United States Patent [19]

Mumford et al.

[11] **3,857,505**

[45] **Dec. 31, 1974**

[54] **SAFETY CLOSURE**

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

[22] Filed: **Oct. 1, 1973**

[21] Appl. No.: **402,199**

[52] **U.S. Cl.** **215/9,** 215/220

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

[58] **Field of Search** 215/9, 220

[56] **References Cited**

UNITED STATES PATENTS

3,692,199	9/1972	Mumford	215/9
3,795,337	3/1974	Nozawa	215/9
3,795,338	3/1974	Swartzbaugh	215/9

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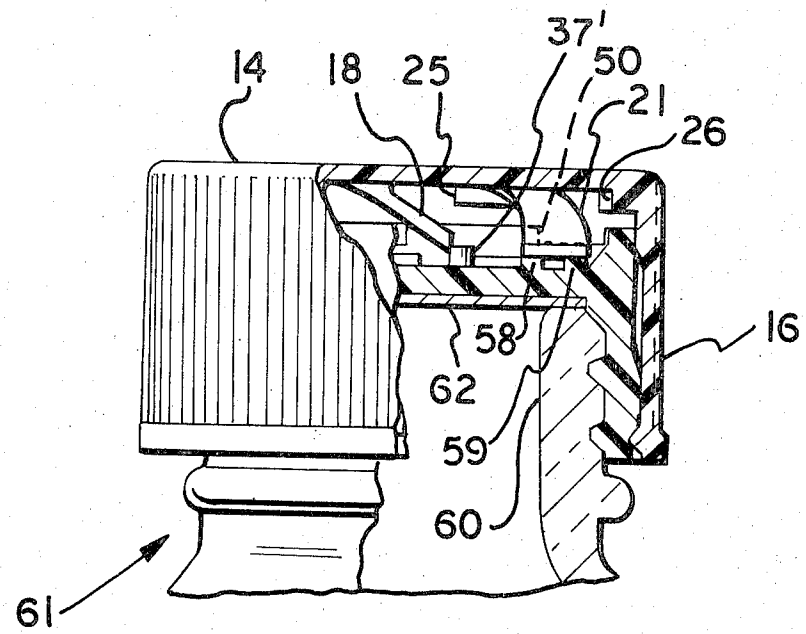
Assistant Examiner—R. E. Hart
Attorney, Agent, or Firm—Steve M. McLary; E. J. Holler

[57] **ABSTRACT**

A child-resistant, two-piece closure which may be attached to a container by conventional capping machines. An inner cap member is formed with a circular top panel having a depending skirt integrally molded therewith. The depending skirt is threaded on its interior surface for engagement with a conventional threaded container finish. A ring wall projects vertically from the periphery of the top panel of the inner member. A plurality of spaced apart drive projections extend upwardly from the ring wall. Plural ratchet lug means also extend upwardly from the upper surface of the top panel. An outer member is likewise formed with a circular top panel and an integral depending skirt. Integrally formed with the interior of the outer member top panel are a plurality of downwardly extending leaf spring members. A plurality of drive lugs extend downwardly from the periphery of the interior of the outer member top panel. 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 a horizontal plane and will drivingly engage the ratchet lug means in the tightening direction to allow the assembled closure to be put on a container. However, the leaf spring members will slip over the lug means 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 to overcome the bias of the leaf spring members. This will bring the drive lugs of the outer member into engagement with the spaces between the drive projections of the inner member, thereby allowing rotation of the inner and outer members in unison to allow removal of the closure.

