United States Patent [19]

Libit

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[54] **CHILD-RESISTANT CLOSURES**

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[52] **U.S. Cl.** **215/224;** 206/207; 215/216

[51] **Int. Cl.**[2] **B65D 55/02;** B65D 55/12

[58] **Field of Search** 215/9, 224, 216; 206/225, 206/807

[56] **References Cited**

UNITED STATES PATENTS

3,071,271	1/1963	Thomas	215/224
3,434,614	3/1969	Moller	215/224
3,627,160	12/1971	Horvath	215/224
3,695,475	10/1972	Ruekberg	215/224
3,830,391	8/1974	Uhlig	215/9
3,831,797	8/1974	Stevens	215/9
3,869,057	3/1975	Miller	215/216
3,877,597	4/1975	Montgomery et al.	215/216
3,892,326	7/1975	Schneible	215/216

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Assistant Examiner—Bruce H. Bernstein
Attorney, Agent, or Firm—Leonard S. Knox

[57] **ABSTRACT**

There is disclosed a closure for a container for fluent substances which may be harmful if ingested, especially by a child of tender years. The closure consists of two parts: one is secured to that portion of the container which defines the pouring opening and the other is manipulatable with respect to the first to open and close the opening. The parts have respective elements, at least one of which is helical, adapted to be engaged upon relative rotary movement to open the pouring opening but so arranged and constructed that the rotary movement must be accompanied by sustained digital squeezing force on two opposite sides of the movable part in order that rotary movement results also in axial movement. Such axial movement thereby disengages a bead and groove connection normally maintaining the two parts in fluid-tight relation. Re-engagement is obtained by simple axial thrust of the movable part on to the other. In one aspect the exterior configuration of the movable part is frustoconical to render it more difficult for a child to grasp and pull.

