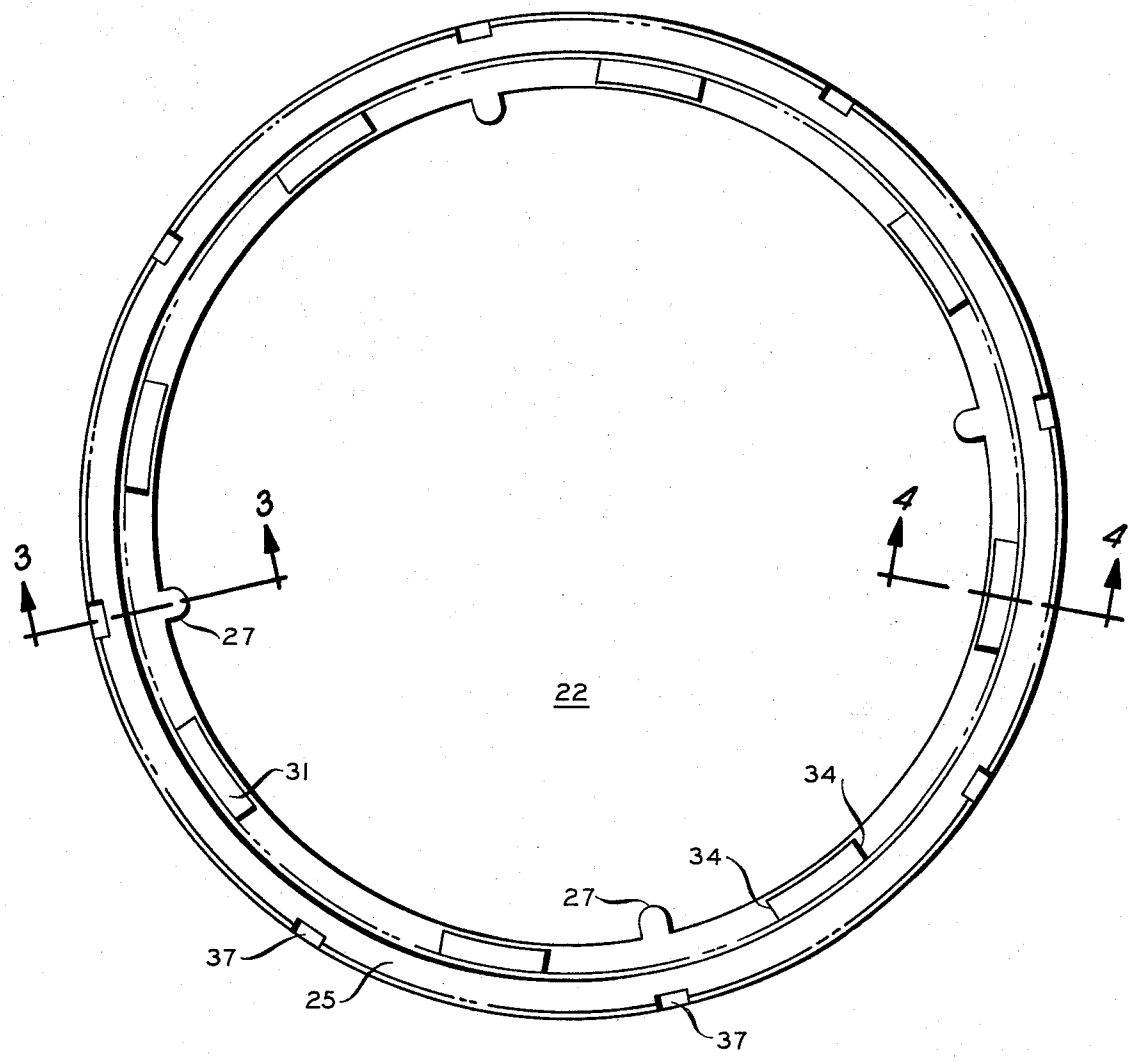

FIG. 2

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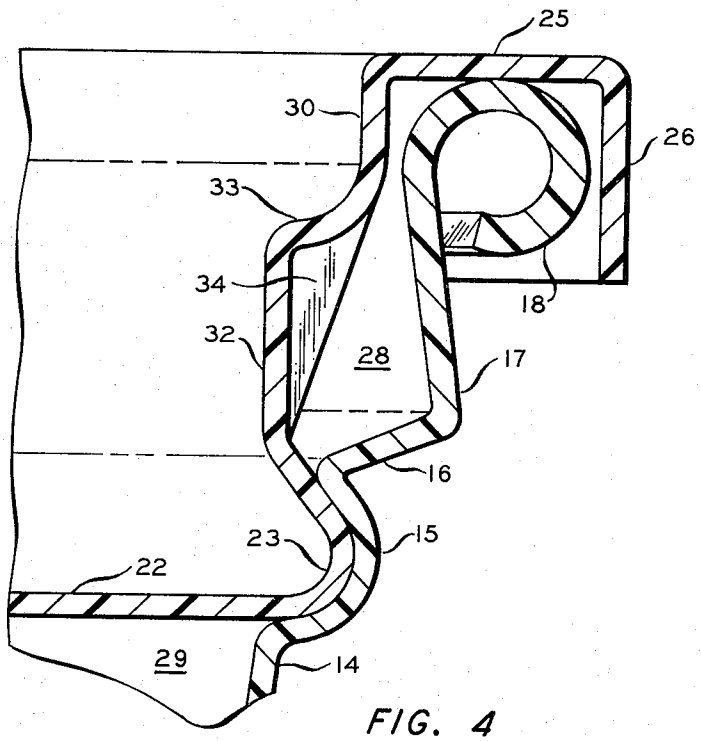

