

[54] **SAFETY CLOSURE DEVICE**

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[51] Int. Cl. **B65d 55/02**

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

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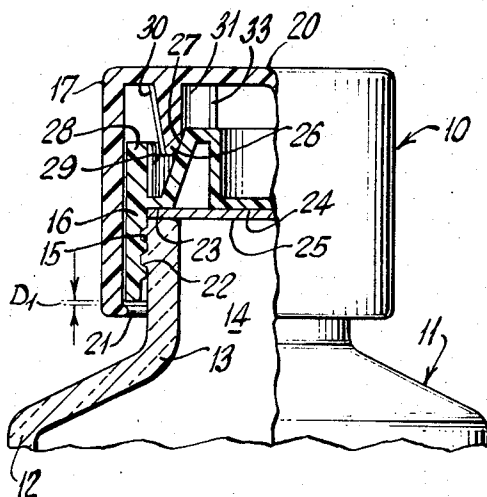
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[57] **ABSTRACT**

The invention contemplates selectively openable closure means that is tamper-proof, in the sense that a correct sequence of two deliberate and independent movements of lockable closure elements is necessary in order to achieve access to the contents of the bottle or the like which is protected by the closure.

The specific construction that is described involves a bottle member with a threaded neck and a closure-cap member. The latter comprises telescoped relatively rotatable parts, the inner of which threads to the neck, and the outer of which is for manual operation. The parts of the closure-cap member have a limited axial lost-motion connection, and deformable means on one of the tubular members has cammed engagement with a coating part of the other tubular member during the course of lost-motion displacement. Thus, lost-motion displacement must occur before the bottle can be uncapped.

17 Claims, 7 Drawing Figures



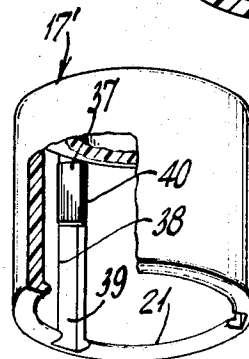
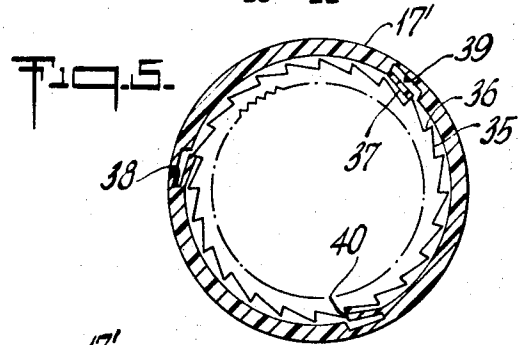
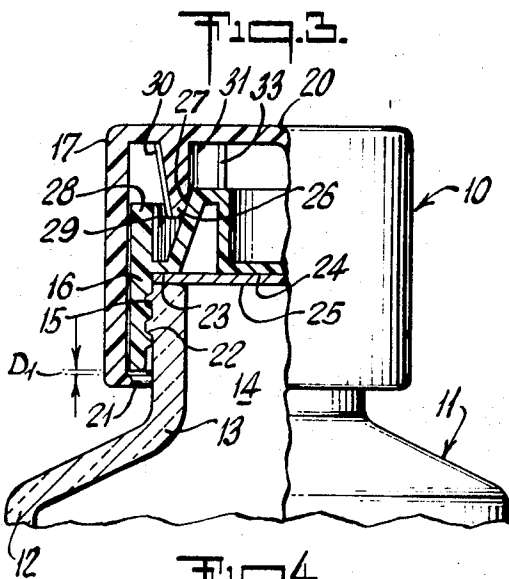
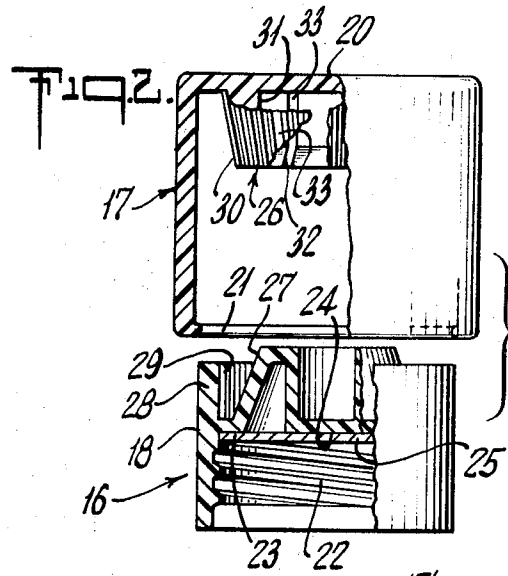
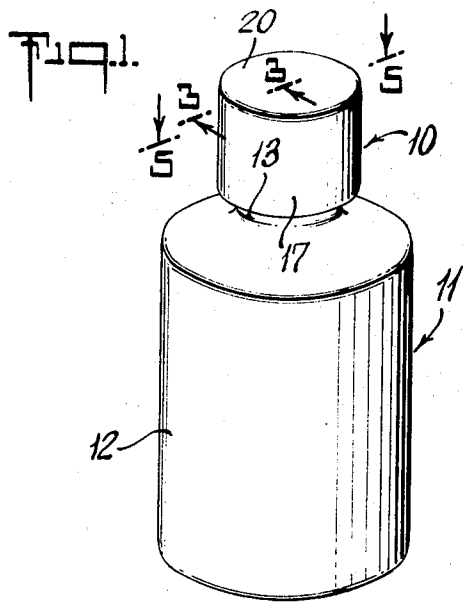


