ABSTRACT

The invention relates to a tamper-indicating bottle closure consisting of a threaded bottle cap and a tamper-indicating band connected thereto by selectively rupturable connectors. The band is provided with at least to radially protruding camming members adapted to move over a retaining lip provided on a bottle, by temporarily radially deforming the band, during closure movement between cap and bottle and to be locked behind the retaining rib during opening movement between cap and bottle at a force exceeding the force of the opening movement.
TAMPER-PROOF BOTTLE CAP

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This is a continuation-in-part of application Ser. No. 09/284,126 filed Apr. 6, 1999.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The invention, in general, relates to tamper-proof bottle cap and, more particularly, to tamper-proof threaded bottle caps of the kind allowing reclosure even of plastic bottles but which once unscrewed and then screwed back leave behind an indication of prior opening of the bottle.
[0004] 2. The Prior Art
[0005] Such tamper-proof bottle caps have been generally known for some time and have found wide acceptance not least as means of warning consumers of prior opening, and possible contamination of the contents, of bottles. In some instances, such bottle caps may consist of the cap proper and a tear strip connected thereto which must be removed, sometimes with not inconceivable difficulty, before the cap can be unscrewed. Also known are tamper-proof bottle screw caps provided on their skirt with a severally connected or rupturable extension supposed to provide an indication, when the cap is unscrewed, that the bottle has been opened before.
[0006] U.S. Pat. No. 4,846,361 issued Jul. 11, 1989 to Hafner discloses a tamper-indicating bottle closure consisting of molded plastic tamper band connected to the closure or cap skirt by rupturable means. The tamper band is provided with a plurality of solid inwardly projecting beads which by engaging a transfer bead on the bottle neck as the cap is unscrewed are said to rupture the band. The beads are arranged on the band in tiers at three different heights and disposed at an angle equal to the pitch angle of the container threads. While such an arrangement may eliminate the need for top pressure when closing the container and locking the beads in place, it suffers from the drawback that it leaves more than a probability of the band not rupturing, particularly if as a result of elevated ambient temperatures the plastic of the band has been rendered abnormally pliable, when the closure is unscrewed from the container. Moreover, since the band is removed with the closure, the latter, once removed, leaves no mark of the container having been opened before. It could then easily be closed again by some other cap of pseudo-authentic appearance. Since the band in any event remains connected to the closure it may well prevent proper subsequent reclosure of the container by being jammed between the closure and the threads of the container. Another drawback of such a bead arrangement is that the tamper-indicating band may rupture during the initial closing operation if for some reason or other the closure is not properly axially aligned with the container.

OBJECTS OF THE INVENTION

[0007] It is an object of the invention to provide a bottle cap with a severally connected tamper-indicating strip which remains on the bottle upon unscrewing the cap.

[0008] Another object of the invention is to provide a bottle closure with a tamper-indicating strip which facilitates closing by high-volume bottling machines.

[0009] Other objects are in part obvious and will in part appear hereinafter.

SUMMARY OF THE INVENTION

[0010] In the accomplishment of these and other objects the invention, in a preferred embodiment thereof, provides for a bottle cap having an internally threaded skirt adapted threadedly to engage a complementary threaded bottle neck and an axially extending tamper-indicating band connected thereto for selective separation as a result of interaction between locking surfaces of protruding inwardly from the band and outwardly from the neck of the bottle.

DESCRIPTION OF THE SEVERAL DRAWINGS

[0011] The novel features which are considered to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, in respect of its structure, construction and lay-out as well as manufacturing techniques, together with other objects and advantages thereof, will be best understood from the following description of preferred embodiments when read in connection with the appended drawings, in which:

[0012] FIG. 1 is a view in longitudinal section of a bottle cap and its tamper-indicating band in accordance with the invention;

[0013] FIG. 2 is an exploded view of a bottle neck shown in side elevation and the bottle cap and its tamper-indicating band shown in section along line II-II of FIG. 1 as configured when seated on the bottle neck;

[0014] FIG. 3 is a cross-sectional view of the bottle cap and its tamper-indicating band along line II-II of FIG. 1 as configured during movement of the band over an annular bead on a bottle neck;

[0015] FIG. 4 is a perspective view from below of the bottle cap and tamper-indicating band of FIG. 1;

[0016] FIG. 5 is a cross-sectional view along line V-V of FIG. 6 between the lower edge of the cap skirt and the upper edge of the band;