FIG. 4

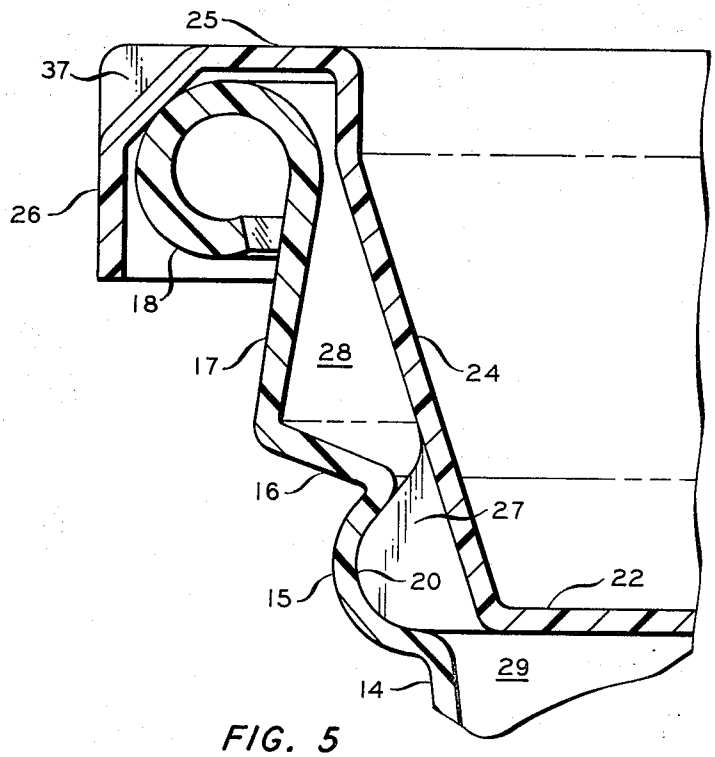

FIG. 5

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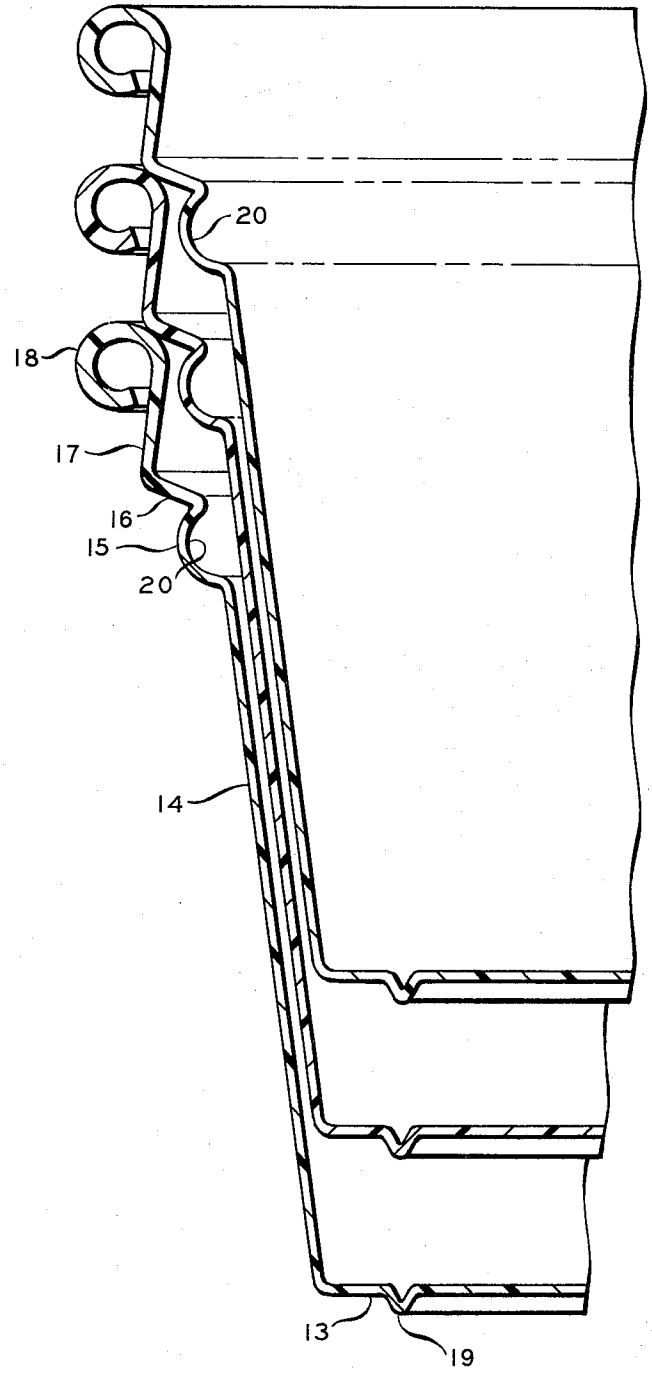

FIG. 6

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CONTAINER AND CLOSURE THEREFOR

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 addition many of the containers have been designed to provide resiliency in the upper wall portion thereof for stacking purposes. However, a significant degree of compressibility of the stacking ring section of the containers can promote jamming of the containers, depending upon the type of thermoplastic material, the wall thickness, the size of the container and the overall container design, the configuration of the closure, and the handling procedures to which the package is to be subjected. The seal between the container and closure can be improved or adversely affected by such resiliency in the portions of the container and closure involved in the closure retention function.

While the stacking structure of the container can be separated from the closure retention structure of the container by placing the stacking structure below the closure retention portion of the container, this increases the height of the configurated portion of the sidewall of the container, which can adversely affect the esthetic values of the container design as well as reducing the area of the sidewall available for printing.

In accordance with the present invention it has been discovered that the stacking ring section and the closure retention section of the container can be combined while providing different degrees of resilience for the stacking function and the closure retention function.

Accordingly, it is an object of the invention to provide a new and improved container. It is another object of the invention to provide an improved stacking structure for a container. Another object of the invention is to provide an improved package comprising a container and a closure therefor wherein the closure is formed as a C-clamp to grip the container, and the thus gripped portion of the container is contoured for increased resilience. Another object of the invention is to provide an improved reclosable venting structure for a combined container and closure. A further object of the invention is to provide a more effective sanitary seal for a combined container and closure. Yet another object of the invention is to reduce the effects 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 fragmentary cross-sectional view taken along line **3—3** in FIG. **2** when the package is in a static or non-venting condition;

FIG. **4** is a fragmentary cross-sectional view taken along line **4—4** in FIG. **2**;

FIG. **5** is a fragmentary cross-sectional view taken along line **3—3** in FIG. **2** when the package is in a venting condition; and

FIG. **6** is a fragmentary cross-sectional view in elevation of a stack of the containers of FIG. **1**.