8 Claims, 7 Drawing Figures



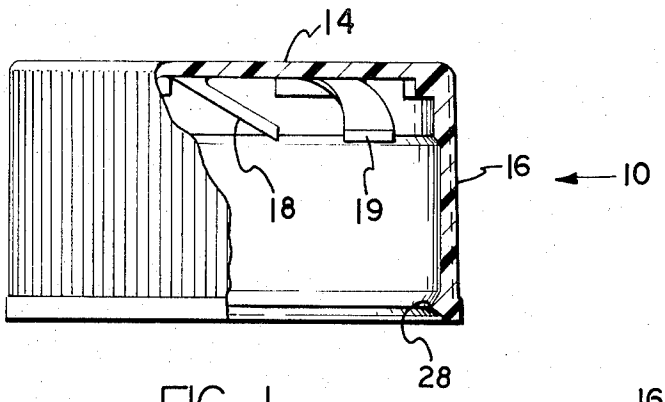


FIG. 1

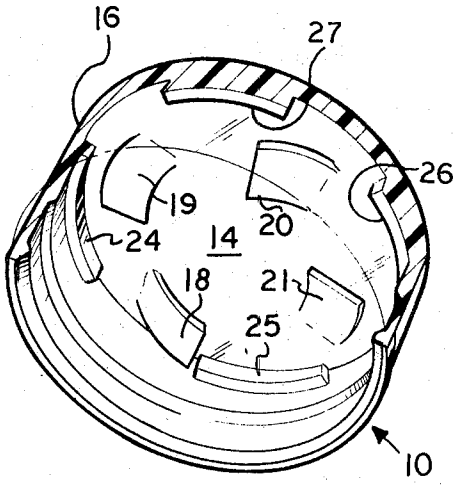


FIG. 2

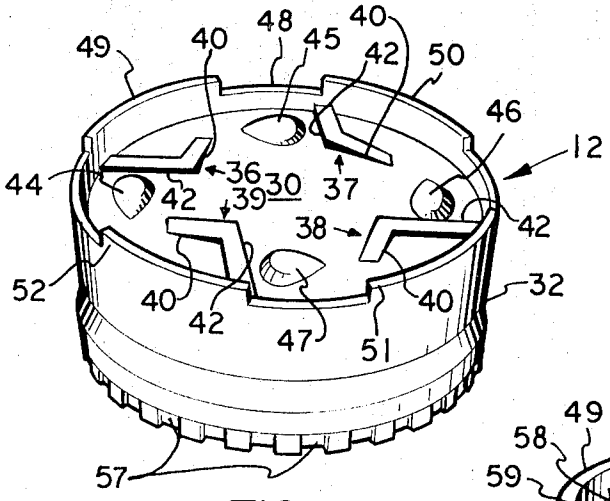


FIG. 3

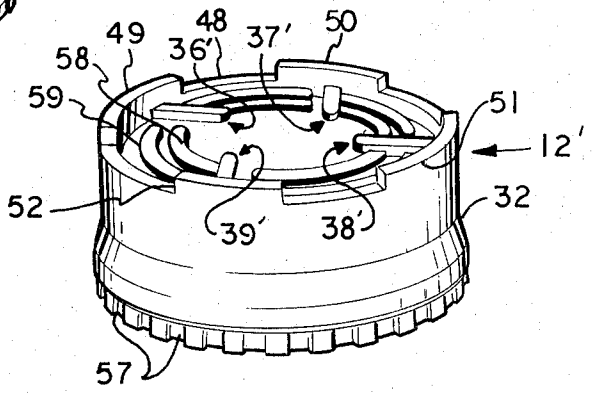


FIG. 4

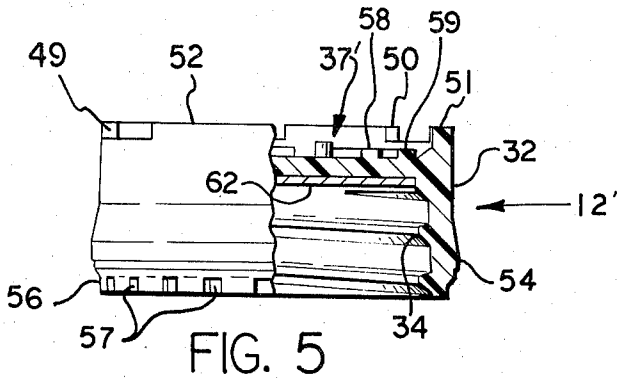


FIG. 5

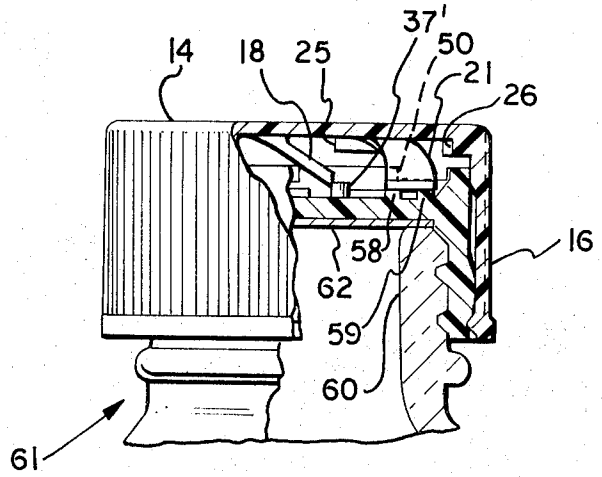


FIG. 6

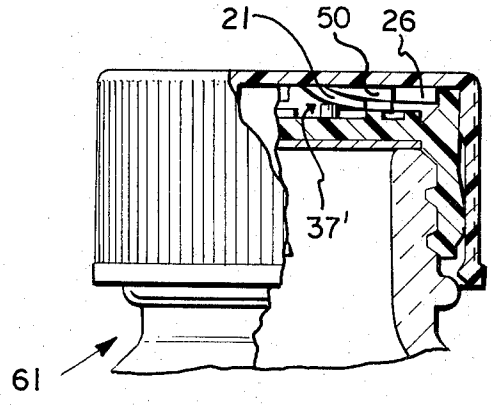


FIG. 7

SAFETY CLOSURE

BACKGROUND OF THE INVENTION

This invention generally relates to closures for containers. More specifically, this invention relates to a child-resistant safety closure. Most particularly, this invention relates to a child-resistant safety closure, having an improved type of removal drive, which may be applied with conventional capping machinery.

The closure of the present invention is similar in concept to one disclosed in a co-pending application, U.S. Ser. No. 273,177, filed July 19, 1972 and having an assignee and one inventor in common with the present closure. The closure disclosed in the cited application has proven commercially workable. However, the present invention was developed to provide a better removal drive and to enhance the safety factor of the cited closure. Examples of the prior art may be seen in the following U.S. Pat. Nos. 2,964,207; 3,055,524; 3,692,199; and 3,705,662.

SUMMARY OF THE INVENTION

This invention is a child-resistant closure for containers having an externally threaded finish portion. The closure includes the following components: (a) An inner cap member is formed having a top panel integrally formed with a depending skirt portion. The depending skirt portion has threads formed on its interior surface for engagement with the container finish portion. A vertically extending ring wall is integrally formed with the periphery of the inner member top panel. A plurality of spaced-apart drive members extend upwardly from the ring wall; (b) An outer cap member is formed with a top panel integrally formed with a depending skirt portion. The depending skirt portion of the outer member loosely encompasses the depending skirt of the inner member to allow relative rotary and axial movement between the inner and outer members. A plurality of downwardly directed drive lugs are integrally formed with the top panel of the outer member on the interior thereof. The drive lugs will engage the spaces between the drive members in one position of axial displacement of the inner and outer members and will be disengaged therefrom in a second axial position of the inner and outer members; (c) Ratchet lug means are formed on either the inner or the outer member and are interposed these two members; (d) A plurality of inclined leaf spring members are formed on either the inner or the outer member and are interposed these two members. The leaf spring members provide a biasing force to maintain the inner and outer members normally in the second axial position. In this position, the leaf spring members will engage the ratchet lug means to drive the inner and outer members as a unit in the closure tightening direction, but will slip over the ratchet lug means freely in the untightening direction to prevent unscrewing of the inner member from the container finish portion. Downward pressure on the outer member will overcome this bias of the leaf spring members to place the inner and outer members in the first axial position; and (e) A means is provided for loosely retaining the inner member within the outer member.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 2 is a perspective view, partially cut away, of the interior of the outer cap member of the present invention;

