

July 23, 1968

R. B. McINTOSH

3,393,818

PLASTIC CAP HAVING PRESSURE VENTING FEATURES

Filed Feb. 28, 1967

2 Sheets-Sheet 1

FIG. 2

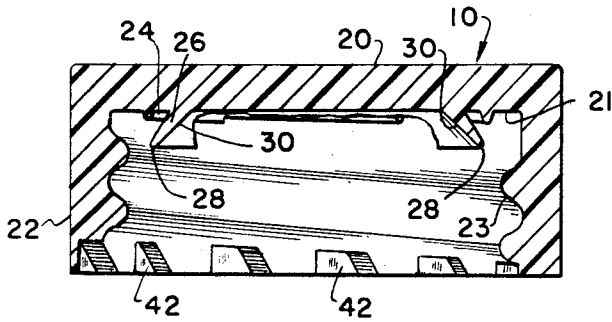


FIG. 3

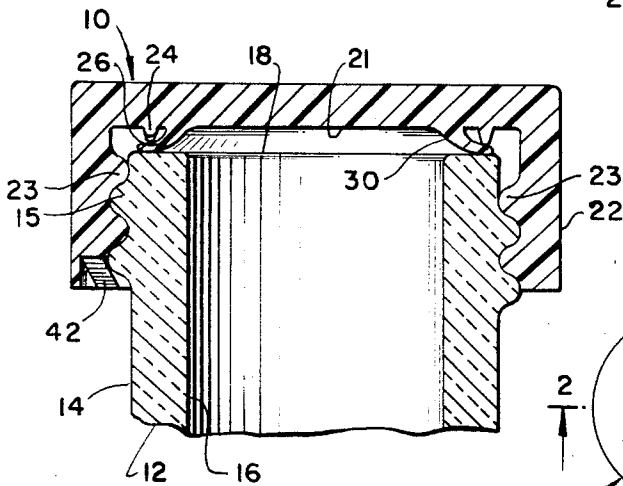
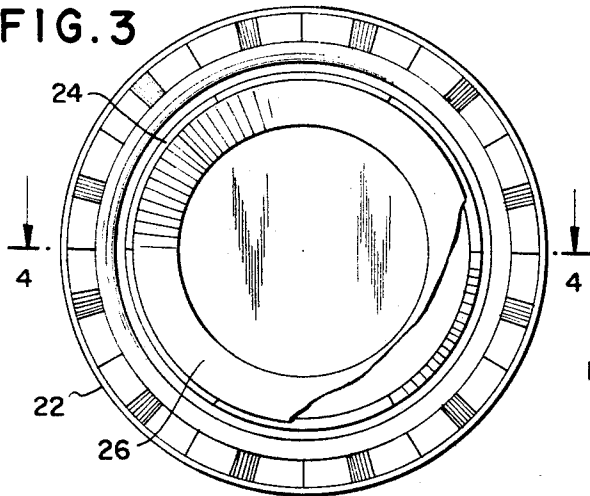


FIG. 4

FIG. 5

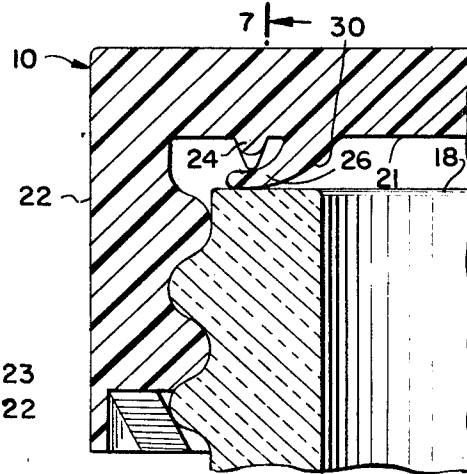
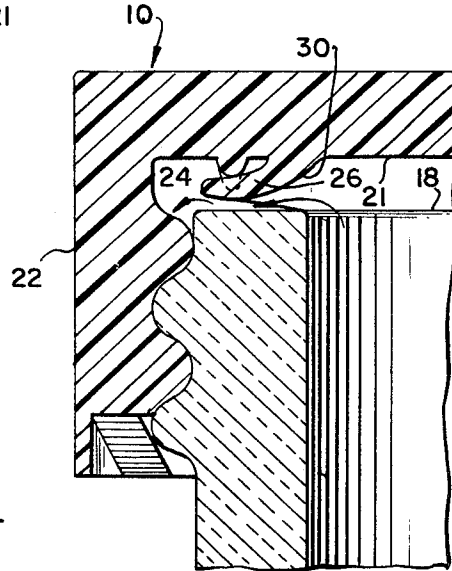