[0017] FIG. 6 is a perspective view of an alternative embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] A shown in FIGS. 1 and 2, a tamper-proof bottle closure 1 consisting of a cap 2 with an internally threaded skirt 6 and a tamper-indicating band 3. Preferably the cap 2 and band 6 are fabricated by injection molding from thermoplastic material. A base portion 4 of the cap 2 is provided with an annular sealing rib 5 disposed concentrically around the axis of symmetry A of the cap 2 and internally of the skirt 6. While other configurations are conceivable, the skirt 6 as well as the sealing rib 5 are shown to extend substantially normal to the base portion 4. The lip 5 is adapted to be seated in the mouth of a bottle 17. The threads 7 protruding from the internal wall of the skirt 6 may be continuous or, as shown in FIG. 1, separated into axially aligned tiers. The tamper-indicating band 3 is integrally connected to the bottom edge of the skirt 6 by rupturable connecting webs or strands 9 of a diameter in the order of a few tenths of a millimeter. The length of the webs 9 or spacing between the edge of the skirt 6 and the adjacent upper edge 10 of the band 3 is also no more than a few tenths of a millimeter.
[0019] The tamper-indicating band 3 is provided at its internal surface 11 with two pairs of oppositely placed camming members 12a, 12b and 13a, 13b. The pairs 12a, 12b and 13a, 13b are displaced about 90° from each other and respectively disposed in axial planes separated by a distance a. The camming members 12a, 12b are placed closer to the lower edge 14 of the band 3 than the camming members 13a, 13b. Preferably, the axial spacing is a less than the axial extend b of an annular retaining rib 15 surrounding the neck 16 of the bottle 17. It is to be noted that camming members 12a, 12b and 13a, 13b are preferably provided with inclines surfaces facing away from the base 4 of the cap 2 and that the retaining rib 15 is provided with an inclined surface facing toward the mouth of the bottle 17. Opposite their respective inclined surfaces, the camming members 12a, 12b and 13a, 13b and the retaining rib 15 have surfaces, hereinafter sometimes referred to as "locking surfaces", which extend substantially normal to the axis of symmetry A. While the bottle 17 may be made from any conventional material, such as glass or metal, it is preferably made from polycarbonate therrophthalate (PET). Between the mouth of the bottle 17 and the retaining rib 15 the neck of the bottle 17 is provided with threads 18 complementing those of the closure 7 which can be continuous or, as shown in FIG. 2, separated into axially aligned tiers circumferentially spaced from each other by a distance less than the length of the thread sections 7 of the skirt 6.

[0020] Preferably, the connecting webs 9 are circumference-ally disposed between the camming members 12a, 12b, and 13a, 13b. Alternatively, the connecting webs 9 may be replaced by a rupturable continuous film (not shown).

[0021] The functioning of the tamper-indicating band 3 will now be described with reference to FIG. 3. As the cap 2 is screwed onto the neck of the bottle 17 in a clockwise direction it moves axially along the neck thereof. Initially, the threads 7 of the cap 2 are in engagement with and, move along, the threads 18 of the bottle 17 until the inclined surfaces of the retaining members 12 and 12b move into engagement with the inclined surface of the retaining rib 15. Further axial movement of the cap 2 causes the camming member 12a and 12b to slide over the retaining rib 15 and temporarily to deform the otherwise circular skirt 6 into an outward-flaring ellipsoidal configuration. At the same time, the camming members 13a and 13b are moved inwardly until the members 12a and 12b have escaped over the apex of the rib 15. Somewhat before but not later than this occurrence, the inclined surfaces of the camming member 13a and 13b move into engagement with the inclined surface of the rib 15, and during further axial movement of the cap 2 deform the skirt 6 ellipsoidally until the camming members 13a and 13b have also moved over the retaining rib 15 at which time the cap 2 resumes its initial substantially circular configuration as a result of its inherent resiliency. The radial dimensions of the camming members 12a, 12b and 13a, 13b and of the retaining rib 15 are such that the temporary ellipsoidal deformations of the skirt 6 do not exceed the elasticity of the material from which the cap is made. During movement of the camming members 12a, 12b and 13a, 13b over the retaining rib 15 the torque exerted on the cap 2 causes the lower edge 8 of the skirt 2 to move against the upper edge 10 of the band 3 after subjecting the connecting webs 9 to slight mechanical stress, and thus prevent their rupture. Once the camming members 12a, 12b and 13a, 13b have been moved over the retaining rib 15 the connecting webs 9 return to their original configuration. At the same time, the camming members 12a, 12b and 13a, 13b are effectively locked behind the retaining rib 15.

