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F. J. A. KERN ET AL

3,310,191

SCREW-TYPE CLOSURE

Filed Sept. 13, 1965

FIG 1

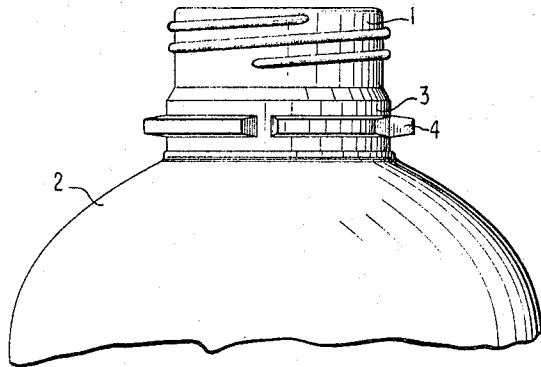


FIG 3

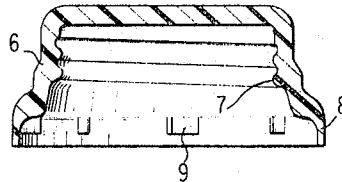


FIG 2

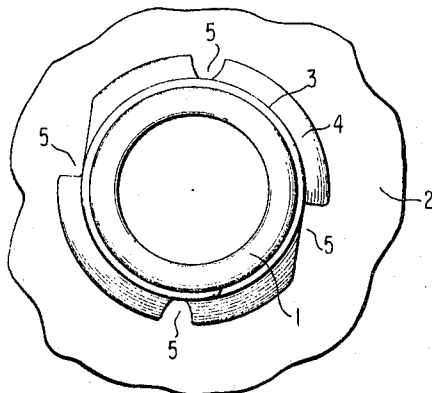


FIG 4

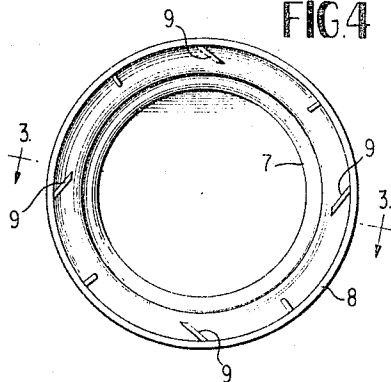


FIG 5

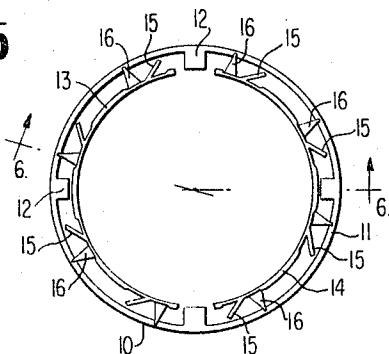


FIG 7

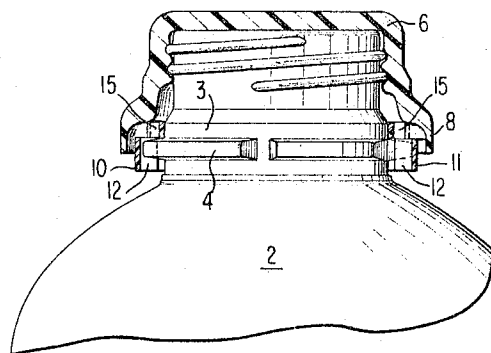
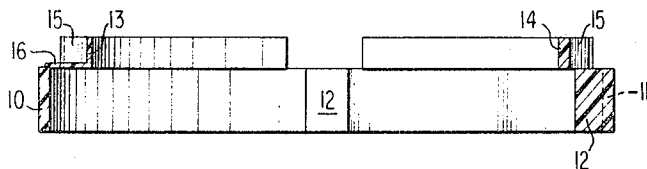


FIG 6



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1

3,310,191

SCREW-TYPE CLOSURE

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The present invention relates in general to a closure device for use on a wide variety of containers which will provide a visual external indication of any attempt, previously made, to open the container.

