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Swartzbaugh et al.

[11] **3,795,338**

[45] **Mar. 5, 1974**

[54] **RATCHET DRIVE CHILD-RESISTANT CLOSURE**

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[73] Assignee: **Owens-Illinois, Inc.**, Toledo, Ohio

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[21] Appl. No.: **273,177**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 181,797, Sept. 20, 1971, abandoned.

[52] **U.S. Cl.** **215/9**

[51] **Int. Cl.** **B65d 43/02**

[58] **Field of Search** ..... 215/9, 43 A

[56] **References Cited**

UNITED STATES PATENTS

3,692,199	9/1972	Mumford	215/9
3,679,085	7/1972	Gach	215/9

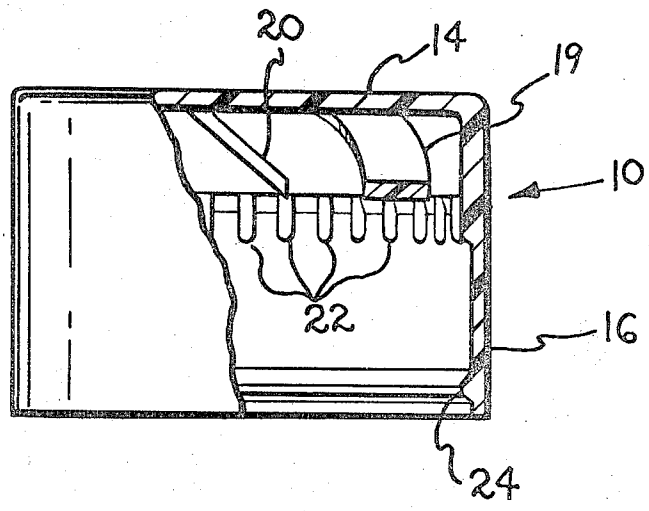
Primary Examiner—George T. Hall

Attorney, Agent, or Firm—Steve M. McLary; E. J. Holler

[57] **ABSTRACT**

A child-resistant, two-piece closure which may be attached to a container by conventional capping machines. An inner member is formed with a circular top panel having a depending skirt integrally molded therewith. The depending skirt is threaded on its inner surface for engagement with a conventional threaded container finish. The exterior surface of the depending skirt has a plurality of splines about its entire circumference. A plurality of vertical lugs project from and are integrally molded with the top panel. An outer member is likewise formed with a circular top panel and a depending skirt. Integrally formed with the interior of the outer member top panel are a plurality of downwardly extending leaf spring members. The inner surface of the outer member depending skirt has integrally molded therein a plurality of splines extending about its entire circumference. The two members are assembled by pressing the inner member over a retention bead formed in the interior of the lower portion of the outer member depending skirt. The leaf spring members are inclined from the horizontal and will drivingly engage the vertical lugs to allow the assembled closure to be put on a container. However, the leaf spring members will slip over the lugs if one attempts to remove the closure, thus allowing the outer member to rotate freely with respect to the inner member. To remove the closure, the outer member must be pressed down, overcoming the bias of the leaf spring members, to bring the splines of the inner and outer members into driving inter-engagement.

