

[54] **CHILD-RESISTANT CLOSURE FOR LIQUID CONTAINERS**

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[51] Int. Cl. **B65d 55/02; B65d 85/56; A61j 1/00**

[58] Field of Search **215/9, 216, 221, 222**

[56] **References Cited**

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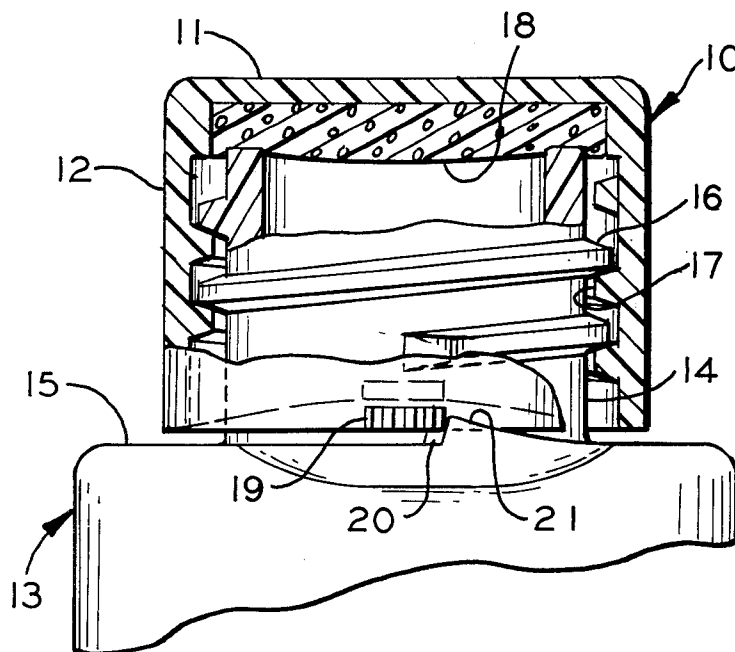
Attorney, Agent, or Firm—Henry K. Leonard

[57] **ABSTRACT**

A child-resistant closure for a liquid container having a tubular threaded neck. An inverted cup-shaped cap for the neck has a liner positioned on the underside of

its flat top which engages the open end of the container neck when the cap is in closed position. A radially extending locking tab on the lower margin of the cap skirt cooperates with the lug on the container shoulder to prevent retrograde rotation of the cap, thus to provide a child resistant lock which however is resiliently deformable by an adult in order to remove the cap. The cap and neck thread tolerances and the positions of the tab and lug are designed so the cap is turned onto the neck at least to or somewhat beyond the locking position by automatic capping machinery. The container neck is surrounded by an annular shoulder formed on the container. The length of the cap skirt is sufficiently greater than the length of the container neck so that when the cap is screwed onto the container at least to the locking position and then until its lower edge abuts the container neck, the liner is compressed within its elastic limit and is sealed against the end of the container neck. This obviates the possibility that top loading the cap, as in stacking during shipment or storage, will move the cap a distance permitted by the normal manufacturing tolerances of the threads such that it will compress the liner beyond its elastic ability to restore. In such a case, as in a standard liquid container, if a child were then to endeavor to remove the cap and to rotate it in a retrograde direction until the locking tabs are engaged, a leaker would result.