FIG. 3 is a perspective view of the upper portion of the inner cap member of the present invention;

FIG. 4 is a perspective view of a slightly modified inner cap member as shown in FIG. 3;

FIG. 5 is a side elevational view, partially cut away, of the inner member shown in FIG. 4;

FIG. 6 is a side elevational view, partially cut away, of the assembled closure in engagement on a container in the configuration for application to a container; and

FIG. 7 is a view similar to FIG. 6 showing the inner and outer members engaged for rotation as a unit to allow removal from the container.

DETAILED DESCRIPTION OF THE DRAWINGS

The closure of the present invention is made up of two components: an outer cap member **10**, shown in FIGS. **1** and **2**, and an inner cap member **12**, shown in FIG. **3**, with modifications of this member **12'** shown in FIGS. **4** and **5**. With reference to FIG. **1**, the outer cap member **10** is formed with a circular top panel **14** integrally molded with a depending skirt portion **16**. Molded into the underside of the top panel **14** and extending into the interior of the outer member **10** are a plurality of leaf spring members **18, 19, 20** and **21**, best seen in FIG. **2**. The embodiment illustrated shows 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** 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. It should also be noted that the leaf spring members **18, 19, 20** and **21** are positioned on a radius from the center of the top panel **14** which is less than the inside radius of the outer member **10**. In addition to the spring members, a plurality of drive lugs **24, 25, 26** and **27** are also molded into the underside of the top panel **14** and depend downwardly. The drive lugs **24** through **27** are preferably located adjacent to the extreme outer portion of the inside diameter of the outer cap member **10** adjacent to the depending skirt **16**. The drive lugs **24** through **27** then extend inwardly toward the leaf springs **18** through **21**, but their edges terminate before reaching the leaf spring members **18** through **21**. The illustration of four drive lugs **24** through **27** is simply by way of illustration and a single drive lug would function properly, but multiple drive lugs are preferred to allow a number of different removal engagement positions, as will be described later. A retention bead **28** is molded into the interior wall of the depending skirt **16** near the lower portion of the depending skirt **16**. The retention bead **28** 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 neces-

sary spring quality for the integrally molded leaf spring members **18** through **21**. Materials which are proven successful for this purpose are polyethylene and propylene.