FIG. 6

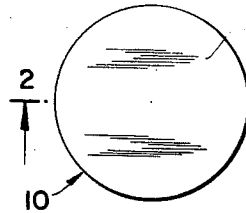


FIG. 1

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FIG. 7

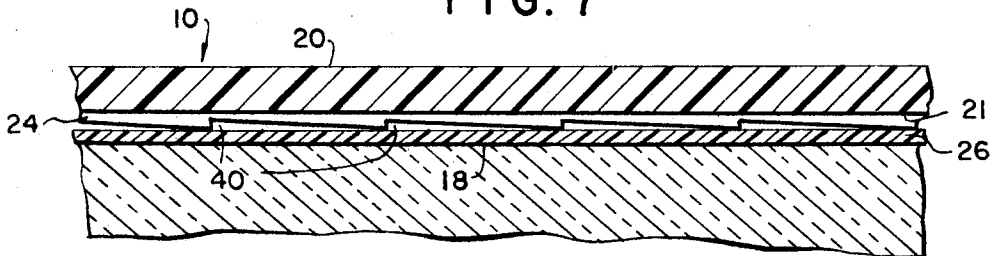


FIG. 8

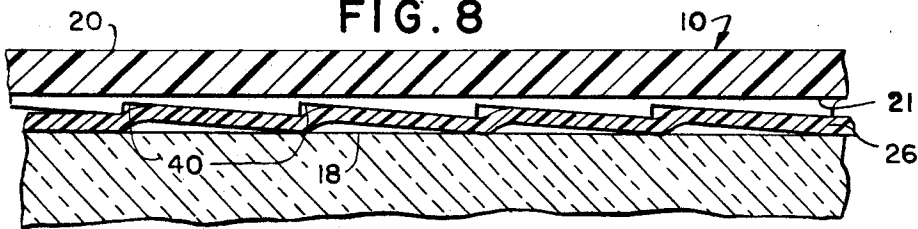


FIG. 9

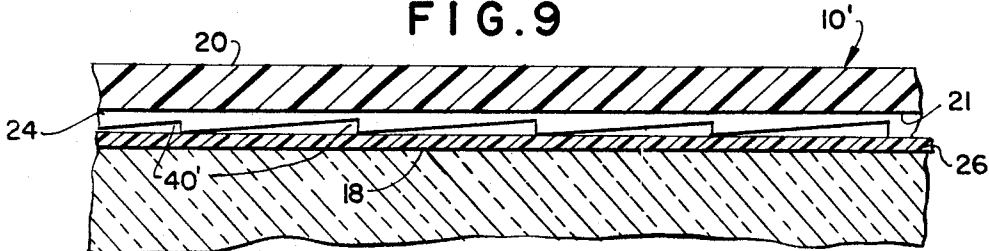


FIG. 10

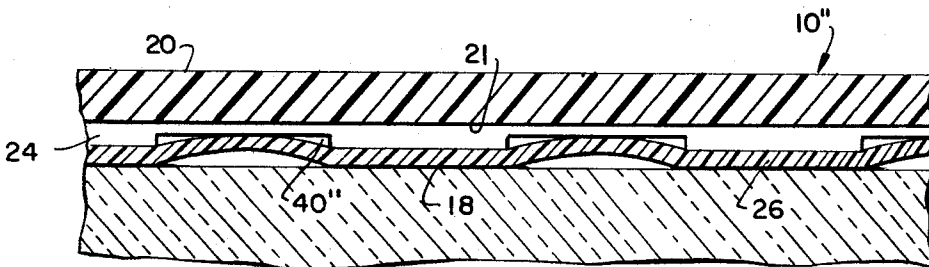
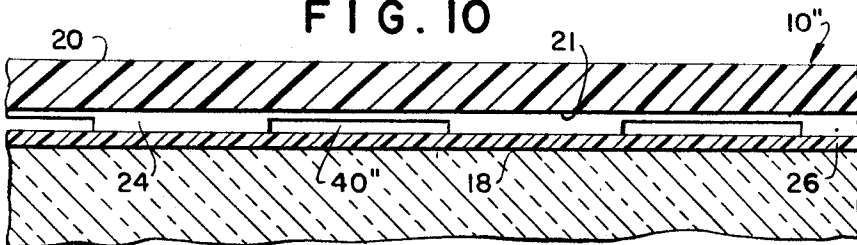


FIG. 11

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PLASTIC CAP HAVING PRESSURE VENTING FEATURES

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Filed Feb. 28, 1967, Ser. No. 619,454

3 Claims. (Cl. 215—56)

ABSTRACT OF THE DISCLOSURE

A sealing closure for use on containers having threaded necks, having good sealing properties as well as pressure venting features is shown. A plastic cap having an annular sleeve on its underside which seals against the container rim and is held in place by a second annular bead is adapted for pressure venting by providing indentations in the lower periphery of the annular bead.

SPECIFICATION

This invention relates to a sealing closure for containers having threaded necks which provides a tight seal against the upper rim of the container and has sufficient flexibility to withstand repeated sealings without deformation. In more detail the invention relates to an improved closure which while maintaining a tight seal is adapted to open and vent excessive pressures which may build up in the container.

This invention is an improvement on the sealing closure in U.S. Patent No. 3,286,866 to McIntosh which permits that sealing device to open in response to an excessive pressure within the container and vent gases from the container through the closure threads to the atmosphere. The device disclosed in that patent, though satisfactory for sealing most liquid-containing vessels, is of limited value where the contents of the vessel either because of mechanical agitation, increase in ambient temperature or chemical decomposition, release gases and build up internal pressures. Certain types of bleaches for example fall into that category. The dangers in such situations need not be described and it is obvious that the art is faced with the need for a closure which will tightly seal the container and yet allow gases to vent under excess internal pressure. To provide such a container is the object of this invention.