10 Claims, 5 Drawing Figures



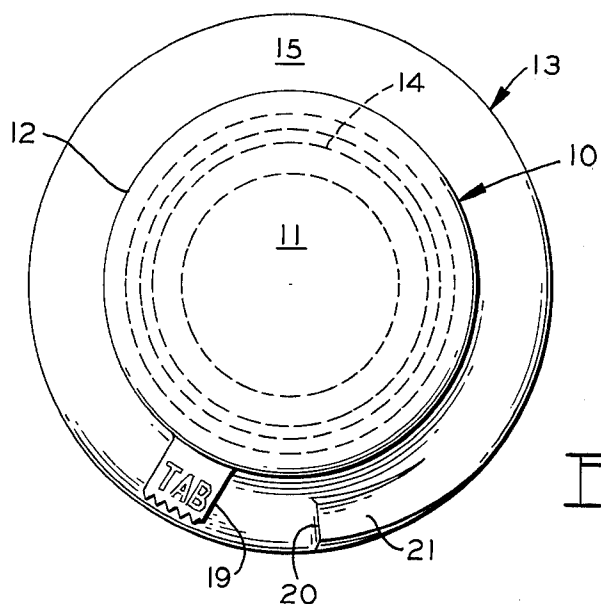


FIG-1-

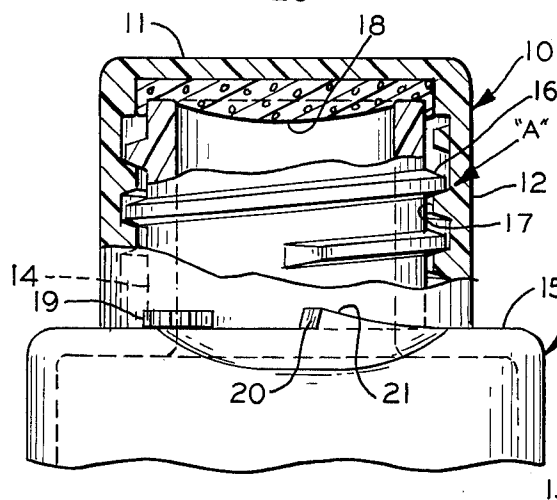


FIG-2-

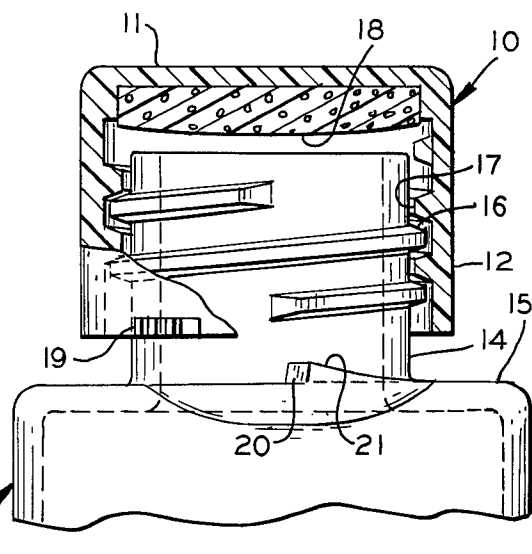


FIG-3-

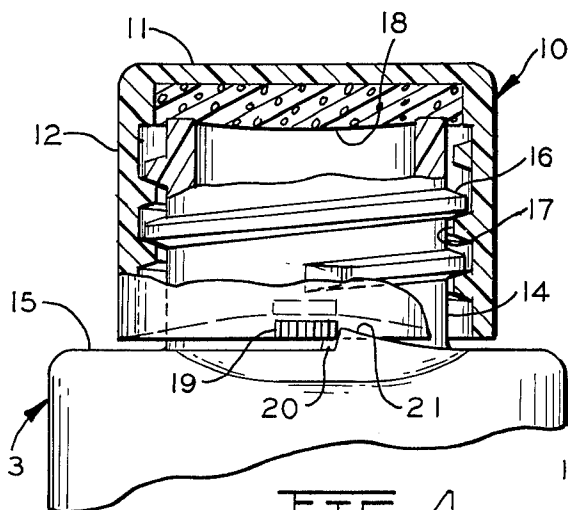


FIG-4-

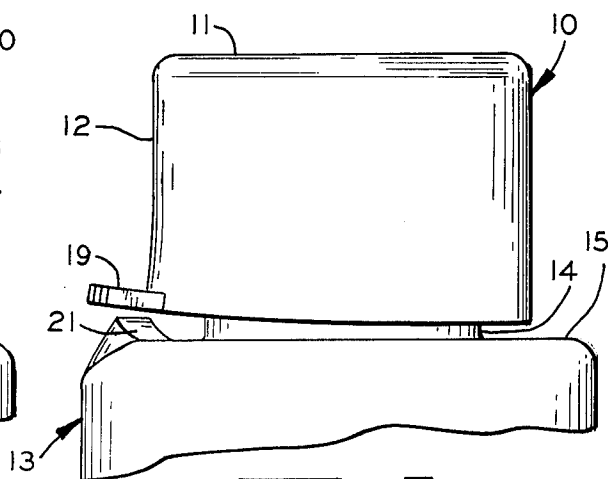


FIG-5-

CHILD-RESISTANT CLOSURE FOR LIQUID CONTAINERS

BACKGROUND OF THE INVENTION

Particularly since the passage of the Poison Prevention Packaging Act of 1970 many so-called "child-proof" or "child-resistant" closures have been suggested for liquid containers. Many of such closures have cooperating interlocking lugs on the caps and bottle necks so that after the caps are screwed onto the bottles a sufficient distance to seal the bottles, the lugs engage and a small child is unable to disengage them and thus to open the bottles. While caps of designs such as that shown in Martin U.S. Pat. No. 2,827,193 possess this ability to a greater or lesser degree, relatively few of the threaded child-resistant closures have provided structure whereby the result of "top-loading" of the containers during shipment and storage does not have a deleterious effect upon the capacity of the closure to prevent leakage of the liquid even when the closure is in child-resistant position.

Because of tolerances in the manufacture of the threaded container necks as well as the threaded caps themselves, when a cap is threaded onto the neck of a container and even when the threads are so designed that they ostensibly "mate" with each other, there is very likely to be vertical play between the cap and the container neck, in many instances as much as 0.125 inch. Also because of the variances in tolerances between individual bottles and between bottles and caps, when a cap must be turned onto a bottle neck a certain distance in order to engage the child-resistant locking means, the designer of the closure can select a liner for the cap having a thickness such that it is slightly compressed at this point thus sealing the container against leaking. However, when such a container is stacked with other similar loaded containers during shipping or during storage, the weight of the superimposed containers and their contents presses downwardly on the cap and the tolerances in manufacture allow the cap to move down a considerable distance such as the 0.125 inch mentioned above. Under these conditions, if the top loading continues for any appreciable period of time as it may during shipping and storage, the liner may be compressed beyond its elastic limit and very often takes a permanent set at the greater compression.