With respect to FIGS. **3, 4** and **5**, the inner cap member **12** is also formed as an integral unit having a circular top panel **30** and a depending skirt **32** attached thereto. The interior of the depending skirt **32** ay be provided with threads **34** for engagement with a threaded finish portion of a conventional container. Projecting vertically up from and integrally attached to the top panel **30** are a plurality of ratchet lug means. In the embodiment shown in FIG. **3**, the ratchet lug means take the form of four ramp-type lugs **36, 37, 38** and **39**. Each of the ramp lugs **36** through **39** has a substantially L-shaped configuration formed by an inclined ramp portion **40** joined to an axially extending vertical wall portion **42**. The beginning of the ramp portion is in a plane substantially identical to the plane of the top panel **30**. The vertical wall portion **42** terminates at an elevation such that the spring members **18** through **21** will jam on the vertical wall portion **42** if it is attempted to pass them by the vertical wall portion **42**. This, of course, takes place in the assembled closure, and this precise function will be described in detail later. The precise configuration of the ratchet lug means is not an especially critical aspect of this particular closure. For example, FIG. **4** illustrates a modification of the ratchet lug means, in which the ratchet lug means comprises four elliptically shaped, vertically or axially extending ratchet lugs or raised bosses **36'**, **37'**, **38'** and **39'**. The ratchet function could be achieved by the use of a single elongated lug extending diametrically across the center of the top panel **30**. Spaced between each of the ramp lugs **36** through **39** in FIG. **3** are teardrop shaped detent projections **44, 45, 46** and **47**. These detent projections **44** through **47** project above the plane of the top panel **30** and, likewise, lie in the path of travel of the spring members **18** through **21**. The precise functioning of these members will be explained later in detail. It may, likewise, be seen that the upper portion of the inner cap member **12** is of a general configuration that may be considered to be castellated. That is, a ring wall **48** rises above the plane of the top panel **30**. Spaced at intervals around the ring wall **48** are upwardly or axially extending drive projections **49** through **52**. In the assembled closure, the drive lugs **24** through **27** on the interior of the outer cap member **10** are sized such that they may mesh into the openings between the drive projections **49** through **52**. This imparts a driving force to the inner cap member **12** so that it may be driven with the outer cap member **10**. As best seen in FIG. **5**, a retention bead **54** is molded into the exterior surface of the depending skirt **32**. The retention bead **54** extends about the entire circumference of the depending skirt **32** and is of a diameter greater than that of the retention bead **28** formed in the depending skirt **16** of the outer cap member **10**. The depending skirt portion **32** may terminate in an inwardly depending tapered sleeve **56** which has formed therein a number of grooves **57**. This particular feature is strictly for convenience in manufacture and allows removal of the inner cap member **12** from a mold with greater facility, the grooves **57** serving as a gear drive to screw the inner cap member **12** off of its mold form. The modified form of the inner cap member **12**, designated in FIG. **4** as **12'**, retains substantially most of the features described with resepct to the inner cap member **12**. In fact, these two members **12** and **12'** are interchangeable with the outer cap member **12**. However, specific problems involved with differing sizes of closures, that is in terms of the actual diameter of the container which the closure is to seal, require some modifications of the specific design of the drive mechanism. As previously described, the ratchet lug means in FIG. **4** are in the form of the elongated elliptical lugs **36'** through **39'**. In addition, two radially separated arcuate lands extend between adjacent ratchet lugs **36'** through **39'**. These lands **58** and **59**, are used primarily to bias the spring members **18** through **21** into a particular desired degree of downward force and to hold their position accurately. This enhances the safety feature of the assembled closure in eliminating any possibility of accidental engagement of the drive mechanism. It should be realized that the elliptical ratchet lugs **36'** through **39'** could be used with the detent projections **49** through **51**, and conversely, the ramp lugs **36** through **39** could be used with the arcuate lands **58** and **59**. The precise configuration which will be chosen depends upon the specific design problems involved, but is a matter that should be readily soluble by one skilled in the art. The inner cap member **12** is an independent closure in itself for a container. The inner member **12** therefore may be made of any suitable material and need not necessarily be made of the same material as that of the outer cap member **10**; however, it has been found that a thermoplastic material such as polyethylene or polypropylene is particularly well adapted for the manufacture of the inner cap member **12**.