Several closures have been proposed which employ in combination therewith a locking or safety ring designed to be ruptured when the closure is removed from the container. For instance, a tamper-proof closure device is described in German patent specification 619,169 which is constructed of sheet metal and comprises a top cup joined to an underpart by connecting elements. Unfortunately metal screw caps cannot always be used for containers holding corrosive chemicals and, of course, such as tamper-proof closure is therefore not universally suitable for chemical purposes.

Another known type of closure comprises a combination of two parts: a screw cap and a locking or safety ring (see, for example, U.S. Patent 2,950,832). Although with this type of closure device it is possible to ascertain by careful examination if the container has or has not previously been opened, it is nonetheless of limited utility because of the locking ring consisting of pressed artificial material which is brittle and therefore readily broken. Furthermore, a mere attempt to open the container cannot be visually detected.

Still another type of tamper-proof closure as disclosed in U.S. Patent 2,124,638 comprises, in combination with a screw cap, a one-piece locking ring which breaks when the cap is unscrewed and the container is opened. In closures of this kind the locking ring which must consist of breakable material does not break in a predetermined and accurate pattern. As a result of the random breaks or cracks, as the case may be, the locking ring often remains wedged between the container neck and cap thereon and it is not always apparent when the cap has been unscrewed slightly and the ring has been broken.

It is a general object of this invention to provide for containers an improved closure device designed to visually indicate it has been removed from the container.

It is another object of this invention to provide for containers an improved closure device, a portion of which is designed to be ruptured when an attempt is made to remove the closure device from the container.

It is still another object of this invention to provide for containers an improved closure device which is designed to provide a visual indication whenever an attempt has been made to remove the closure.

It is yet another object of this invention to provide for containers an improved closure device which can be reconstructed only with great difficulty after being ruptured, if at all.

It is still a further object of this invention to provide a container having an improved neck structure designed to receive the closure device of this invention.

It is yet another object of this invention to provide with the above closure cap an improved locking ring of thermoplastic material composed of at least two mutually connected rings which are designed to break in a predetermined manner when the cap thereon is partially unscrewed.

Upon further study of the specification and claims other objects and advantages of the present invention will become apparent.

2

To attain the objects of this invention, there is provided for containers an improved combination screw closure which can be made of plastics resistant to chemical attack and which is particularly suitable for closing glass containers, more particularly glass bottles. Even more fundamental is the fact that the new closure combination of this invention provides a visual indication of any attempt made to unscrew or otherwise remove the closure from the container.

According to the present invention, there is provided an original screw closure for containers having a threaded neck, a centering edge disposed below the threaded portion of the neck, and a collar of a diameter greater than that of the centering edge disposed thereabove. The collar is provided with one or more recesses or grooves therein, designed to receive in locking engagement the lugs formed on the locking ring.

The closure member or cap proper comprises an internally threaded screw cap having a depending skirt of a diameter greater than the inside threaded portion thereof and the inner face of the skirt is provided with one or more teeth which extend inwardly and at an angle oblique to the inside surface in a direction generally opposite to the direction in which the cap is rotated to screw it onto the container. To be used in combination with the above-described closure is a locking ring comprising an outer ring and an inner ring interconnected by rupturable webs, the outer ring being dimensioned to fit snugly around the collar of the container and having one or more inwardly directed lugs which can be located within the recesses or grooves in the collar to provide a locking system which will prevent rotation of the outer ring while permitting axial movement thereof.

The inner ring segment of the locking ring is dimensioned to fit around the centering edge and is provided on its outer surface with a plurality of teeth extending obliquely outwardly in a direction generally similar to that in which the cap is rotated when it is screwed onto the container. In order to effect the desired cooperation between the above members, the teeth on the screw cap are adapted to slide over the teeth on the locking ring when the locking ring is positioned on and about the centering edge and collar of the container and the screw cap is screwed onto the neck, and further these teeth are also adapted to engage with each other to provide another locking system. Generally, the outer ring is provided with more than one lug, preferably with 2 or 4 lugs which fit into the same number of recesses in the collar of the container.