Referring now to the drawings in detail, and to FIGS. **1**, **3** and **6** 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**, a sidewall **14**, a closure retention groove wall section **15**, a stacking shoulder **16**, a spacer wall section **17**, and a rim **18**. The bottom wall **13** can be of any suitable configuration and can, for example, be provided with a downwardly directed, upwardly opening concavely contoured annular groove **19**. A circumferentially continuous sidewall **14** extends generally outwardly and upwardly from the periphery of bottom wall **13** as a frustoconically contoured section. The closure retention groove wall section **15** extends generally upwardly from the periphery of the upper extent of sidewall **14** and is shaped to provide an outwardly directed, inwardly opening, concavely contoured, circumferentially continuous annular groove **20**. Stacking shoulder **16** is a circumferentially continuous, frustoconical section extending in a substantially straight line outwardly and upwardly from the periphery of the upper extent of section **15**. Spacer wall section **17** is a circumferentially continuous frustoconical section extending in a substantially straight line inwardly and upwardly from the periphery of the upper extent of the stacking shoulder section **16**. Rim **18** extends generally outwardly from the upper periphery of spacer wall section **17**. The rim **18** 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.

As shown in FIG. **6**, the outer diameter of stacking shoulder **16** is greater than the inner diameter of the upper extent of spacer wall section **17** so that the outer portion of stacking shoulder **16** rests upon the rim **18** of the next lower container in the stack of nested identical containers. The outermost diameter of the closure retention groove wall section **15** is less than the inner diameter of the upper extent of spacer wall section **17** so that the closure retention groove wall section **15** of the upper container can enter the area bounded by spacer wall section **17** of the next lower container without interfering with the stacking function of the superimposed containers. In fact, where the outermost diameter of the closure retention groove wall section **15** is only slightly less than the inner diameter of the upper extent of spacer wall section **17**, the closure retention groove wall section **15** serves a preliminary centering function during the insertion of an upper container into a lower container. This minimizes the possibility of one container being cocked or misaligned within the next lower container during the nesting operation. In the presently preferred embodiment, the rim **18** initially curves upwardly and outwardly from the periphery of the upper extent of spacer wall section **17**, and the outer portion of the shoulder section **16** of an upper container rests upon the initially curved portion of the rim **18** of the next lower container in the stack. The inward and upward inclination of spacer wall section **17** increases the extent of overlap of stacking shoulder **16** of an upper container and the rim **18** of the next lower container beyond the

mere thickness of spacer wall section 17. Stacking shoulder 16, spacer wall section 17 and rim 18 thus form a Z-shaped stacking ring for container 11. The degree of compressibility of the stacking ring structure can be varied by varying the angle of inclination of spacer wall section 17 with respect to the vertical.

Referring now to FIGS. 2, 3, and 4 closure 12 is a one piece, thermoformer structure having substantially circular horizontal cross-sections and comprises a circular closure disk or diaphragm 22, a retention bead 23, upwardly and outwardly sloping wall section 24, rim 25, and depending flange or skirt 26. Disk 22 is illustrated as being planar, but can be bowed upwardly or dished downwardly and/or provided with an angular 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 disk 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 elongated axis thereof 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 disk 22 which has a significantly smaller diameter than the diameter of the inner edge of retention groove section 15 or the upper extent of sidewall 14. Wall 24 of closure 12 is spaced inwardly from the wall formed by stacking shoulder 16 and spacer section 17 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 disk 22. If desired, the upper portion 30 of closure sidewall 24 can be directed substantially vertically from the main portion of wall 24 upwardly to rim 25. The inner diameter of wall section 30 is slightly greater than the outermost diameter of retention bead 23 to permit the nestable stacking of the closures. Stacking lugs 31 are provided as circumferentially spaced positions in sidewall 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 sidewalls 34. Shoulder 33 extends outwardly in a generally horizontal direction from the upper extent of back or inner wall 32 to the point of joinder of the outward sloping portion of wall 24 and the substantially vertical portion 30. Shoulder 33 can be curved outwardly and upwardly in conformance with the contour of the lower portion of bead 23. 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 substantially cylindrical wall section 30 serves as a stabilizing wall for the bead 23 of the next higher closure to minimize lateral motion of the closures in the stack thereof. 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. 3, upon insertion of closure 12 into container 11, bead 23 cams inwardly on the sloping stacking shoulder section 16 and then snaps into closure retention groove 20. The 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 20 at point 35. The underside of rim 25 contacts the top of rim 18 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, walls 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 18 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 ensure 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 18 and camming contact therebetween occurs during venting of the package. Preferably this contact is made in the first 45° of curvature of rim 18 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. 3. 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 18. The camming action causes rim 25 of closure 12 to move upwardly from rim 16 to the position shown in FIG. 5, 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 18 to provide a clearance therebetween even when the closure is contorted to the venting condition. Upon release of the excessive pressure, the closure and container return to the relationship shown in FIG. 3.

