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Adomaitis

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[54] **TAMPER-PROOF CLOSURE FOR A PRESSURIZED CONTAINER**

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[52] **U.S. Cl.** **215/42,** 215/47

[51] **Int. Cl.** **B65d 41/20**

[58] **Field of Search** ..... 215/42, 46 A, 47, 48, 55; 220/27; 222/541

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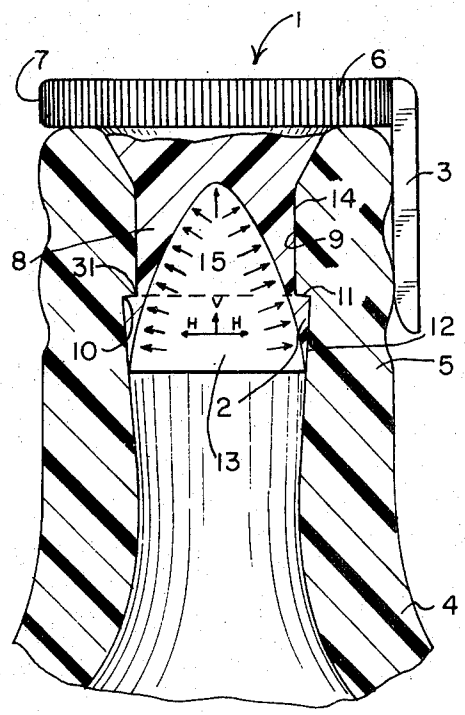
[57] **ABSTRACT**

A tamper-proof closure having an area of least strength some distance down its neck is provided. The combination of the tamper-proof closure which also has an anchor portion and a bottle which has an internal lock shoulder is part of the invention. The bottom of the anchor is indented with a recess so that the pressure coming upward in the bottle neck presses the sides of the closure against the sides of the bottle to form a better seal between the closure and the bottle. The inner side of the closure recess and the inner edge of the external lock shoulder form an area of least strength so that when pressure is applied to lift the closure out of the bottle neck, the closure snaps along the area of least strength.

12 Claims, 2 Drawing Figures



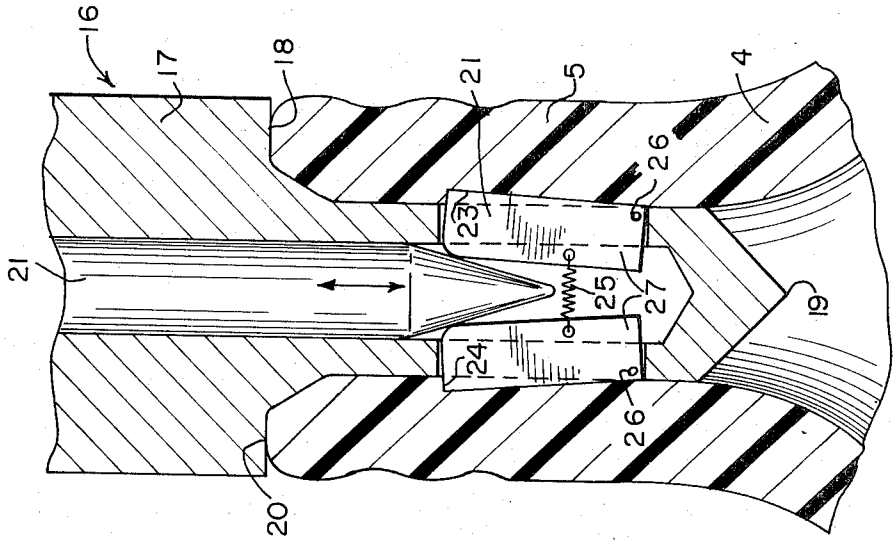

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FIG. 2.