U.S. Patent No. 3,286,866 shows a linerless sealing closure made from polypropylene or similar semi-rigid, semi-flexible material which is adapted to seal a container having at its neck a threaded outer wall, an inner wall and an interconnecting rim. The closure has a top wall and depending therefrom a tapered cylindrical skirt which threadedly engages the threaded outer wall of the neck of the container. An annular resilient bead is positioned on the under side of the top wall concentrically within the tapered skirt. The annular resilient bead is sized so that its median diameter is greater than the diameter of the inner wall of the neck but less than the diameter of the outer wall of the neck. The closure member is also provided with an annular resilient sleeve positioned on the under side of the top wall within the annular resilient bead, the sleeve being joined or sealed at its inner peripheral edge to the top wall and depending angularly downwardly from the top wall and outwardly toward the skirt. The sleeve is generally in the form of a hollow, truncated cone tapering outwardly from its attachment to the top wall. The slant height of the sleeve from its inner peripheral edge to its outer peripheral edge is greater than the radial distance between the inner peripheral edge and the bead.

When the closure member engages the threaded neck of the container and advances downwardly to a sealed position, the resilient sleeve is deflected upwardly and outwardly so that the resilient sleeve bears against the resilient annular bead. In effect the sleeve is then supported at its inner peripheral edge by its attachment to the top wall and is supported at a second point, generally close to its outer peripheral edge, by the resilient annular bead, while the rim of the neck is maintained in contact with the resilient sleeve generally intermediate the points of support, thereby creating an extremely effective sealing relationship.