Fig. 7.

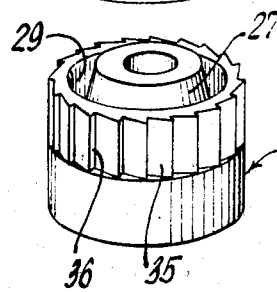
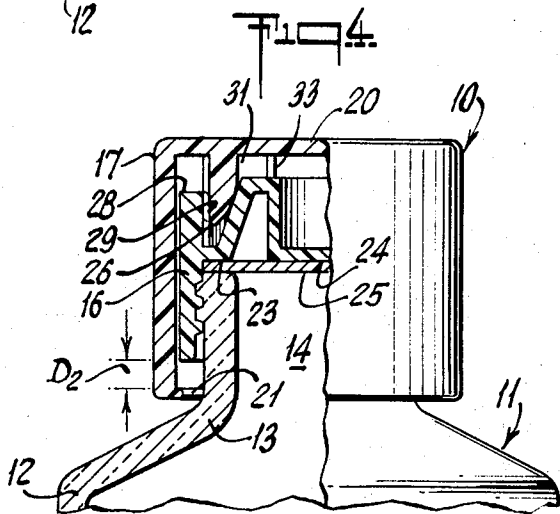


Fig. 6.

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SAFETY CLOSURE DEVICE

This invention relates to tamper-proof selectively openable closure devices, as for closure of bottles containing solid matter such as pills which may be injurious when in unauthorized hands.

With recent growth in the use of drugs, pills, and the like, each with its specific prescribed purpose for a particular member of a household, there has been a corresponding increase in the chances for unauthorized access, particularly access by small children. And it has become increasingly difficult, if not impossible, to supervise children enough to assure against their access to materials that can be harmful to them.

Accordingly, it is an object of the invention to provide a tamper-proof feature in containers for materials of the character indicated.

A specific object is to achieve the above-stated object with a construction in which a correct sequence of independent motions of securable closure parts is a pre-requisite for access to the contents of the container.

Another object is to achieve the foregoing objects with a simple construction, lending itself to plastics injection-molding fabrication.

A specific object is to provide a container and its closure cap with integral formations inherently achieving tamper-proof closure of the container.

Another object is to provide an improved threaded closure-cap construction, achieving the foregoing objects in application to externally threaded glass, metal, or plastic bottle necks of conventional design.