Attempts to overcome this problem have been made by utilizing natural cork liners in caps of this type but the cost of cork has become so great as to render it prohibitive for this purpose. Other materials from which liners can be fabricated do not have the ability of cork to restore to its previous thickness even after continued over-compression. As the result, after such a container has been stacked and been top-loaded for some time, and the container is delivered to a customer, a small child endeavoring to open the container can readily rotate the cap backwardly until the child-resistant locking means engage. This results in elevating the caps slightly, and, because of the "set" of the liner, results in a leaker.

If the tolerances could be maintained close enough, it would be possible, of course, to always turn the cap onto the bottle to the same position, i.e., to stop the rotation of the cap on to the bottle immediately after the child-resistant means have locked. However, most packaging companies have automatic capping machines which turn the caps onto the bottles with torque

responsive clutches so that the variance in tolerances results in successive caps being screwed onto successive bottles to different degrees of rotation with the child-resistant locking means often passed so that the final position of the cap is beyond the position necessary to interlock the child resistant means.

It is therefore the principal object of the instant invention to provide a child-resistant closure for a liquid containing bottle which will enable caps to be screwed onto bottles regardless of variations in the tolerances to a predetermined stop position with the cap actually engaging the shoulder of the container thus to create the torque which causes the capping chuck to stop. Because of this engagement between the cap and the container, subsequent top loading does not move the cap downward on the container neck and thus does not overcompress the liner causing it to take a permanent set.