It has now been found that if a notch or indentation is provided in the lower peripheral edge of the resilient annular bead the improved sealing closure of Patent No. 3,286,866 will retain its excellent sealing properties but in addition will permit gases generated within the sealed container to escape when the pressure in the container becomes excessive. In response to such internal pressure the annular resilient sleeve positioned on the under side of the top wall is deflected upwardly and outwardly at those places along its circumference where it is not restrained by the downwardly projecting annular resilient bead, that is at those places where a notch or indentation is provided in the lower peripheral edge of the annular resilient bead. The gases within the container are thereby permitted to vent to the atmosphere between the cap and the threads on the outer wall of the neck of the container. By proper sizing of the notch or notches in the bead and choice of the material for the sleeve and bead the closure can be designed to vent at any desired pressure. These design variables can be determined by those skilled in the art with a minimum of experimentation.

In order to describe the invention with greater detail reference is made to the attached drawing which is illustrative of a particularly advantageous embodiment of the invention:

FIGURE 1 is a plan view of a sealing closure;

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a bottom view with parts broken to show additional details;

FIGURE 4 is a sectional view taken along the line 4—4 of FIGURE 3 showing the sealing closure in sealing relationship with the container neck;

FIGURE 5 is an enlarged fragmentary sectional view similar to FIGURE 4 showing the annular sleeve in a venting position;

FIGURE 6 is similar to FIGURE 5 showing the annular sleeve in a sealing position;

FIGURE 7 is a developed surface taken substantially along the line 7—7 of FIGURE 6 showing indentations in the annular bead suitable for closures having a right hand thread and showing the closure in a sealing relationship with the container rim;

FIGURE 8 is the developed surface of FIGURE 7 showing the closure in a venting relationship with the container rim;

FIGURE 9 is a developed surface showing a reverse indentation in the annular bead suitable for closures having a left hand thread;

FIGURE 10 is a developed surface showing rectangular indentations in the annular bead and showing the closure in a sealing relationship with the container rim;

FIGURE 11 is the developed surface of FIGURE 10 showing the closure in a venting relationship with the container rim.

In the drawing the reference numeral 10 indicates the sealing closure and the reference numeral 12 indicates the threaded neck of a container. The neck 12 includes a

threaded outer wall 14 having threads 15, an inner wall 16 and an interconnecting rim 18 at the upper ends of the outer wall 14 and the inner wall 16. The closure member 10 has a top wall 20 and an internally tapped generally cylindrical skirt 22 extending downwardly from the top wall 20. The cylindrical skirt 22 is tapped to provide threads 23 which mate with the threads 15 on the container neck 12. An annular resilient bead 24 is positioned on the lower surface 21 of top wall 20 projecting downwardly and disposed concentrically within the cylindrical skirt 22. An annular resilient sleeve 26 is also positioned on the lower surface 21 of top wall 20 projecting downwardly and outwardly and disposed concentrically within the annular resilient bead 24. The inner peripheral edge 30 of the annular sleeve 26 is substantially parallel to the outer peripheral edge 28 so that the resilient annular sleeve 26 is generally in the form of a hollow truncated cone. The annular resilient sleeve 26 is tapered from its outer peripheral edge 28 to its inner peripheral edge 30.

The relative dimensions of the various components of closure member 10 are critical. The median diameter of resilient annular bead 24 is greater than the diameter of the inner wall 16 of neck 12 but less than the diameter of the outer wall 14 of neck 12. Furthermore, the slant height of annular sleeve 26, i.e., the linear radial dimension from its outer peripheral edge 28 to its inner peripheral edge 30 is greater than the radial distance between the inner peripheral edge 30 and median diameter of resilient annular bead 24. The necessity of these relative dimensions is evident from the discussion below. Advantageously, the diameter of resilient annular sleeve 26 at its inner peripheral edge 30 is less than the diameter of the inner wall 16 of neck 12.