A further object is to achieve the stated objects with a construction which lends itself to full automation, namely, to automated filling, to automated closure, and to automated assembly with the tamper-proof feature.

It is a general object to provide a tamper-proof closure which is basically inexpensive and reliable, which lends itself to storage of liquid or dry contents, and which incorporates automatic establishment of the tamper-proof feature, as a necessary consequence of applying the closure and driving it to closed position on the container.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

FIG. 1 is a perspective view showing a container to which closure means of the invention has been applied;

FIG. 2 is an enlarged exploded view of two parts of the closure construction of FIG. 1, partly broken-away and in longitudinal section, to reveal internal formations;

FIG. 3 is a fragmentary view of secured parts of FIG. 1, partly broken-away and in section on the alignment 3-3 of FIG. 1;

FIG. 4 is a view similar to FIG. 3 to illustrate the initial axial displacement which is a condition precedent to unthreading the safety closure of the invention;

FIG. 5 is a sectional view, substantially at the radial plate 5-5 of FIG. 1 to illustrate a modification;

FIG. 6 is a perspective view of the inner part of the closure of FIG. 5; and

FIG. 7 is a partly broken-away perspective view of the outer part of the closure of FIG. 5.

Briefly stated, the invention contemplates selectively openable closure means that is tamper-proof, in the sense that a correct sequence of two deliberate and independent movements of lockable closure elements is necessary in order to achieve access to the contents of the bottle or the like which is protected by the closure.

The specific construction that is described involves a bottle member with a threaded neck and a closure-cap member. The latter comprises telescoped relatively rotatable parts, the inner of which threads to the neck, and the outer of which is for manual operation. The parts of the closure-cap member have a limited axial lost-motion connection, and deformable means on one of the tubular members has cammed engagement with a coating part of the other tubular member during the course of lost-motion displacement. Thus, lost-motion displacement must occur before the bottle can be uncapped.

As shown in FIG. 1, the invention provides a cap 10 for closure of a bottle 11 in such manner as to be indistinguishable from any conventional threaded-cap closure. The bottle 11 happens to be shown with a body 12 which is substantially enlarged from its neck 13, which is seen in FIG. 3 to have a reduced dispensing opening 14 and to have external thread formations 15. However, beyond this, any similarity with conventional construction ends.

In accordance with the invention, the closure cap 10 comprises nested inner and outer parts 16-17, shown separately in FIG. 2, and assembled in FIG. 3. The outer part 17 is solely for manual manipulation, and the inner part 16 is solely for closing the bottle opening 14. A deliberate axial relative motion of these nested parts must be accomplished in order to engage them sufficiently to enable unthreading rotation, to remove the cap 10 from the bottle 11.

The parts 16-17 may be generally tubular, with adjacent cylindrical surfaces 18-19 which establish a well-piloted, relatively rotatable relationship. The clearance 18 shown in FIGS. 3 and 4 between these surfaces will be understood to have been exaggerated, for better interpretation of the remainder of these figures. The closure parts 16-17 have coating elements determining their limited axial lost-motion connection. As shown, the outer part 17 fully encompasses the inner part 16, and radially inward formations on part 17 establish the retention. The closed end wall 20 provides one retaining limit, and a flange or bead 21 defines the retaining limit at the open end of the outer part 17. Part 17 is shown as of injection-molded plastic, such as polyethylene, polypropylene or medium-impact polystyrene, a preference being indicated for polypropylene; part 17 therefore possesses a limited degree of resilient deformability. The unstressed inner radial dimension of the opening at bead 21 is preferably such as to slightly interfere with the outer surface 18 of the inner part 16, to enable forced nesting assembly of these parts, followed by snap-in action of bead 21, to retain the assembly 16-17.