8 Claims, 8 Drawing Figures



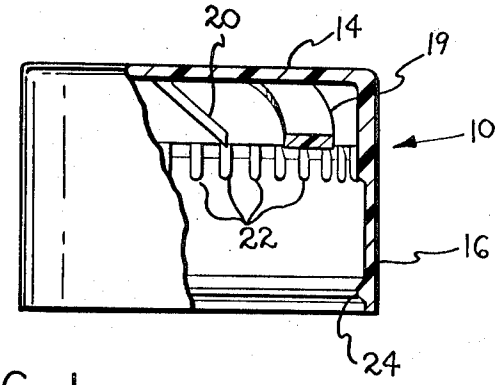


FIG. 1

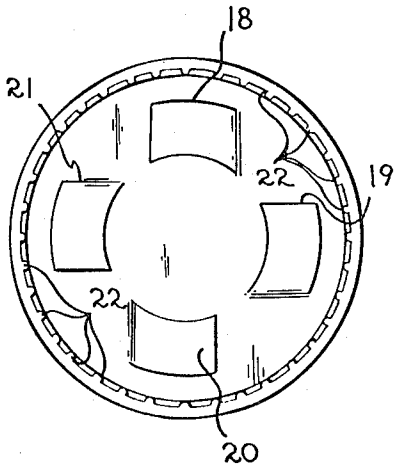


FIG. 3

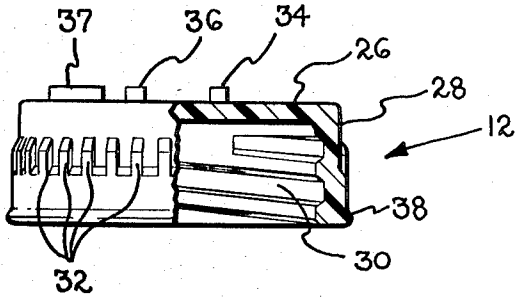


FIG. 2

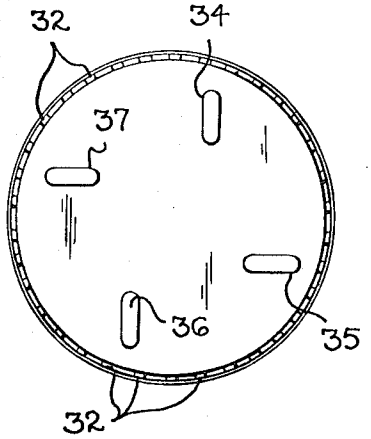


FIG. 4

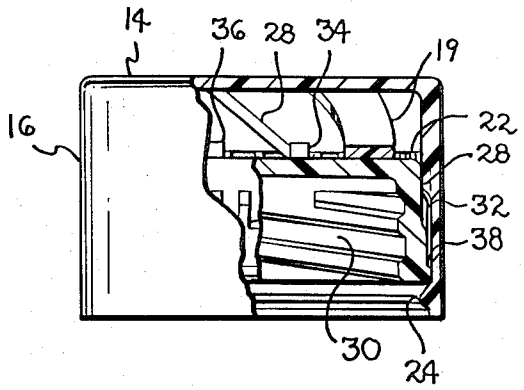


FIG. 5

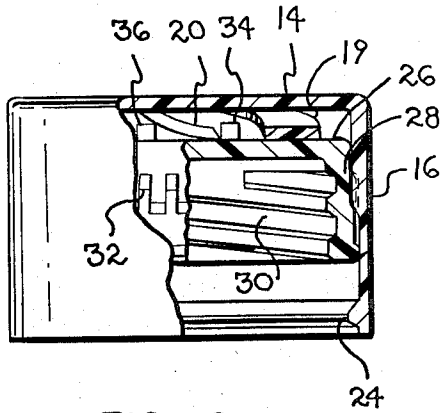


FIG. 6

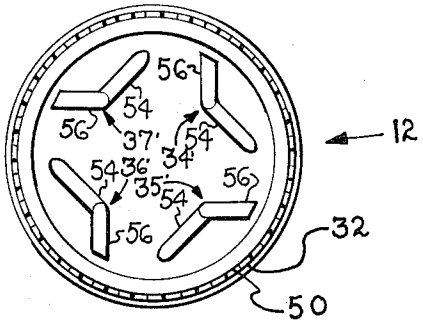

56
54
56
37'
54
34'
54
36'
35'
56
54
56
12
32
50

FIG. 8

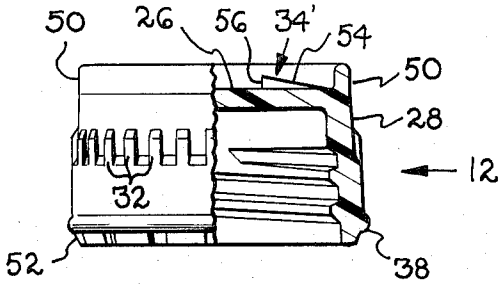

50
26
56
34'
54
50
28
12
32
52
38

FIG. 7

RATCHET DRIVE CHILD-RESISTANT CLOSURE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation-in-Part of copending application, Ser. No. 181,797, filed Sept. 20, 1971, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates generally to closure for containers. More specifically, this invention relates to a child-resistant safety closure. Most particularly, this invention relates to a child-resistant safety closure which may be applied with conventional capping machinery.