The diameter of the peripheral edge 30 of annular sleeve 26 need not be less than the diameter of the inner wall 16, however, but can be equal to or somewhat greater than the diameter of inner wall 16 depending on the thickness of the neck wall. In such instance the rim 18 initially bears against the outer peripheral edge 28 and, as the closure member 10 is advanced downwardly relative to the neck 12, the resilient sleeve 26 will be displaced so that eventually the rim 18 bears against the lower surface of sleeve 26 and bead 24 bears against the upper surface of sleeve 26. It is essential however that the slant height of resilient sleeve 26 is greater than the radial distance between the inner peripheral edge 30 and the median diameter of annular bead 24 so that when the resilient sleeve 26 is displaced by the rim 18, the sleeve is of such size that it reaches to at least the median diameter of annular bead 24.

Advantageously, the resilient sleeve is formed tapering outwardly from its inner peripheral edge to its outer peripheral edge. Such shape provides the sleeve with a greater degree of rigidity at its point of attachment to the top wall and a greater degree of flexibility at its point of contact with the rim. Also, the resilient annular bead is formed tapering outwardly from its attachment to the top wall. Thus both the resilient sleeve and bead can have a wall thickness, for example, varying from 10 to 30 thousandths of an inch. The resilient annular sleeve is positioned such that its inner surface is at an angle with respect to the top wall surface of 40 to 50° and its outer surface is at an angle of 55 to 65° and the resilient annular bead is positioned such that its inner surface is at an angle with respect to the top wall surface of 75° to 85° and its outer surface is at an angle of 80° to 90°.

The improved feature of the sealing closure resides in the indentations which are provided in the lower periphery of resilient annular bead 24. These indentations or notches which are in the shape of right triangles are seen in the cut-away portion of FIGURE 2 and are designated generally by reference numeral 40. Their function is discussed in greater detail below.

In operation the sealing closure 10 is placed upon the

neck 12 and as the threads 15 on the outer wall 14 of the neck 12 engage the threads 23 on the cylindrical skirt 22, the rim 18 of neck 12 eventually bears against the lower surface of the annular sleeve 26. This relationship between closure member 10 and neck 12 is illustrated in FIGURE 4. To provide the sealing relationship, the annular resilient sleeve 26 is displaced upwardly and outwardly by rim 18 so that rim 18 bears against the lower surface of resilient annular sleeve 26 while the resilient annular bead 24 bears against the upper surface of annular sleeve 26. In this juxtaposition the annular resilient sleeve 26 is compressed between the lower outer surface of resilient annular bead 24 and rim 18 proximate the mid-point of rim 18 of neck 12. Furthermore, in this juxtaposition the annular resilient bead 24 is compressed by the upper inner surface of resilient annular sleeve 26 to the extent that the annular resilient sleeve 26 is compressed by rim 18. Where there is a depression in the upper surface of rim 18, the resiliency of annular bead 24 maintains the pressure of resilient annular sleeve 26 against rim 18 thereby establishing a firm sealing relationship.

The indented resilient annular bead 24 performs its sealing function at the lowermost position of its periphery but indented portions permit the annular sleeve 26 to expand upwardly and outwardly in response to an excessive pressure in the container. The closure in a sealed position is best seen in FIGURES 4 and 6; and in a venting position in FIGURE 5. FIGURE 7 shows in greater detail the sealing arrangement; FIGURE 8 shows the same arrangement in a venting position.

The closures of this invention are most efficiently produced by forming them in molds and ejecting them from the molds by "unscrewing" them. The notches in the annular bead in the drawings discussed are for closures having a right hand thread, i.e., those which close in a clockwise direction; the closures are removed from the mold by counterclockwise rotation and the notches must be provided as shown to permit removal of the closure without locking or destruction of the annular bead. A series of cammed surfaces 42 integral with the inner and lower portion of cylindrical skirt 22 and having a surface at an angle to the horizontal greater than the thread, provide by their counterclockwise rotation against the mold, an axial directed force on the closure which ejects it from the mold.