The inner part 16 may also be of plastic. It is relatively rigid and may be an injection-molded polystyrene or a compression-molded urea product. Its open end is formed with standard threads 22 to match the bottle threads 15. Its other end is closed by a wall of special contour, for purposes to be later described. This wall closure includes an outer radial shoulder portion 23

and a central-area region 24 in a common radial plane, for suitable support of a seal disc 25, as of foil-coated cork, or the like. When the part 16 is secured to the bottle at 15—22, the seal may be liquid-tight, with the projecting axial rim of neck 13 compressing seal 25 against the shoulder 23. The circumferential friction which characterizes this compression, and the multi-turn frictional extent of the thread engagement, are adequate to securely maintain the closed condition of the bottle, as will be understood.

Use is made of the indicated lost-motion connection to clutch and de-clutch the inner and outer parts 16—17, and the relation depicted in FIG. 3 represents substantially one limit of the lost-motion, wherein the lower end of the inner part 16 is substantially at the bead 21, being shown with slight axial spacing D1 therefrom. At this one lost-motion limit, the parts 16—17 are declutched; they are therefore free for relative rotation, meaning that no amount of rotary drive at 17 will be adequate to dislodge the static-friction hold, at 15—22 and at 13—25—23. Preferably, resilient means normally urges the parts 16—17 into the said one-limit position (FIG. 3), for a normal "free-wheeling" relation of the outer cap 17 with respect to the inner cap 16. However, upon axial displacement away from this first or normal-limit position, as by pressing the outer cap 17 downwardly, the resilient action is overcome and a clutched relation is established between parts 16—17. The extent of such displacement is suggested at D2 in FIG. 4.

In the form shown, the clutch action relies upon a deformable toothed or dog element 26 carried by the outer cap 17 and having cammed engagement with a flared formation 27 on the inner cap 16, in the course of lost-motion movement over the distance D2. An axial skirt 28 integral with the closed end of part 16, is internally characterized with toothed or dog formations 29, with which tooth or dog formations 30 of element 26 mesh, upon cammed radially outward deformation of the latter, as illustrated in FIG. 4.

The deformable element 26 is shown in a plurality of four, all integrally molded with the end wall 20 of outer cap 17 and in angularly spaced relation about the central axis. Basically, elements 26 are formed within a generally frusto-conical tubular axial projection within cap 17; the outer wall of this projection converges or tapers inwardly, and the toothed or dog formations 30 are molded therein. The inner wall of this projection may be a cylindrical bore 31, with a substantial outward flare or chamfer 32 near the projecting end; the slope at flare 32 preferably substantially matches that of the surface 27. Angularly spaced radial slots 33 in this projection separate and complete the definition of elements 26. It will be seen that the described structure provides the plural elements 26 with free downward ends which are weakened and therefore deformable, in response to the radially outward cam action which results from axial interference with flared surface 27. The available lost-motion displacement D2 is such as to assure a radial lock at 29—30 when outer cap 17 is firmly depressed toward the bottle. Such firm pressure must be maintained while applying unthreading torque, and upon release of such pressure the resilient action of elements 26 reacts on the flare or cam 27 to return the outer cap 17 to the normal "free-wheeling" position of

FIG. 3. To recap the bottle, it is again necessary to depress the outer cap 17 to the FIG. 4 relation, for application of tightening, sealing torque.

In the arrangement of FIGS. 5 to 7, the parts are virtually the same and therefore the same reference numerals are used, where applicable. The only significant difference resides in provision of a ratcheting action, one-way-engaging, in the thread-on direction; this action couples parts 16—17 in the engaging direction, so that no depressing force need be applied to the outer cap 17 when securing the closure. As best shown in FIG. 6, an upper fraction of the periphery of the inner tubular part 16' is circumferentially characterized by a plurality of ratchet teeth 35. For the case of the right-hand threads shown, the teeth 35 are formed for right-hand thread-on drive, and for escapement in the opposite direction. Thus, each tooth 35 is defined by a short radial flat 36 between the outer radial limit of one large oblique flat and the inner radial limit of the next adjacent large oblique flat. The radial flats 36 face to receive driving abutment by one or more pawl elements 37, in the clockwise direction, in the sense of FIG. 6.