With respect to FIG. **6**, the completed safety closure of the present invention is shown partially cut away. The safety closure is formed by assembling the outer cap member **10** and the inner cap member **12**. To assemble the completed closure, the retention bead **28** is forced over the retention bead **54**, in the process causing the depending skirt **16** of the outer closure cap member **10** to spring outwardly slightly. Once the larger diameter retention bead **28** has passed over the retention bead **54**, the depending skirt springs back inwardly trapping the inner cap member **12** within the outer cap member **10**. As can be seen in FIG. **6**, 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 **32**. Thus, the outer cap member **10** may both rotate and axially slide with respect to the inner cap member **12**. It will be appreciated that the actual configuration of the inner cap member **12** shown in FIG. **6** is the modified embodiment **12'** shown in FIG. **4**. The inner cap member **12'** is threadably engaged on the exteriorly threaded finish portion **60** of a container **61**. A sealing disk **62** is trapped between the upper portion of the finish **60** and the lower portion of the top panel **30** of the inner member **12'**. The leaf spring member **18** may be seen to be in driving engagement with the lug **37'**. Similarly, although not seen in this view, the other leaf spring members **19, 20** and **21** are in driving engagement with the other ratchet lug members **36', 38'** and **39'**. Thus, the completed closure as shown in FIG. **6** may be screwed onto the finish of a container **61**, since the rotation of the outer cap member **10** will cause the leaf spring members **18** through **21** to drivingly engage the ratchet lugs **36'** through **39'** and consequently turn the outer member

10 and the 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 or the direction normally unscrewing the cap from the container 61, the leaf springs 18' through 21' would slip over the ratchet lugs 36' through 39'. Thus, these two functions provide a one-way ratchet drive for the inner cap member 12'. The outer cap member 10 thus can 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 32 and the depending skirt 16 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 60 of the container 61. Many closures of this type in the prior art provided a tight engagement between the two components of a 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. The arcuate lands 58 and 59 of the inner closure member 12' are seen to be touching the leaf spring members 18 through 21, thus holding the leaf spring members 18 through 21 in a preferred biasing position, providing a known spring force to keep the inner member 12' separated from the outer member 10. Although the embodiment designated as 12 in FIG. 3 is not shown, it should be obvious to one skilled in the art that the ratchet function just described would also take place if this particular embodiment were used. In the tightening direction, the leaf spring members 18 through 21 would wedge or drivingly engage the vertical wall portions 42 of the ramp lugs 36 through 39. Thus, the combined closure could be tightened or screwed onto the threaded finish 60 without any further manipulation. Conversely, if the outer cap member 10 were rotated in the loosening or unscrewing direction, the leaf springs 18 through 21 would rise up the ramp portions 40 of the ramp lugs 36 through 39 and would not impart sufficient loosening torque to the inner cap member 12. The detent projections 44 through 47 act as a further safety feature in the embodiment shown in FIG. 3. If the outer cap member 10 is turned in a direction which would normally unscrew the combined closure from the finish 60, once the leaf springs 18 through 21 have risen completely up the ramp portion 40 of the ramp lugs 36 through 39 and fallen off the opposite side, the detent projections 44 through 47 will tend to hold the leaf springs 18 through 21 in that position. It is necessary then to exert further force to move the leaf springs 18 through 21 to the next ramp lug to raise it up the ramp portion 40. In addition, the detent projections 44 through 47 are positioned such that the drive lugs 24 through 27 are aligned with the drive projections 49 through 52 when the leaf springs 18 through 21 are stopped by the detent projections 44 through 47. This position helps prevent overstressing of the leaf springs 18 through 21 when the closure is subjected to a vertical load, as in a warehouse. The drive lugs 24 through 27 are in contact with the drive projections 49 through 52 to prevent this overstressing.