By thus limiting the maximum distance which the cap can be screwed down onto the container, the liner can be so designed that at that position, regardless of the tolerances in the threads and container necks, the liner is not over compressed beyond its ability to restore. Therefore, even when the cap is rotated in a retrograde direction a slight distance as by a child seeking to open the bottle, the liner is capable of maintaining a liquid-proof seal against the neck of the bottle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a closure embodying the invention,

FIG. 2 is a fragmentary side view, partly in section, illustrating a closure embodying the invention in its seated position,

FIG. 3 is a view similar to FIG. 2 but showing the cap only partly threaded onto the container neck,

FIG. 4 is a view similar to FIGS. 2 and 3 but illustrating how the resilient cap liner is capable of restoring to the degree necessary to maintain a liquid seal even when the cap is turned in a retrograde direction from the bottom-out position illustrated in FIG. 2 to the child-resistant interlock position shown in FIG. 4, and

FIG. 5 is a fragmentary side view in elevation illustrating how the child-resistant locking means are disengaged to enable the cap to be removed from the container.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A closure embodying the invention comprises an inverted cup-shaped cap generally indicated by the reference number 10 which has a flat top 11 and an annular skirt 12. The cap is utilized with a container generally indicated by the reference number 13 which has a neck 14 that is spaced inwardly from a larger diameter of the container 13 to provide a generally flat annular shoulder 15. The exterior of the container neck 14 and the interior of the cap skirt 12 have cooperating mating threads 16 and 17, respectively, which enable the cap then to be threaded downwardly onto the container neck 14.

Because of manufacturing tolerances, particularly when the container 13 is fabricated from glass and the cap 10 fabricated from plastic material, or, even when both are fabricated from plastic material, the cap 10 is threaded onto the container neck 14 by the engagement of the upper surfaces of the thread 17 with the

lower surfaces of the container neck threads 16. Such engagement is shown, for example, at the point indicated by the arrow A in FIG. 2.

A resilient liner 18 is positioned interiorally of the cap 10 lying against the inner surface of its top 11. In the figures of the drawings the thickness of the liner 18 and its distortion, compression and re-expansion are exaggerated in order to explain the functioning of the closure embodying the invention and the particular dimensions, spacing, etc. are not intended to be limiting but only to be illustrative.

In a closure embodying the invention, the length of the container neck from its open end to the container shoulder 15 is designed relative to the positioning of the threads 16 on the container neck 14 and relative to the threads 17 on the cap 10 and the length of the cap skirt 12. The liner 18 also is so designed as to be compressible to the degree exaggeratedly illustrated in FIG. 2 yet to possess sufficient resiliency and ability to restore to its normal thickness so as to maintain a liquid tight seal against the end of the container neck 14 even if the cap 10 is turned in a retrograde direction to engage the child-resistant locking means, as illustrated in FIG. 4.

In common with several other child-resistant closures, a closure embodying the invention comprises an outwardly extending tab 19 on a lower edge of the skirt 12 of the cap 10 and a raised abutment 20 formed on the shoulder 15 of the container 13. It will be readily appreciated that when the cap 10 is turned downwardly onto the container neck 14, the tab 19 will ride up a ramp 21 and, being resilient, will snap down behind the abutment 20. However, because of the variations in tolerances already mentioned, the skirt 12 may not bottom-out against the shoulder 15, thus to resist further rotation of the cap 10 onto the neck 14, until the cap 10 reaches any one of many various relative angular positions. For example, as illustrated in FIG. 1, the tab 19 may be rotated up to 30° or so beyond the point of immediate engagement of the tab 19 with the abutment 20. In view of the variations resulting from the tolerances, this engagement of the end of the skirt 12 with the container shoulder 15 may take place immediately after passage of the tab 19 beyond the abutment 20 or at any point angularly thereafter such as the 30° position of FIG. 1 or even a greater distance. However, by reason of the careful design of the relative lengths of the skirt 12 and the container neck 14 above the shoulder 15, the tolerances expected between the threads 16 and 17 and the resiliency of the liner 18, it is possible, in a cap according to the invention, to provide for a maintenance of sealing contact between the liner 18 and end of the neck 14 as illustrated in FIG. 4 even when the cap 10 is turned in a retrograde direction as far as a child is able to turn it, i.e., until the engagement of the child-resistant locking means.

When the cap 10 is turned fully onto the container neck 14 and the end of the skirt 12 engages the shoulder 15, of course, the capping chuck cannot turn the cap further and it disengages. Because the liner 18 is designed to restore from the position illustrated in FIG. 2 to at least the position illustrated in FIG. 4, while maintaining a sealing engagement with the end of the neck 14, and because of the abutment of the end of the skirt 12 with the shoulder 15, top loading has no deleterious effect upon the ability of the closure embodying the invention to maintain the cap sealed against leak-

age during storage, shipment, and the attempts of children to open the container.