Two-piece safety closures of the type herein disclosed are known in the art; however, they have not been widely accepted because of the requirement that special capping equipment be used to apply the cap to the finish of a container. That is, such closures required manipulation for both application and removal. An example of such a closure is that taught by U.S. Pat. No. 3,964,207. A copending application, U.S. Ser. No. 86,672, filed Nov. 4, 1970, having an assignee in common with the present invention discloses a two-piece safety closure in which an overcap may be positioned after an inner cap has sealed the container. However, this is stil a two-step process. The present invention allows the assembled safety closure to be placed on a container using conventional equipment. In addition, closures of the prior art called for a tight fit between the inner and outer members. In such closures, the safety feature could be circumvented by squeezing the outer member to make friction contact with the inner member. The two members of the present invention fit quite loosely within one another to prevent such a failure of the safety feature. Finally, the safety locking feature of the present invention may be completely removed to allow use of the inner member as a conventional screw cap. The safety feature of this closure is designed to protect children of tender years. However, the product using such a closure may be sold to a childless household in which such a feature is an annoyance. The elderly, in particular, often find the manipulations required to open the container bothersome. Thus, an adult may remove the outer member of the present invention to obtain a standard screw cap on the bottle; however, the action necessary for removal is beyond the ability of the child whose welfare is protected by the safety feature of the closure.

SUMMARY OF THE INVENTION

This invention is directed to a child-resistant closure which may be placed on container using conventional capping machinery. An inner closure member is threaded to engage a standard screw finish. The inner member is snapped into an outer member and held loosely in place with relative axial and rotational movement possible between the two members. A plurality of leaf springs hold the two members in a preset axial relationship. The completed closure may be screwed onto a container, the leaf springs engaging a plurality of lug means to allow the inner and outer members to turn as a unit. However, in the reverse of unscrewing direction, the leaf springs slip over the lug means and the outer member turns freely relative to the threaded inner member. Thus, the container may not be opened. To open the container, the outer member is pressed downward to overcome the bias of the leaf springs. This motion engages splines formed on both the inner and outer members. This engagement allows the outer member to be turned so as to thereby unscrew the inner member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side, elevational view, partially cut away, of the outer cap member of the invention;

FIG. 2 is a side, elevational view, partially cut away, of the inner cap member of the invention;

FIG. 3 is a plan view of the interior of the outer cap member of the invention;

FIG. 4 is a top, plan view of the inner member of the invention;

FIG. 5 is a side, elevational view, partially cut away, showing the inner and outer members assembled;

FIG. 6 is a side, elevational view, partially cut away, showing the inner and outer members in engagement to be removed from a container.

FIG. 7 is a side, elevational view, partially cut away, of a modification of the inner cap member shown in FIG. 2; and

FIG. 8 is a top, plan view of the modified inner cap member shown in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The closure of the present invention encompasses two components; an outer cap member **10**, shown in FIG. **1**, and an inner cap member **12**, shown in FIG. **2**. With reference to FIG. **1**, the outer member **10** is formed from a circular top panel **14** integrally molded with a depending skirt **16**. Molded into the underside of the top panel **14** and extending into the interior of the outer member **10** are a plurality of inclined leaf spring members **18, 19, 20** and **21**, best seen in FIG. **3**. The preferred embodiment shown illustrates four leaf spring members **18, 19, 20** and **21**, but as few as two members will operate satisfactorily and more than four members may be employed if desired.