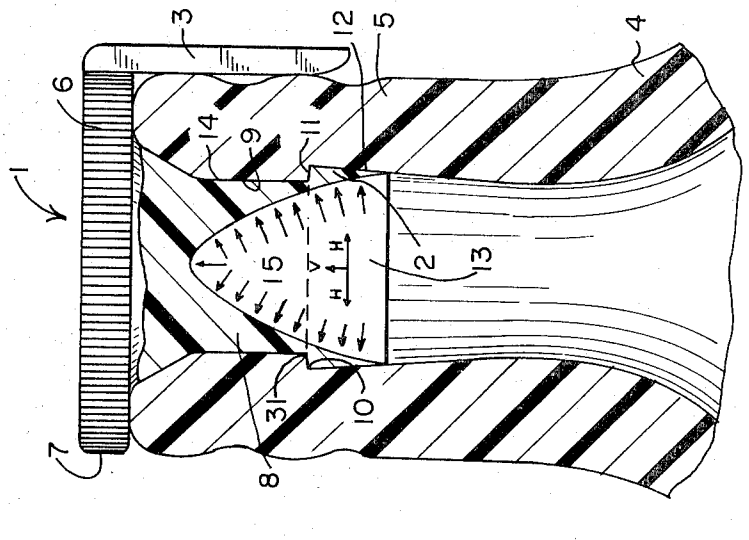
3
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FIG. 1.

TAMPER-PROOF CLOSURE FOR A PRESSURIZED CONTAINER

My invention relates to a tamper-proof closure and particularly to a tamper-proof closure having an area of less strength and shaped so that pressure inside the container tends to seal the closure in the container.

Closure means are known which have self-sealing features and in which a weakening line is featured so that the parts of the closure means separate along the weakening line. These closure means are particularly used in tear-off caps.

Further features of the invention will be apparent from the following embodiments described with reference to the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of the tamper-proof closure of my invention.

FIG. 2 is a cross-sectional view of the tip of a novel reamer with retractable cutting blades used to ream a lock shoulder of the neck of a container.

My tamper-proof closure 1 of FIG. 1 shows a sort of stopper having an anchor element 2 and an easy opening tab 3. The flexural modulus of closure must be lower than the flexural modulus of the bottle neck.

The material of my closure is plastic and a criterion for good operation of this device is that the flexural modulus of the material of the closure must be lesser than the flexural modulus of the material of the bottle 4 and bottle neck 5. This assures that plastic creep of the closure will be sufficient to cause good contact between the closure and the inner surface of the elongated neck as shown in FIG. 1. A lid element 6 or lid portion of the closure lies above the bottle neck and is in close contact with the upper edge of the bottle neck 5 all around its periphery. An easy opening tab 3 is attached to the periphery 7 of the lid portion and hangs downwardly somewhere in the neighborhood of the neck to avoid being in the way during handling.

Integral with the lid portion is the tubular plug portion 8 having the shape generally shown in FIG. 1. This tubular portion extends a distance along the inner surface 9 of the elongated neck to the internal lock shoulder 10 formed along the inner surface 9 of the elongated neck 5. The tubular plug portion 8 is of a size to fit snugly within the inner surface of the elongated neck. Attached at the end of the tubular portion 8 is anchor element 2.

The anchor element 2 comprises an external lock shoulder 11 which compliments the internal lock shoulder 10 of the bottle neck. Extending downwardly from the periphery of the external lock shoulder is a circular flange surface 12 which tapers inwardly as it extends downwardly while in the neck. The circular flange surface may be formed as an annular ring tapering in use only. The circular flange surface is in close contact with the reamed out portion of the elongated bottle neck 5. Indented into the lower portion or lower surface of the tamper-proof closure is a recess 13 having the shape of a cone, for example. When the tamper-proof closure has been pressed into the bottle neck and falls into position as shown in FIG. 1, pressure exerted from inside the bottle will press the outer surface 14 of the tubular plug and the outer surface 12 of the anchor against inner surface 9 of the bottle neck.

The operation of the combination of the tamper-proof closure 1 and the bottle retaining shoulder 10 or internal lock shoulder located in the neck 5 of the bottle is as follows. When the tamper-proof closure is pressed into the bottle neck, pressure which is applied inside of the cone recess 13 presses laterally against the anchor element 2 and against the conical inside 13 of the tubular plug portion 8. The tamper-proof closure 1 is made up of plastic material having the property of creep. The tamper-proof closure 1 moves laterally into a snug fit against the inside of the neck. This pressure applied through the plastic material to the inside of the neck tends to seal the surface of the closure more tightly against the inner surface of the neck. Similarly, lateral pressure against the inner surface of the anchor element operates in this fashion.