FIGURE 9 shows an annular resilient bead 24 with indentations opposite to those in FIGURE 7 suitable for a closure having a left hand thread, i.e., one which closes in a counterclockwise direction. The notches, whether right hand or left hand must have an angle to the horizontal smaller than that of the thread to prevent locking upon rotation of the closure during removal; this can be seen in FIGURE 2.

The indentations shown in the drawings are of preferred shape from the standpoint of closure production but any shape indentation is suitable providing that sufficient relief is established in the lower periphery of the annular resilient bead to permit upward and outward extension of the annular sleeve in response to excessive internal container pressures. Thus rectangular notches as shown in FIGURES 10 and 11 or triangular notches or trapezoidal notches can be provided having a depth of, for example, 10 to 50 thousandths of an inch. One larger notch or a series of smaller notches can be provided; the number and size of the notches can easily be determined by those skilled in the art by routine experimentation.

The sealing closure of the invention can be fabricated from a variety of materials and by several different techniques. The top wall and cylindrical skirt can be made of any material possessing the required strength and rigidity, e.g., any of the more common metals or the more rigid plastics. The bead and sleeve can be formed from any of the well-known resilient plastic materials. The material employed in the resilient sleeve, however, must

not be so flexible that the rotation of the rim when brought into contact with the resilient sleeve in sealing relationship will cause the sleeve to become twisted. The top wall and skirt of the closure can be fabricated as a unit such as by casting or machining and the prefabricated resilient annular bead and sleeve sealed in place within the skirt. Preferably, the entire closure, including top wall, skirt, annular resilient bead and resilient sleeve, is molded as a unit employing a semi-flexible, semi-rigid plastic such as polypropylene.

I claim:

1. In a sealing closure having good sealing properties for use on a threaded neck container including a threaded outer wall, an inner wall and an interconnecting rim, said sealing closure comprising: a top wall; a tapped cylindrical skirt depending from the top wall for threaded engagement with the outer wall of the neck; an annular resilient bead positioned on the underside of the top wall tapering outwardly from its inner peripheral edge to its outer peripheral edge with its inner surface at an angle with respect to the top wall surface of 75° to 85° and its outer surface at an angle with respect to the top wall of 80° to 90°, the annular resilient bead being disposed concentrically with the skirt and having a median diameter greater than the diameter of the inner wall of the neck but less than the diameter of the outer wall of the neck; an annular resilient sleeve positioned on the under side of the top wall and disposed concentrically within the annular resilient bead, the annular resilient sleeve being joined at its inner peripheral edge to the top wall, depending angularly downwardly from the top wall outwardly

toward the skirt such that its inner surface is at an angle with respect to the top wall surface of 40° to 50° and its outer surface is at an angle with respect to the top wall surface of 55° to 65°, and having a slant height from its inner peripheral edge to its outer peripheral edge greater than the radial distance between the inner peripheral edge and the median diameter of the annular resilient bead; the improvement providing pressure venting which comprises at least one indentation in the lower peripheral edge of said annular resilient bead so that in the sealed position wherein the closure engages the threaded neck and the resilient sleeve is deflected upwardly and outwardly by the rim and bears against the annular resilient bead whereby good sealing contact between the underside of the sleeve and the rim is maintained, a space is provided in said annular bead wherein the annular sleeve can be deflected in response to excess pressure within the container.

2. The closure of claim 1 wherein a plurality of equally spaced right-triangular indentations are provided about the lower peripheral edge of said annular resilient bead.

3. The closure of claim 1 wherein a plurality of equally spaced rectangular indentations are provided about the lower peripheral edge of said annular resilient bead.

References Cited

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3,286,866	11/1966	McIntosh	-----	215—40

DONALD F. NORTON, *Primary Examiner*.