The leaf spring members **18, 19, 20** and **21**, in this preferred embodiment, take the form of inclined tabs integrally molded with the underside of the top panel **14**. The leaf spring members **18, 19, 20** and **21** are inclined at an angle of about 45° with respect to the vertical axis of the outer member **10**. However, the angle of inclination may be varied so long as a ratcheting function to be described later may be properly performed by the leaf spring members **18, 19, 20** and **21**.

Molded into the interior of the depending skirt **16** are a plurality of splines **22**. The splines **22** are located in approximately the upper third of the outer member **10** and are open downwardly with their upper portions being closed to limit any engagement with the splines **22** to a particular preset amount. A retention bead **24** is molded into the interior wall of the depending skirt **16** near the lower portion of the depending skirt **16**. The retention bead **24** is continuous about the entire circumference of the depending skirt **16**. The outer cap member **10** may be manufactured of any material sufficiently resilient to provide the necessary spring quality for the integrally molded spring members **18, 19, 20** and **21**. Materials which have proven successful for this purpose are polyethylene and polypropylene.

Turning now to FIG. 2, the inner cap member 12 is also formed as an integral unit having a circular top panel 26 and a depending skirt 28. The interior of the depending skirt 28 is provided with threads 30 for engagement with the finish portion of a conventional container. Arrayed about the entire exterior circumference of the depending skirt 28 are a plurality of splines 32 which open upwardly and are closed on their lower portion to limit the amount of engagement with the splines 22. It should be clear that the splines 22 and 32 need not be continuous, but could be made up of a series of separated groups. In addition, only one of the sets of splines 22 and 32 must be closed on its end to limit engagement. However, closing the ends of both sets of splines 22 and 32 has proven to provide the most satisfactory results. Projecting vertically upward from the top panel 26 is a lug means functioning as a ratchet lug. As best seen in FIG. 4, this preferred embodiment utilizes four eliptically shaped vertically extending ratchet lugs 34, 35, 36 and 37. While this preferred embodiment utilizes four ratchet lugs 34, 35, 36 and 37, as few as two ratchet lugs would operate satisfactorily. Furthermore, the ratchet function may be achieved by the use of a single elongated lug extending diametrically across the center of the top panel 26. In addition, the specific shape of the ratchet lugs is not critical so long as the ratcheting function to be described later may be properly performed. A retention bead 38 is molded in the exterior surface of the depending skirt 28 adjacent the lower extremity of the depending skirt 28. The retention bead 38 extends about the entire circumference of the depending skirt 28 and is of a diameter greater than that of the retention bead 24 formed in the depending skirt 16 of the outer cap member 10. It may be seen that the inner cap member 12 is an independent closure for a container in itself. The inner member 12 may be made of any suitable material and need not necessarily be made of the same material as the outer cap member 10. For example, the inner cap member 12 may be made of metal or may be made of a plastic material similar to that used for the manufacture of the outer cap member 10.