The plurality of pawl elements 37 is preferably at least three, in equal angularly spaced relation, to assure symmetry of ratcheted drive-on torque, and to assure relatively free escapement in the opposite direction of rotation. The pawl elements 37 are shown as locally deformable lugs, extending both circumferentially and radially inward, from integral connection with spaced parts of the bore of outer tubular member 17', as best seen in FIG. 7. To simplify mold construction each pawl lug 37 is rooted at one side wall 38 of an axial groove 39, in the bore of part 17'. The projecting end 40 of each lug 39 abuts the nearest convenient ratchet flat 36, for the drive-on direction of rotation. In the opposite direction, lugs 37 are deflected outwardly into the clearance region provided by the associated groove 39, to permit ratcheting escapement, as will be understood. Assembly of the parts is as previously described, except that counterclockwise relative rotation of part 16 within part 17 is desirable to enable non-fouling placement of pawls 37 between ratchet teeth 35.

It will be seen that I have disclosed an improved closure construction meeting the stated objects and having great latitude of application, whether the contents to be secured are in liquid, powder, or other solid form. The bottle may be completely conventional, and yet security is reliably afforded through the ability to complete a tight static-friction hold, and, through use of the right combination of axial thrust and unthreading torque, to remove the closure. In the case of the ratchet-action closure of FIGS. 5 to 7, no amount of escapement will be operative to disturb the closure; in fact, the ratcheting noise attendant to such escapement may be relied upon to give warning to a person who in a half-sleeping condition and in the darkness of night reaches into his medicine chest for an aspirin (relatively harmless, and therefore without the secure-capping provision) and mistakenly clutches a narcotic or other dangerous prescription drug (secured in a ratchet-escapement container).

While the invention has been described in detail for the preferred forms shown, it will be understood that modifications may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. Tamper-proof selectively openable closure means, comprising a body member including an externally threaded neck with an axial-end opening to be selectively opened and closed, and closure-cap means comprising relatively rotatable inner and outer tubular members, said inner member having a closed end and a bore formed to engage the threads of said neck, interengaging means on said tubular members defining a limited axial lost-motion relation therebetween, said tubular members being relatively free to rotate at one limit of said lost-motion, and deformable follower means on one of said tubular members engageable with a coacting cam part of the other of said tubular members during the course of said lost-motion displacement in the direction away from said one limit, said other tubular member also including a part having clutch engagement with said follower means only when the latter has been deformed by cam action; whereby, when said closure-cap means is secured to said neck, a rotation of said outer tubular member in the unthreading direction is operative to dislodge the threaded engagement only after first axially displacing said tubular members through at least a part of said lost motion.

2. Closure means according to claim 1, wherein said tubular members have overlapping adjacent substantially cylindrical surfaces for substantially concentric piloting of said tubular members.

3. Closure means according to claim 1, wherein said tubular members have ratchet-engaging elements with one-way engagement in the thread-on direction of capping said neck, whereby said freedom for relative rotation applies only for the unthreading direction of driving said outer tubular member with respect to said neck.

4. Closure means according to claim 1, wherein said deformable means is resiliently deformable.

5. Closure means according to claim 4, wherein said deformable means includes a radially deformable element carried by one of said tubular members and having a resiliently deflectable portion poised for interfering relation with a part of the other tubular member during the course of lost-motion movement from said one limit.

6. Closure means according to claim 5, in which said interfering relation applies for substantially all relative axial positions of said tubular members.

7. Closure means according to claim 5, in which the magnitude of said interfering relation progressively increases in the direction of said relative axial displacement away from said one limit.

8. Closure means according to claim 5, in which said deformable element and said other tubular member have dog-engageable formations which are disengaged in the absence of deformation of said deformable member and which engage to lock said tubular members against relative rotation upon axial lost-motion displacement away from said one limit.