Having described my invention, I Claim:

1. A child resistant closure for liquid materials, said closure consisting of
 - a. a container having a body, a threaded neck and a generally outwardly extending annular shoulder at the base of said neck and connecting said neck to said body,
 - b. a cup-shaped cap having a tubular skirt that has internal threads mating with the threads on said neck and a generally flat top,
 - c. cooperating disengageable lug means at the bottom of said skirt and on said shoulder for preventing removal of said cap by retrograde rotation thereof unless said lug means are disengaged, said lug means automatically engaging when said cap is turned onto said neck to at least an engagement position,
 - d. a resilient liner underlying the top of said cap and adapted to be compressed against the end of said neck when said cap is turned onto said neck at least to such engagement position,
 - e. said skirt and said neck being of such axial lengths that the lower end of said skirt engages said shoulder when said cap is turned onto said neck at least to such engagement position,
 - f. and said liner being of such normal thickness and resiliency that said liner is compressed against said neck when said cap reaches engagement position and is not set beyond resilient restoration when said cap skirt engages said shoulder.
2. A closure according to claim 1 in which the skirt portion of the cap is flexible.
3. A closure according to claim 2 in which the cooperating lug means are a radially extending tab on the lower margin of the skirt and an abutment on the shoulder of the container, said abutment lying in an axial plane of the container neck.
4. A closure according to claim 3 in which the tab extends radially beyond the underlying portion of the container shoulder.
5. A child-resistant closure for liquid materials, said closure consisting of
 - a. a container having a body, a threaded neck and a radially outwardly extending stop on said body adjacent the base of said neck,
 - b. a cup-shaped cap having a tubular skirt that has internal threads mating with the threads on said neck and a generally flat top,
 - c. cooperating disengageable locking means on said skirt and on said container for preventing removal of said cap by retrograde rotation thereof unless said locking means are disengaged, said locking means automatically engaging when said cap is turned onto said neck to at least an engagement position,
 - d. a resilient liner underlying the top of said cap and adapted to be compressed against the end of said neck when said cap is turned onto said neck at least to such engagement position,
 - e. said skirt and said neck being of such axial lengths that said skirt engages said stop when said cap is turned onto said neck at least to such engagement position,
 - f. and said liner being of such normal thickness and resiliency that said liner is compressed against said

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neck when said cap reaches engagement position and is not set beyond resilient restoration when said cap engages said stop.

6. A child-resistant closure for liquid materials, said closure consisting of

- a. a container having a body and a threaded neck,
- b. a cup-shaped cap having a tubular skirt that has internal threads mating with the threads on said neck and a generally flat top,
- c. cooperating disengageable locking means on said skirt and on said container for preventing removal of said cap by retrograde rotation thereof unless said locking means are disengaged, said locking means automatically engaging when said cap is turned onto said container to at least an engagement position,
- d. a resilient liner underlying the top of said cap and adapted to be compressed within its elastic limit against the end of said neck when said cap is turned onto said neck to such engagement position,
- e. the tolerance in the axial dimensions of said threads both on said neck and on said cap being such as to permit relative axial movement of said cap and said container with resulting compression

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of said liner beyond its elastic limit, and
f. cooperating axial stop means on said cap and said bottle which are engaged when said cap is turned onto said bottle at least to such engagement position, whereby axial movement of said cap by external loading of said cap is prevented.

7. A closure according to claim 6 in which the locking means consist of a radially extending lug on the cap skirt and an opposed radially extending abutment on the container.

8. A closure according to claim 7 in which at least the lower portion of the cap skirt is resiliently flexible only to a degree such that a small child has significant difficulty disengaging the locking means.

9. A closure according to claim 6 in which the cooperating axial stop means consist of the lowermost portion of the cap skirt and a radially extending surface on the container.

10. A closure according to claim 6 in which the cooperating axial stop means are the lower edge of the cap skirt and an annular shoulder on the container that is adjacent the base of the neck.

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