To remove this closure from a container finish 60, the outer cap member 10 must be compressed downwardly over the inner cap member 12', as shown in FIG. 7. The configuration of FIG. 7 may be considered one position of axial displacement of the outer member 10 and the inner member 12', while the configuration of FIG. 6 may be considered a second position of axial displacement of the outer member 10 and the inner member 12'. The leaf spring members 18 through 21 serve to normally keep the outer member 10 and the inner member 12' in their relationship shown in FIG. 6, in which configuration removal of the closure from the container is impossible. However, utilizing the spring function of the leaf springs 18 through 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 drive lugs 24 through 27 into engagement with the spaces between the drive projections 49 through 52. It should be realized that the alignment of the drive lugs 24 through 27 and the spaces between the drive projections 49 through 52 may not be perfect at the time the outer cap member 10 is pressed downwardly. However, slight rotation of the outer cap member 10 in the loosening direction will bring these members into proper drive engagement. With the drive lugs 24 through 27 properly engaged, the outer cap member 10 may be rotated and the inner cap member 12 will rotate with it as a unit through this driving engagement. 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 the configuration shown in FIG. 6 under the influence of the leaf spring member 18 through 21, thereby placing the closure in configuration suitable for reapplication. The user may then screw the closure back onto the container finish 60 utilizing the driving engagement of the leaf springs 18 through 21 and the ratchet lugs 36' through 39'. 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. Due to the ratchet drive arrangement, it has been found that when a child attempts to remove the assembled closure from a container 61 without pressing downwardly on the outer cap member 10, an audible warning sound is produced. The leaf springs 18 through 21 slipping over the ratchet lugs 36' through 39' 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 of this invention assembled from the outer member 10 and the inner member 12 or 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 the finish of a container 61 without any extra manipulation of the combined closure, a departure from the requirements of most child-resistant closures of the prior art. However, removal of the closure requires manipulation which has been found to be beyond the abilities of most children.

We claim:

1. A child-resistant closure for containers having an exteriorly threaded finish portion comprising, in combination: an inner cap member having a top panel integrally formed with a depending skirt portion, said de-

pending skirt portion having threads formed on the interior surface thereof for engagement with said finish portion of said container, an axially extending ring wall integrally formed with the periphery of said inner member top panel, a plurality of spaced apart drive members formed in the outer extremity of said ring wall; an outer cap member having a top panel integrally formed with a depending skirt portion, said depending skirt portion of said outer member loosely encompassing said depending skirt portion of said inner cap member to allow relative rotary and axial movement between said inner and outer members, a plurality of downwardly directed drive lugs integrally formed on the interior of the top panel of said outer member, said drive lugs engaging the spaces between said drive members in one position of axial displacement of said inner and outer members and being disengaged therefrom in a second axial position of said inner and outer members; ratchet lug means formed on one of said inner and outer members and interposed said members; a plurality of inclined leaf spring members, formed on one of said inner and outer members and interposed said members, said leaf spring members providing a biasing force to maintain said inner and outer members in said second axial position and to drivingly engage said ratchet lug means in said second axial position to drive said inner and outer members as a unit in the tightening direction of said closure but slip over said ratchet lug means freely in the untightening direction to prevent unscrewing of said inner member, downward pressure on said outer member overcoming the bias of said leaf spring members to place said inner and outer members in said first axial position; and means for loosely retaining said inner member within said outer member.

2. The closure of claim **1,** wherein said ratchet lug means comprises at least two axially extending raised bosses acting as ratchet lug projections integrally molded on the exterior of said inner member top panel.

3. The closure of claim **2,** further including detent projections, formed on the exterior of said inner member top panel, positioned between said ratchet lugs for interference with said leaf spring members in the untightening direction of said closure.

4. The closure of claim **2,** further including at least one arcuate land extending between each of said ratchet lugs, said leaf spring members normally being biased by contact with said arcuate lands.

5. The closure of claim **1,** wherein said ratchet lug means comprises at least two inclined ramp ratchet lugs integrally molded on the exterior of said inner member top panel, each of said inclined lugs including, a ramp portion inclined upwardly in the direction in which said inner member would be moved for removal from said container finish, and an axially extending wall portion joined to the upper terminus of said ramp portion.

6. The closure of claim **5,** further including detent projections, formed on the exterior of said inner member top panel, positioned between said inclined ramp lugs for interference with said leaf spring members in the untightening direction of said closure.

7. The closure of claim **5,** further including at least one arcuate land extending between each of said inclined ramp lugs, said leaf spring members normally being biased by contact with said arcuate lands.

8. The closure of claim **1,** wherein said leaf spring members comprise at least two downwardly extending flexible tabs integrally molded on the interior of said top panel of said outer cap member.

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