The relative length of the vectors H and V illustrates the relative value of the horizontal forces and vertical forces acting on the interior surface of the closure. In the configuration of the closure shown in FIG. 1, the lateral force is several times the vertical force. The anchor and the tubular plug are forced laterally into close engagement with the neck of the container. The anchor is forced laterally under the shoulder 10 which may be cut into the neck 5. The external anchor shoulder 11 has an inner edge 31 located at the juncture of outer surface 14 and the external lock shoulder. The lateral force of the pressure inside the container insures a sealing tight fit of the closure in the neck.

The recess is shown as extending well up into the plug portion to give a high horizontal force to vertical force ratio along the length of the closure. Since it is essential that the external shoulder 11 hold fast into the internal lock shoulder 10, the flange 12 is made several times as long as the shoulder width and has a relatively sharp edge. The edge presses tightly against the sloping interior neck surface under the shoulder 10. This tight fit keeps gas from getting in behind the flange surface 12 to prevent the internal pressure of the container from assuring a tight fit of the anchor shoulder 11 under the internal shoulder 10. The anchor must be made of a resilient material. The use of a resilient material such as plastic tends to provide a mechanical rigidity which holds the external shoulder 11 from turning inwardly. It also tends to hold the edge of the flange 12 against the inwardly sloping surface of the neck.

The recess may be the shape of an inverted bowl with the flat top along the area of least strength of the closure shown by dotted line 15 to form a sort of truncated cone. In this configuration, lateral force is applied to the anchor with no specific lateral force applied to the tubular plug portion.

In any configuration, the lateral area of the recess which is exposed to the horizontal pressure inside the container should be greater than the area taken at 90°. Horizontal pressure causes the outer wall of the closure to seal against the inner wall of the bottle neck.

At some point, it will be desired to open the bottle. In order to accomplish this, the easy opening tab 3 is lifted and the lid is urged upward. Since the area of least strength along line 15 has the least plastic material cross-section, this area will be the first to snap or break.

When the closure breaks somewhere along the area of least strength 15, the tubular plug portion 8 becomes an ordinary stopper which can be lifted out or inserted at will. Liquid flowing out through the neck of the bottle flows through anchor element 2 which acts as a funnel of sorts. The conventional stopper provided by the tubular plug portion has the self-sealing features of the

tamper-proof closure discussed above in that the pressure acting inside the cone recess **13** tends to press the stopper laterally against the inner surface of the bottle neck. The anchor element **2** is wedged in place in the tapered recess formed inside the bottle neck.

The advantages of this area of least strength configuration are: That the weakest area allows an easy disconnect to form a typical stopper when it is disconnected. The shape of the annular element and the position of the area of least strength allows the anchor to be inserted past the bottle neck to the internal shoulder with a minimum of buckling. The closure is easily molded because the contours are relatively smooth and there are no notches or score lines to be made in the surface of the closure.

If the bottle is made of a plastic material and the shoulder is not molded into the bottle neck, it is necessary to ream out the shoulder in the bottle neck. A reaming tool **16** such as that shown in FIG. **2** is used. The reaming tool has a shoulder **18** located a certain distance up from the tip **19** of the reamer. If the reduced reamer shank **17** is inserted into the bottle neck **5**, the reamer stops its penetration when the shoulder **18** comes to rest against the top **20** of the neck of the bottle. After the reamer has been inserted a given distance and is turning, then blades **21** are forced outwardly as the activating rod **22** descends between them and pushes them out into the inner surface **23** of the plastic neck. Reamer **16** turns in the neck **5** and reams material from the inner surface **23** of the neck. An internal lock shoulder **24** is formed. When the blades **21** have been pushed outwardly from the reamer by a given amount, then the activating rod **22** is lifted upward and the blades **21** are pulled inwardly by retracting spring **25**. The reamer can be lifted out of the neck at this time. The blades swing a limited angular distance about pivot pins **26** located at the lower extremity **27** of each blade so that the volume cut away in the neck may be of a limited amount which does not weaken the entire wall of the neck to the point that it will not prevent the tubular plug portion from popping out under normal usage.