The threaded screw cap and safety ring may be conveniently constructed of synthetic resinous materials which can be easily and economically molded. Among the various resins suitable for use with this invention are; before all, thermoplastic materials such as, for example, polyethylenes (low and high pressure) having a density of at least 0.95; polypropylenes, polyamides and polystyrenes.

Although, as indicated above, a host of resins exhibiting various properties may be employed, it is preferable to use thermoplastic synthetic resins resistant to the attack of the more corrosive chemicals. The screw cap and safety ring may be constructed of the same or different materials. Whereas the safety ring should consist of a thermoplastic material, the cap may consist either of thermoplastic or of duroplastic material (pressed artificial material) such as melamine resins, urea resins or phenol plastics.

A substantial advantage of the invention is that the screw type closure can be made entirely of thermoplastic material. This is important because certain thermoplastic materials, such as polyethylene, are substantially

more resistant to chemicals than thermosetting resins such as urea and phenol formaldehyde. Moreover, the latter are more easily breakable and much more expensive to mold.

A further advantage of the closure herein resides in the particular design which makes it very difficult or even impossible to reassemble the same. The deformable thermoplastics used in the containers of this closure such as polyethylene, for example, cannot be easily glued or joined together. Only with great difficulties, at best, can these thermoplastic materials be rewelded. Specialized equipment would be required to reweld the present closure, and such an operation would require precision since the segments of the upper ring are connected at only point contacts to the lower ring. The upper ring can consist of two halves or may as well be designed to form several (for example four or six) segments when ruptured.

Further, it is extremely difficult to remove the thermoplastic closure from the container neck with hot air or hot water in such a way that the locking ring will not fall apart since the areas of point contact between the web tend to be easily weakened at elevated temperatures, whereas many of the previously proposed tamper-proof closure can be opened under the influence of heat without the permanent destruction of any portion thereof because the lower portion of the screw cap along its entire circumference and the closure thus can be pulled off under the effect of heat.

In order that the invention may be more fully understood, a preferred embodiment thereof will now be described, by way of example only, with reference to the accompanying drawing in which:

FIGURE 1 is a side elevation of the upper portion of a bottle to be used in conjunction with the improved closure of the present invention;

FIGURE 2 is a plan view of the top of the bottle shown in FIGURE 1, illustrating particularly the structure of the flanged portions thereof;

FIGURE 3 is an axial section of the improved screw cap of the present invention which is adapted for use on the bottle shown in FIGURES 1 and 2;

FIGURE 4 is an inverted plan view of the screw cap shown in FIGURE 3, illustrating with particularity the orientation of the teeth projecting from the inner face thereof;

FIGURE 5 is a plan view of a locking ring adapted for use in conjunction with the screw cap shown in FIGURES 3 and 4 and depicting one form of rupturable web which can be used to join the inner and outer surfaces thereof;

FIGURE 6 is an axial section of the locking ring shown in FIGURE 5; and

FIGURE 7 is a view similar to FIGURE 1 showing the screw cap locking ring in section, located on the neck of the bottle.

Referring to FIGURES 1 and 2, there is shown the neck of a bottle 2 comprising a screw-threaded portion 1, a centering edge 3, and an outwardly projecting collar 4 which is provided with diametrically opposed vertical grooves 5 (see particularly FIGURE 2). A screw cap shown generally at 6 (FIGURES 3 and 4) is adapted to be received in threaded engagement with the neck of the bottle 2; the cap 6 is provided with an internal screw thread 7 and a depending skirt 8 of larger diameter than the screw-threaded portion. The skirt 8 is provided with teeth 9 which extend obliquely from the interior wall thereof in a direction (see FIGURE 4) generally opposite to the direction in which the cap is rotated when it is screwed onto the bottle. The inclination of these teeth 9 can clearly be seen from FIGURE 4 illustrating the closure from below.

The cap 6 is associated in use with a locking ring 10 (FIGURES 5 and 6) which comprises an outer ring 11 connected by webs 16 or the like to two inner ring portions 13 and 14. The outer ring is provided with two

diametrically opposed, inwardly directed lugs 12 and the two inner ring portions 13 and 14 are each provided with teeth 15 which extend in a direction generally similar to the direction in which the cap is rotated when it is screwed onto the bottle.