Thermoformed containers and thermoformed closures are generally 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 section 15 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 shoulder section 16 of container 11 and then snap outwardly into groove 20. 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 18 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 generally 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 37 at the junction of the rim 25 and skirt 26 also takes advantage of the greater rigidity and dimensional 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. However, in some packages, due to the type of thermoplastic material utilized in the container or closure, the size of the package, or some other factor, it is desirable that that portion of the container gripped by the C-clamp closure have greater

resilience than that provided by normal configurations. This increased resilience is provided in container **11** by each of shoulder section **16** and spacer wall section **17** being inclined at an acute angle to the imaginary line **38** which extends through the points of contact **35** and **36**. The angle of inclination α between spacer section **17** and line **38** will usually be in the range of about 15° to about 60°, depending upon the degree of resilience desired for the container stacking function. The angle of inclination β between stacking shoulder **16** and line **38** will usually be in the range of about 30° to about 70°.

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 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.

We claim:

1. A nestable container comprising a bottom wall, an upstanding wall extending generally upwardly and outwardly from the periphery of said bottom wall, an inwardly opening, outwardly directed closure retention groove wall section extending upwardly from the periphery of the upper extent of said upstanding wall, a circumferentially continuous, frustoconical stacking shoulder extending outwardly and upwardly in a straight line from the periphery of the upper extent of said closure retention groove wall section, a circumferentially continuous, frustoconical spacer wall section extending inwardly and upwardly in a straight line from the periphery of the upper extent of said stacking shoulder, a rim extending generally outwardly from the upper periphery of said spacer wall section, the outer diameter of said stacking shoulder being greater than the inner diameter of the upper extent of said spacer wall section, the outermost diameter of said closure retention groove wall section being less than the inner diameter of the upper extent of said spacer wall section, so that the outer portion of the stacking shoulder of one container rests upon the rim of the next lower container in a nested stack of identical containers.

2. A container in accordance with claim **1** wherein said rim initially curves upwardly and outwardly from the periphery of the upper extent of said spacer wall section, and wherein the outer portion of the stacking shoulder of the upper container would rest on this initially curved portion of the rim of the next lower container in a nested stack of identical containers.

3. A container in accordance with claim **2**, wherein said container is a one piece integral thermoformed structure; and wherein said upstanding wall, said closure retention groove wall section, and said rim are circumferentially continuous.

4. A container in accordance with claim **1** further comprising a closure applied to said container and having a diaphragm, a sidewall, an outwardly directed, inwardly opening retention bead extending generally upwardly from the periphery of said diaphragm to the lower extent of said sidewall, and a rim extending outwardly from the upper extent of said sidewall; said retention bead being dimensioned to snap into said closure retention groove wall section of said container; 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 the container rim and the closure rim and the point of contact of the retention bead and the closure retention groove wall section 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; each of said stacking shoulder and said spacer wall section being inclined at an acute angle to an imaginary line through said points of contact to increase the resilience of the portion of said container between said points of contact.

5. A container and closure in accordance with claim **4** wherein said container is a one piece integral thermoformed structure having substantially circular horizontal cross-sections; wherein said upstanding wall, said closure retention groove wall section, and said rim are circumferentially continuous; and wherein said upstanding wall is frustoconically contoured.

6. A container and closure in accordance with claim **4** wherein the angle of inclination of said spacer wall section to said imaginary line is in the range of about 15° to about 60° and wherein the angle of inclination of said stacking shoulder to said imaginary line is in the range of about 30° to about 70°.

7. A container and closure in accordance with claim **4** wherein said retention bead is interrupted at circumferentially spaced locations by a plurality of venting grooves which extend to a point on said diaphragm which is spaced inwardly a significant distance from the inner edge of said closure retention groove wall section to provide continuously open fluid communication between the packaging space within the container below said diaphragm and the annular space between said sidewall of said closure and the laterally adjacent portion of said container; wherein said rim of said container curves outwardly and downwardly; and further comprising a skirt depending from the outer periphery of the rim of said closure, and 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 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.

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