9. Tamper-proof selectively openable closure means, comprising a body member including an externally threaded neck with an axial-end opening to be selectively opened and closed, and closure-cap means comprising relatively rotatable inner and outer tubular members, said inner member having a closed end and a bore formed to engage the threads of said neck, the external periphery of said inner tubular member being

substantially cylindrical and including a tubular skirt portion projecting axially away from the open end of said inner tubular member, coacting axial-retaining means on said tubular members defining a limited axial lost-motion relation therebetween, said tubular members being relatively free to rotate at one limit of said lost motion, cam means on said inner tubular member and within said skirt, deformable projecting clutch means including a cam-follower element carried by the outer tubular member, and said clutch means having cammed rotation-resisting engagement with said skirt at a relative axial position of said tubular members removed from said one limit but relatively free of such rotation-resisting engagement at substantially said one limit, whereby displacement of said tubular members away from said one limit is a condition precedent to an unthreading drive of said inner tubular member upon grasping said outer tubular member.

10. Closure means according to claim 9, in which resilient means coacting between said tubular members urges said tubular members in the direction of said one limit.

11. Closure means according to claim 9, in which said outer tubular member has a closed end overlapping the closed end of said inner tubular member, said projecting means including an element carried by the closed end of said outer tubular member.

12. Closure means according to claim 9, in which said axial-retaining means comprises axially spaced radially inwardly directed elements carried by said outer tubular member, whereby said inner tubular member is at all times fully contained within said outer tubular member.

13. Tamper-proof selectively openable closure means, comprising a body member including an externally threaded neck with an axial-end opening to be selectively opened and closed, and closure-cap means comprising relatively rotatable inner and outer tubular members, said inner member having a closed end and a bore formed to engage the threads of said neck, the external periphery of said inner tubular member being substantially cylindrical and including a tubular skirt portion projecting axially away from the open end of said inner tubular member, said outer tubular member having a closed end overlapping the closed end of said inner tubular member, coacting-axial-retaining means on said tubular members defining a limited axial lost-motion relation therebetween, said tubular members being relatively free to rotate at one limit of said lost motion, projecting means including an element carried by the closed end of the outer tubular member and having rotation-resisting engagement with said skirt at a relative axial position of said tubular members removed from said one limit but relatively free of such rotation-resisting engagement at substantially said one limit, said projecting element extending generally longitudinally within said skirt at a location offset from the axis of said tubular members and being resiliently radially outwardly deformable, and a flared cam surface forming part of the closed end of said inner tubular member and poised to interfere with said projecting element in the course of lost-motion displacement away from said one limit.

14. Closure means according to claim 13, in which said projecting element is one of a plurality of such ele-

ments, angularly spaced about said axis and in like interfering relation with said flared surface.

15. Closure means according to claim 13, in which said projecting element and said skirt have cooperating tooth formations for said rotation-resisting engagement.

16. Closure means according to claim 15, in which the tooth formations on said skirt are generally cylindrically arrayed about said axis, and in which the tooth formations on said projecting element are arrayed in a tapering surface about said axis, said tapering surface being deformed in approach to conformity with the cylindrically arrayed formations of said skirt in the course of said lost-motion displacement away from said one limit.

17. Tamper-proof selectively openable closure means, comprising a body member including a neck with an axial-end opening to be selectively opened and closed, and closure-cap means comprising relatively rotatable inner and outer tubular members in retained axial lost-motion relation, said neck being externally configured to be engaged with and closed by said clo-

sure-cap means with an action which involves at least as a component of such action a first rotational direction to close and the opposite rotational direction to open, said inner member having a closed end and a bore configured to engage the external configurations of said neck with said action, coaxing one-way engagement means between said tubular members and having driving engagement for said first direction of rotation of said outer tubular member and escaping non-driving relation in said opposite direction of rotation of said outer tubular member, and means for selectively connecting said tubular members for rotation in said opposite direction of rotation, said last-mentioned means including a deformable follower element on one of said tubular members engageable with a coaxing cam part of the other of said tubular members; during the course of lost-motion displacement, said other tubular member also including a part having clutch engagement with said follower element only when the latter has been deformed by cam action.

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