It will be seen from FIGURE 6 that the two smaller inner ring portions 13 and 14 are disposed above the larger outer ring 11 and the webs 16 generally connect the lower edges of the portions 13 and 14 to the top edge of the outer ring 11.

It is preferred that the web 16 be formed to connect in point contact with the outer ring 11 thereby positioning the weakest structural portion of the web at the point where it unites with the outer ring. It is preferred in this embodiment, that the neck make point contact at the surface of the outer ring. It is important that the enscrewed, rupture occurs in a predetermined manner at the surface of the outer ring. It is important that the entire web break away from the outer ring at its surface in order that the same will be entirely free and disconnected from the web and hence slide unimpeded down the container neck.

In addition to the position at which the web contacts the outer ring, it is likewise important that the area and type of point contact between these segments of the locking ring be such as to be readily capable of being severed. In this connection it is important in order to avoid excessive exertion in opening the cap, that the total of point contact area between the web and the outer ring be about 0.1 to 0.4 mm.², preferably about 0.2 to 0.3 mm.² based on a cap diameter of 1 cm.

Another way of expressing the binding effect between the web and outer ring is in the ratio of the area of point contact to the diameter of the ring. Thus it can be seen that the greater the diameter of the cap, the greater mechanical advantage is provided in turning the cap and a greater area of point contact can be provided, when using larger diameter caps. Thus, whereas the total point contact area for a cap having a diameter of one centimeter is in the range of about 0.1 to 0.4 square millimeter, a cap having a larger diameter can have a disproportionately higher point contact area.

It is also preferred to employ a plurality of point contacts which are uniformly spaced about the periphery of the locking ring.

In order to seal the bottle 2, the ring 10 is first placed in the top of the container, particularly over the neck, so that the inner ring portions 13 and 14 girdle the centering edge 3 and the lugs 12 are located within the grooves 5 of the collar 4. The cap 6 is then screwed onto the neck, the inwardly directed teeth 9 of the skirt 8 sliding over the outwardly directed teeth 15 of the ring portions 13 and 14 until the cap is screwed tight.

Thereafter when it is desired to open the closure and the screw cap 6 is unscrewed, the teeth 9 and 15, which extend in opposite directions to one another, engage with one another so that upon further rotation of the cap 6, the webs 16 tear away from the outer ring, and the outer ring 11 then drops down onto the bottle shoulder. When the closure has been fully unscrewed, the two inner portions 13, 14 also drop. It is an important feature of the closure as described hereinbefore that the outer ring 11 is severed from the inner ring when the closed cap is first turned and then drops down to provide a clear visual indication that an attempt has been made to open the closure.

The closure according to the invention, therefore, gives an indication not only that a closed container has been fully opened, but also that an attempt has been made to open it. Another advantage of the closure according to the invention is that the ring 10 and cap 6 can be made of thermoplastics which are not seriously affected by normal impacts and which can withstand corrosive chemicals, while the containers to be closed can be made of glass or plastics. The closure according to the invention

can therefore be used to close glass containers containing corrosive chemicals in such a way that any opening or attempt at opening is immediately and visually apparent.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions. Consequently, such changes and modifications are properly, equitably, and intended to be within the full scope of the following claims.

What is claimed is:

1. In combination with a container having a threaded neck, a tamper-proof closure comprising a closure cap and a safety ring having a first and second section adapted to fit onto the neck of the container, said first section composed of a plurality of upper disconnected ring members adapted to be positioned between the cap and the container neck and each of which is connected to the second section by a plurality of rupturable webs, the area of contact of each of said webs with the first section being larger than the area of contact between said web and the second section, said second section when in operative position is below the upper ring members and the cap is designed to griddle the neck and slide axially thereon, two locking means, a first of said locking means being disposed between the closure cap and first ring section which only permits the cap to be inserted over and onto the neck having a safety ring thereon thereby to close the container, the second of said locking means being disposed between the second ring section and the container neck and acting to inhibit rotation of the second ring section and downward axial movement of the said first ring section, the locking means between the cap and ring being activated after the cap has been inserted over the neck and said first section of the ring to lock the same to the cap and the second ring section to the neck, whereupon a slight movement of the neck of the cap to remove the same will result in rupture of said web and downward axial movement of the second ring section and hence provide a visual indication of any attempt to open the closure.