[0022] Opening the bottle by rotating the cap 2 relative to the neck of the bottle 17 in a counter-clockwise direction causes the locking surfaces of the retaining rib 15 and of the camming members 13a and 13b to move into locking engagement with each other. Further counter-clockwise rotation and, hence, axial movement of the cap 2 results in rupture of all or at least some of the connecting webs 9. In the unlikely event that the camming surfaces 13a and 13b escape beyond the retaining rib 15, the locking surface of the camming surfaces 12a and 12b will at once engage the locking surface of the retaining rib 15 and prevent further axial and rotational movement of the band 3 and cause any connecting webs 9 which have not already been ruptured to be broken.

[0023] It will thus be seen that removal of the cap 2 from the bottle 17 will result in the band 3 to remain thereon and thus provide, by the broken connecting webs 9 a clear indication that the bottle was previously opened if the cap 2 or any cap is placed on the bottle to close it again.

[0024] Turning now to FIGS. 5 and 6, there is shown an alternate embodiment of the invention. It differs from the embodiment described supra by having a section x in which the cap 2 and the band 3 are permanently connected to each other. Adjacent this permanent connection section x and intermediate a camming member 12a and a camming member 13a the band 3 is provided by a rupturable weakened section 22 formed by an incision, a tear-line or reduced wall thickness 21 or the like of the band 3. Engagement of the locking surfaces of the camming member 13a and 13b by counter-clockwise rotation of the cap 2 relative to the bottle 17 causes the weakened section 22 to rupture and the webs 9 adjacent the camming members 13a and 13b to rupture before engagement of the locking surfaces of the camming members 12a and 12b with the locking surface of the retaining rib 15.

[0025] Subsequently replacing the cap 2 and its split or ruptured tamper-indicating band 3 on the bottle 17 will yield a clear indication of prior opening of the bottle.

What is claimed is:

1. A threaded tamper-proof bottle closure for use with a bottle provided with an opening a neck provided with thread and a retaining lip on the side of the thread opposite the opening, comprising:

- a cap having a base portion and a skirt extending axially, laterally therefrom and provided with threads adapted to mate with the thread on the neck to impart opening and closing axial movement therebetween during relative rotational movement thereof;

- an annular tamper-indicating band extending axially of the skirt and provided with at least a first pair of unitary camming members disposed opposite each other in a first axial plane and a second unitary camming member angularly displaced from the first pair and disposed in a second axial plane, the camming members being adapted by radial deformation of the band sequentially to move over the retaining rib during rotational opening movement between the cap and the bottle and to move into locking engagement with the retaining rib during rotational opening movement between the cap and the bottle;

- means for releasably connecting the band to the skirt, the means being of a strength exceeding the torque required for moving the camming members over the
retaining rib and sufficiently weak to rupture by
engagement of at least one of the camming members
with the retaining rib during opening rotational move-
ment between the cap and the bottle.

2. The closure of claim 1, wherein there are provided at
least two pairs of oppositely placed camming members
disposed in axially separated planes.

3. The closure of claim 2, wherein the retaining rib is of
a predetermined axial dimension and the first and second
axial planes are separated from each other by less than the
axial dimension.

4. The closure of claim 2, wherein the connecting means
comprises a plurality of rupturable strands extending
between a lower margin of the cap and an upper margin of
the band.

5. The closure of claim 4, wherein the strands are alter-
natingly positioned between the camming members.

6. The closure of claim 1, wherein the connecting means
comprised a circumferential section permanently connecting
the cap and the band and a plurality of selectively rupturable
strands and wherein the band is provided with a selectively
rupturable section.

7. The closure of claim 6, wherein one camming member
is positioned diagonally opposite the rupturable section.

8. The closure of claim 1, wherein the retaining rib and the
camming members are provided with complementary
inclined surfaces to facilitate movement of the camming
members over the retaining lip.

9. The closure of claim 1, wherein the cap, band and
connecting means are integrally formed.

10. The closure of claim 1, wherein the cap, band and
connecting means are made of a thermoplastic material.