The advantages of my invention are that a plastic closure is sealed in a plastic neck of a container. A good closure fit is assured and a device is shown for reaming out the neck in appropriate fashion. Blow-out of the closure in storage is minimized also and pull-out of the external lock shoulder **11** upon applying leverage to sever the cap is minimized. The area of least strength is formed in the plane of the retaining shoulder by the convergence of the barrel and the recess cone in the plane **15** of the area of least strength for ease of moulding. The inner rounded surface of the neck under the internal shoulder is tapered and has the effect of preventing the anchor from falling into the contents of the container when the area of least strength is severed.

The foregoing is a description of an illustrative embodiment of the invention, and it is applicant's intention in the appended claims to cover all forms which fall within the scope of the invention.

What is claimed is:

1. In combination with a container having a neck which has an inner surface with an internal lock shoulder part way down said inner surface and a sloping annular surface extending downwardly from the periphery of said internal lock shoulder, a tamper-proof closure comprising:

a lid engaging the top of said neck;

a plug portion extending from said lid, said plug portion having an external lock shoulder extending radially from an inner edge formed by the juncture of the lower part of said plug portion and the external lock shoulder;

a generally cylindrical flange surface depending from the outer circumference of said external lock shoulder contiguous with the sloping annular surface of the neck to form an anchor element; and

a recess indented into the bottom of the tamper-proof closure up to at least the height of the external lock shoulder to form an area of least strength at the closest proximity of the surface of said recess and the inner edge of said external lock shoulder, whereby when said lid is lifted, said tamper-proof closure breaks along said area of least strength and said plug portion is separated from said anchor element.

2. The combination of a container with a tamper-proof closure as defined in claim **1** in which,

said plug portion is tubular whereby said plug acts as a conventional stopper when said anchor element is disconnected from the rest of said tamper-proof closure.

3. The combination of a container with a tamper-proof closure as defined in claim **2** in which,

said plug portion is longer than said anchor element.

4. The combination of a container with a tamper-proof closure as defined in claim **1** in which,

said lid extends beyond the outer perimeter of said elongated neck.

5. The combination of a container with a tamper-proof closure as defined in claim **1** in which,

said recess extends inwardly beyond the area of least strength.

6. The combination of a container with a tamper-proof closure as defined in claim **1** in which,

said closure is made of a material having a flexural modulus less than the flexural modulus of the material of the container.

7. The combination of a container with a tamper-proof closure as defined in claim **6** in which,

said tamper-proof closure is made of a plastic material having the property of plastic creep whereby pressure which is internal of said bottle is transmitted into the recess and presses the lateral surfaces of the tamper-proof closure against the inner surface of said neck to give a greater sealing area.

8. The combination of a container with a tamper-proof closure as defined in claim **7** in which the lateral area of the recess inside the closure is greater than the area of said recess at 90° thereto.

9. The combination of a container with a tamper-proof closure as defined in claim **1** comprising further:

a sharp edge at the juncture of the surface of the recess and the surface of the cylindrical flange.

10. The combination of a container with a tamper-proof closure as defined in claim **1** having the further limitation that:

the vertical length of said cylindrical flange is several times the radial width of said external lock shoulder.

11. The combination of a container with a tamper-proof closure as defined in claim **1** comprising further:

a tab attached to said lid and lying close to the surface of said container whereby if said tab is lifted said tamper-proof closure tends to break along said area of least strength.

12. A tamper-proof closure for use with a container having a neck with an internal lock shoulder comprising:

a lid having a diameter greater than the neck of the container;

a plug portion depending from the center of said lid;

a lock shoulder having an inner edge and extending radially from the lower part of said plug;

a generally circular flange surface depending from said lock shoulder and extending away from said lid; and

a recess indented into the bottom of said tamper-proof closure and extending upwardly at least to the level of said lock shoulder to form an area of least strength at the inner edge of said lock shoulder, whereby when said lid is lifted said tamper-proof closure breaks along said area of least strength.

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