2. The combination defined by claim 1, wherein the second locking means on the lower ring section releases the same after the cap has been turned in a direction to remove it, the lower ring section upon rupture of the webs then slides axially downwardly around the neck of the container and thus provides a visual indication of any attempt made to open the closure.

3. The combination as defined by claim 2, wherein a centering edge is disposed on the neck below the threaded portion thereof and a collar having a diameter greater than the centering edge is disposed therebelow, the collar being provided with at least one recess therein, the first locking means disposed between the closure cap and said first safety ring section comprising interlocking teeth permitting relative rotation between the cap and said safety ring in the mounting direction only, the second locking means comprising lugs on the second ring section extending inwardly and being receivable in recesses provided in said collar thereby to prevent rotation of said second ring section and to permit only downward axial movement thereof upon severance from the first ring section.

4. The combination defined by claim 3, wherein the second ring section is dimensioned to girdle the collar and the first ring section is dimensioned to girdle the centering edge and rest on an upper edge of the collar and thereby be inhibited from downward movement by the larger projecting collar.

5. The combination of a container having a threaded neck and a screw closure for use therewith, said container having a centering edge disposed below the threaded portion of the neck, and a collar of greater diameter

than the centering edge disposed therebelow, the collar being provided with at least one recess therein, said closure comprising an internally threaded screw cap having a depending skirt of larger diameter than the threaded portion thereof, the skirt being provided on the inner surface thereof with a plurality of teeth which extend obliquely inwardly in a direction generally opposite to the direction in which the cap is rotated to screw it onto the container, and a locking ring comprising an outer ring and an inner ring interconnected by a plurality of rupturable webs, the area of contact of each of said webs with the outer ring being smaller than the area of contact between said webs and the inner ring, the outer ring being dimensioned to fit around the collar of the container and having at least one inwardly directed lug which can be positioned within said recess in the collar to prevent rotation of the outer ring while permitting axial movement thereof, and said inner ring being dimensioned to fit around the centering edge and being provided with a plurality of teeth which extend obliquely outwardly in a direction generally similar to the direction in which the cap is rotated to screw it onto the container, the teeth on the screw cap being adapted to slide over the teeth on the locking ring when the locking ring is positioned on the centering edge and collar of the container and the screw cap is screwed onto the neck, said teeth being adapted to engage each other on unscrewing the cap thereby to rupture and sever said webs and result in a subsequent downward axial movement of the outer ring about the neck.

6. A locking ring for use in a tamper-proof closure comprising a first ring and a smaller second ring, said first ring having on the inside periphery thereof at least one inwardly directed lug, said second ring having a diameter smaller than the first ring and having a plurality of teeth extending obliquely outwardly, a plurality of rupturable webs joined between and connecting said first and second rings, the area of contact of each of said webs with the first ring being smaller than the area of contact between each of said webs and the second ring.

7. The locking ring defined by claim 6 wherein each of said webs is attached by a point contact with the first ring.

8. A tamper-proof closure comprising an internally threaded screw cap having a depending skirt below the threaded portion, the skirt being provided on the inner surface thereof with a plurality of teeth which extend obliquely inwardly, and a locking ring comprising, a first ring and a smaller second ring, said first ring having on the inside periphery thereof at least one inwardly directed lug, said second ring having a smaller diameter than the first ring and having a plurality of teeth extending obliquely outwardly, a plurality of rupturable webs joined between and connecting said first and second rings, the area of contact of each of said webs with the first ring being smaller than the area of contact between said webs and the second ring.

9. The tamper-proof closure defined by claim 8 wherein, in said locking ring, each of said webs is attached by a point contact with the first ring.

10. The tamper-proof closure defined by claim 8, wherein said cap is constructed of polyethylene, having a density of at least 0.95.

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