Turning now to FIG. 5, the assembly of the outer cap member 10 and the inner member 12 to form a child-resistant closure of the invention is shown partially cut away. To assemble the completed closure, the retention bead 38 is forced over the retention bead 24, in the process causing the depending skirt 16 to spring outwardly slightly. Once the larger diameter retention bead 38 has passed over the retention bead 24, the depending skirt 16 springs back inwardly trapping the inner cap member 12 within the outer cap member 10. As can be readily seen from FIG. 5, the fit between the outer member 10 and the inner member 12 is not tight. There is an appreciable gap between the interior of the depending skirt 16 and the exterior of the depending skirt 28. Thus the inner cap member 12 may both rotate and axially slide within the outer cap member 10. In addition, the outer cap member 10 may be pried off of the inner cap member 12 by a force applied under the edge of the outer cap member 10 to spring the retention bead 24 away from the retention bead 38 and allow the outer cap member 10 to be removed from the inner cap member 12. This process may be done while the completed two-piece closure unit is in place on a container. The procedure is not an extremely simple one making it unlikely that a child would be able to disassemble the completed closure, thus retaining its child-resistant features. However, an adult for whom the child-resistant feature, to be discussed later, would prove an annoyance may remove the outer member 10, thereby providing a simple screw-type closure on the container in the form of the inner cap member 12. As seen in FIG. 5, the leaf spring member 20 is in driving engagement with a ratchet lug 34. Similarly, although not seen in this view, the other leaf spring members 18, 19 and 21 are in engagement with the other ratchet lug members 35, 36 and 37. Thus the completed closure as shown in FIG. 5 may be screwed onto the finish of a container since rotation of the outer cap member 10 will cause the leaf spring members 18, 19, 20 and 21 to drivingly engage the ratchet lugs 34, 35, 36 and 37 and consequently turn the outer member 10 and inner member 12 as a unit in the tightening direction. Conversely, it may be seen that if the outer member 10 were rotated in the opposite direction, the leaf spring 20 would slip over the next ratchet lug 36. It is clear that these two functions provide a well known one-way ratchet drive for the inner cap member 12. Thus the outer member 10 would rotate freely with respect to the inner member 12 in the loosening direction. It is this feature which makes the combined closure child-resistant, since it is impossible to unscrew the combined closure without an additional motion. Furthermore, the gap between the depending skirt 16 and the depending skirt 28 makes it unlikely that a child could compress the outer member 10 by squeezing it against the inner member 12 sufficiently to be able to unscrew the inner member 12 from the finish of the container. Many closures of this type in the prior art provided at tight engagement between the two components of the closure, thus making it possible to squeeze the outer member against the inner member and obtain a driving engagement, thereby by-passing the child-resistant features of the closure. It will be noted also in FIG. 5, that the upper splines 22 in the outer cap member 10 are not engaged with the lower splines 32 in the inner cap member 12.

To remove the combined closure from a container, the outer cap member 10 must be compressed downwardly over the inner cap member 12 as shown in FIG. 6. The leaf spring members 18, 19, 20 and 21 serve to normally keep the outer member 10 and the inner member 12 in the relationship shown in FIG. 5, in which configuration removal of the closure from the container is impossible. However, utilizing the spring function of the leaf springs 18, 19, 20 and 21, the outer cap member 10 may be pressed downwardly over the inner cap member 12. The downward displacement of the outer cap member 10 brings the splines 22 into inter-engagement with the spaces between these splines 32. Conversely, the splines 32 are inter-engaged with the spaces between the splines 22. Since both sets of splines are closed on one end, the degree of engagement of the two sets of splines 22 and 32 is limited, thereby preventing overflexing of the leaf spring member 18, 19, 20 and 21. With the splines 22 and 32 so inter-engaged, the outer cap member 10 may be rotated and the inner cap member 12 will rotate with it as a unit through the driving engagement of the splines 22 and 32, thus making removal of the closure from the container finish possible in this configuration. Once the combined closure is removed from the container and the downward pressure on the outer cap member 10 is

released, the combined closure will spring back to the configuration shown in FIG. 5 under the influence of the leaf springs 18, 19, 20 and 21, thereby placing the closure in a configuration suitable for reapplication. The user may then screw the closure back onto the container utilizing the driving engagement of the leaf springs 18, 19, 20 and 21 and the ratchet lugs 34, 35, 36 and 37. Once back on the container, the combined closure may not be removed again without the downward compression of the outer cap member 10 over the inner cap member 12. It has been found that when a child attempts to remove the assembled closure from a container without pressing downward on the outer cap member 10, an audible warning sound is produced. That is, the leaf springs 18, 19, 20 and 21 slipping over the ratchet lugs 34, 35, 36 and 37 produce a loud and distinctive clacking sound. This sound may be heard for some distance and can serve as a warning to parents that children are tampering with a container whose contents may be harmful to them.

The combined closure assembled from the outer member 10 and the inner member 12 may be applied by conventional capping machinery, since there is no need for any manipulation of the closure during the tightening procedure. That is, the combined closure may always be put onto a bottle without any external manipulation of the combined closure, a departure from the requirements of all known child-resistant closures of the prior art. However, removal of the closure requires a manipulation which has been found to be beyond the abilities of most children of tender years whose welfare is protected by the utilization of closures of this type. In addition, in those households which are childless, the child-resistant aspects of this closure may be removed by adults to whom such provisions are merely an annoyance and are unnecessary.

FIGS. 7 and 8 illustrate a modified design for the inner cap member 12. The modified design will still function properly with the outer cap member 10 previously described. In FIG. 7, it may be seen that a vertical ring wall 50 has been integrally molded with the periphery of the top panel 26 and extends vertically upwardly from the top panel 26. The ring wall 50 is provided to control the degree to which the outer cap member 10 may be tipped with respect to the inner cap member 12. It should be recognized that the safety closure of the present invention can be made in a wide range of sizes to fit numerous containers. In some size ranges, the sidewise tipping of the outer member 10 with respect to the inner member 12 can become excessive; under these circumstances, the ring wall 50 is added to control the relative motion of the two components. In addition, a second ring wall, of a diameter slightly less than the ring wall 50, could be molded into the interior of the top panel 14. This second ring wall would be downwardly depending when the closure was assembled, and would cooperate with the ring wall 50 to still further limit tipping. In addition, the retention bead 38 may be moved upward slightly from its' normal position adjacent the lower extremity of the depending skirt 16. In this situation, an inwardly depending tapered sleeve 52 defines the lower extremity of the depending skirt 16.

FIGS. 7 and 8 further illustrate one possible alternative configuration of the ratchet lugs designated as 34', 35', 36' and 37'. Each of the ratchet lugs 34'–37' is made up of a substantially L-shaped combination having an inclined ramp portion 54 joined to a vertical wall portion 56. The leaf spring members 18–21 will be wedged against the wall portions 54 when the outer cap member 10 is turned in the tightening direction. However, if the outer cap member 10 is turned in the removing direction, the leaf spring members 18–21 will ride up the ramp portions 54 and slip off, thus giving no removal force to the inner cap member 12.

We claim:

1. A child-resistant closure comprising, in combination: an inner threaded member adapted to be screwed onto a threaded container neck, an outer member loosely encompassing said inner member in detachable interengagement, said inner and outer members being capable of relative rotary and axial sliding movement, internal splines formed on said outer member, external splines formed on said inner member, said splines being engageable in one position of axial displacement of said inner and outer members and disengaged in a second axial position of said members, lug means formed on one of said members and interposed said members, a plurality of inclined leaf spring members interposed said inner and outer members in the path of travel of said lug means to maintain said inner and outer members in said second axial position and drive said inner and outer members as a unit in the tightening direction but slip over said lug means freely in the untightening direction to prevent unscrewing of said inner member, and means for loosely retaining said inner member within said outer member.

2. The closure of claim 1, wherein said lug means comprises at least two vertically upwardly extending projections integrally molded on the exterior of the upper surface of said inner member.

3. The closure of claim 1, wherein said leaf spring members comprise at least two downwardly extending flexible tabs integrally molded on the interior of the upper surface of said outer member.

4. The closure of claim 1, wherein said inner and outer members are formed of a plastic material.

5. The closure of claim 1, wherein said means for loosely retaining said inner member comprises an outwardly extending first circumferential bead integrally formed on the exterior of the lower portion of said inner member and an inwardly extending second circumferential bead of a diameter less that the diameter of said first circumferential bead integrally formed on the interior of the lower portion of said outer member.

6. The closure of claim 1, wherein at least one of said sets of internal and external splines is closed on the end opposite said other set of splines for limiting the axial movement between said inner and outer members.

7. The closure of claim 1, further including a vertically extending ring wall integrally formed with the periphery of the exterior of the upper surface of said inner member.

8. The closure of claim 1, wherein said lug means comprises at least two inclined ratchet lugs integrally molded on the exterior of the upper surface of said inner member, each of said inclined ratchet lugs comprising, a ramp portion inclined upward in the direction in which said inner member would be unscrewed from said container, and a vertical wall portion joined to the upper terminus of said ramp portion and integrally molded on the exterior of the upper surface of said inner member.

* * * * *