16 Claims, 13 Drawing Figures

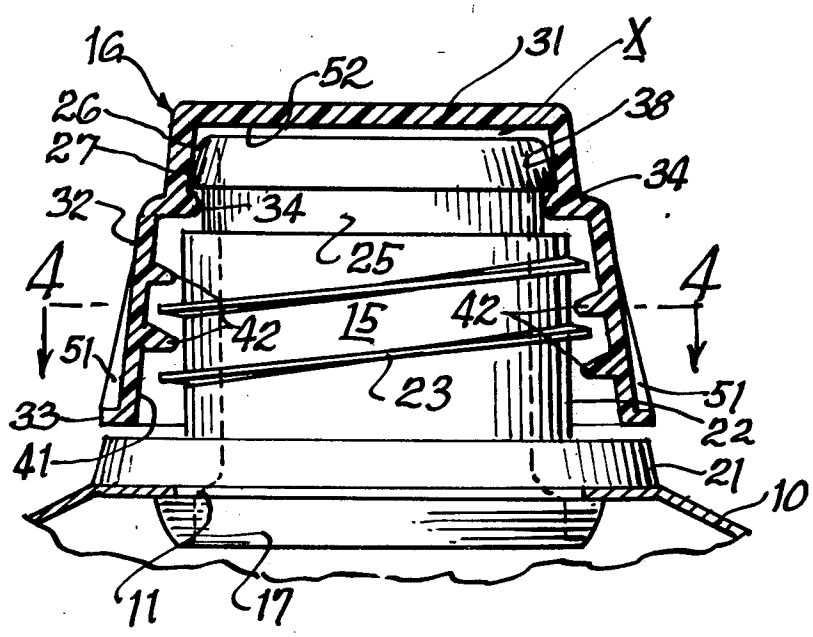


FIG. 1

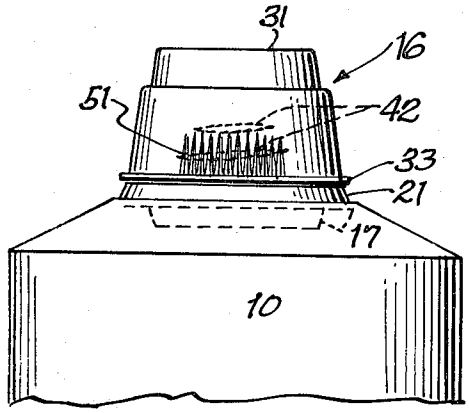


FIG. 2

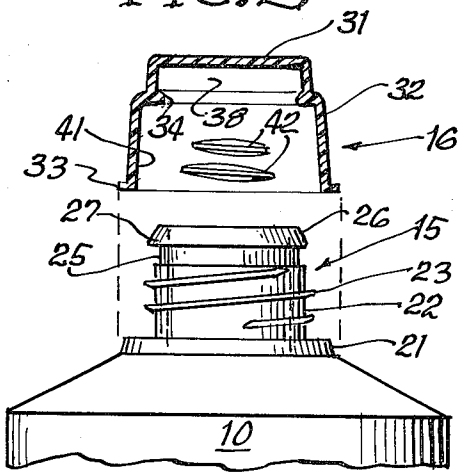


FIG. 3

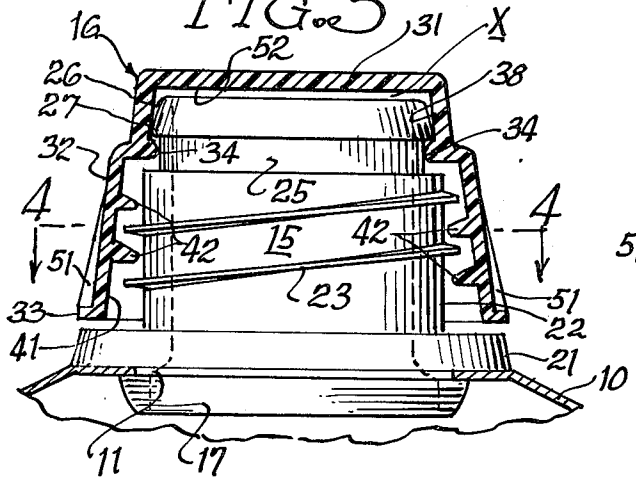


FIG. 4

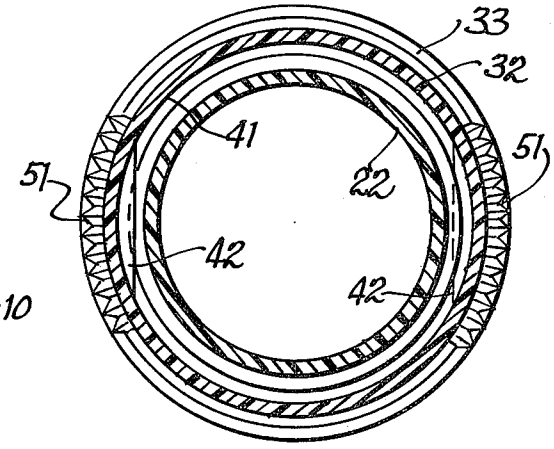


FIG. 5

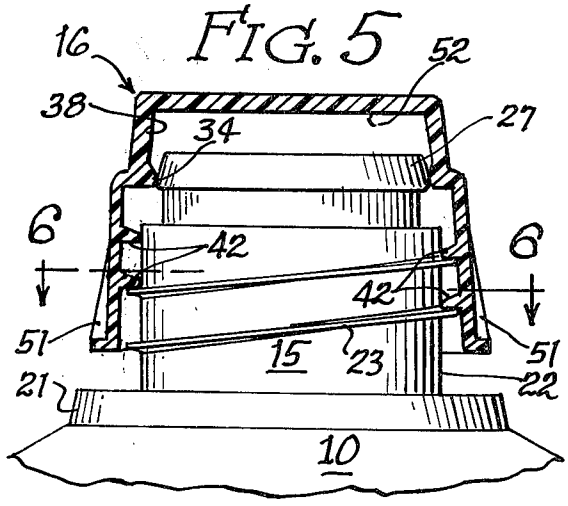


FIG. 6

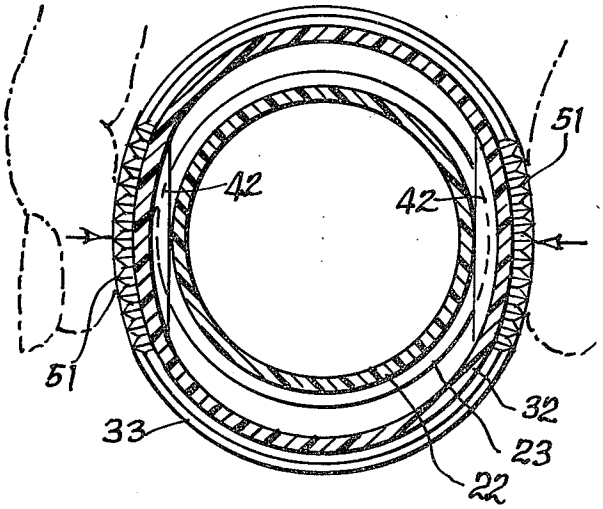


FIG. 7

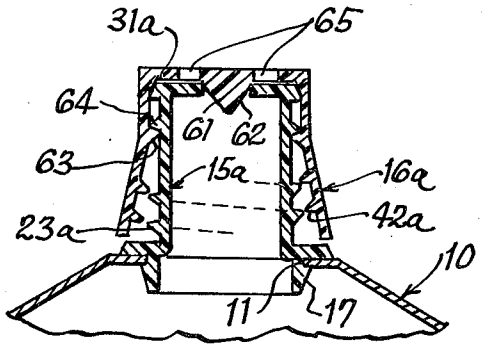


FIG. 8

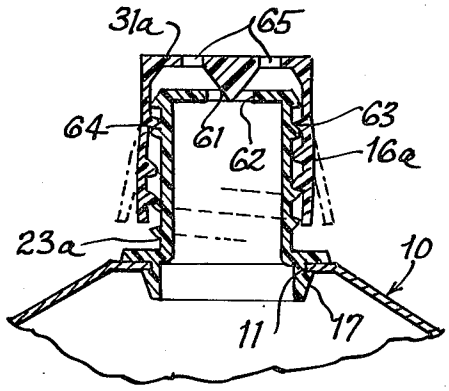


FIG. 9

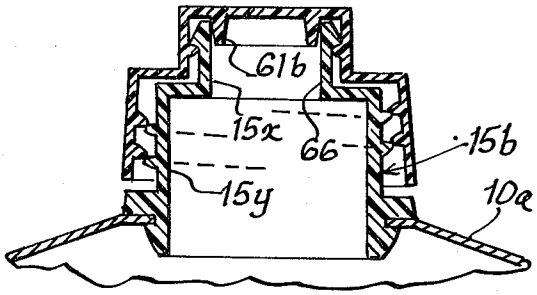


FIG. 10

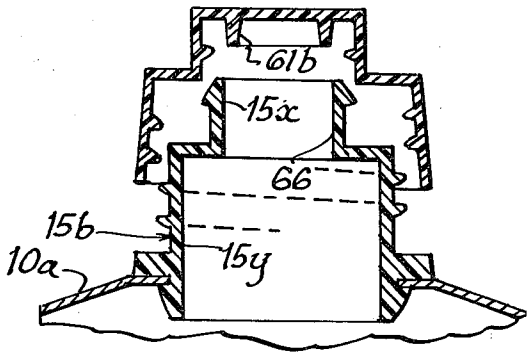


FIG. 11

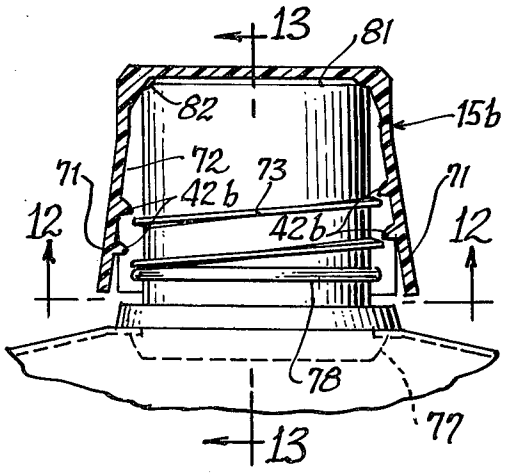


FIG. 12

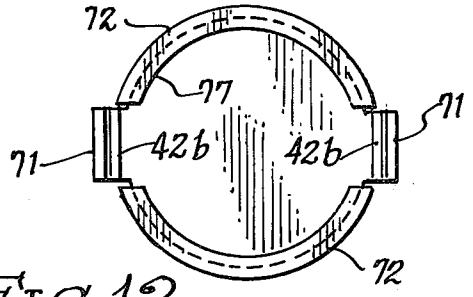
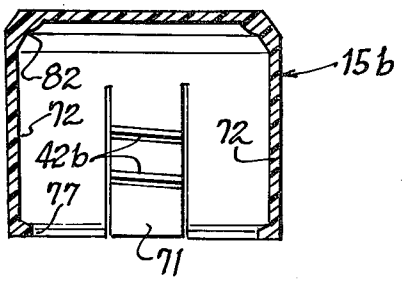


FIG. 13



CHILD-RESISTANT CLOSURES

BACKGROUND OF THE INVENTION AND SUMMARY THEREOF

Laws coming into force in recent years make it mandatory to seal containers holding dangerous substances against access by a child. In terms of these laws the efficacy of a closure is established by tests of prototypes, using children as the operators, under controlled laboratory conditions. One hundred percent performance is not required for a specific closure to be acceptable but a low percentage of successful attacks is tolerated. Closures operating on principles closely related to those of the present invention have been tested and have yielded about 5½% of successful attacks.

The invention closure is based on the inability of small children to carry on two sustained manual operations simultaneously. In the present case these operations are rotational and translational, requiring the child to squeeze a flexible skirt on the movable part of the closure while rotating the same in the manner of a nut and bolt. The seal between the fixed and movable parts of the closure is obtained through the medium of an annular bead fitting snugly with a snap fit into a complementary groove. Since plastic material having a memory is utilized for the movable part, the bead-and-groove engagement may be overcome by relative rotation of the two parts, the accompanying force, in turn, being converted into translational force separating the bead and groove. Re-engagement is accomplished by forcing the bead and groove into snap type relation.

Further to thwart the child's attempts at opening, the outer surface of the movable part is frustoconical with the larger diameter nearest the container. By so doing any attempt by the child to separate the two parts by brute force must involve the gripping of a smooth, tapered body and pulling against the forces maintaining the bead and groove in engaged relation. It has been found that this type of operation even presents difficulties for an adult.

In a preferred form the invention closure comprises a fixed member generally in the form of a sleeve having means for attachment to the margin of the opening of the container through which its contents are discharged, together with a cap-like movable member adapted to be detachably secured over the fixed member. At its distal end the movable member has a peripheral bead adapted to engage in a complementory groove within the fixed member with a snap fit whereby to provide fluid-sealing between the two members.

One of the members, say, the fixed one, is provided with a helical rib over a portion of its length and the movable member has a lateral skirt carrying one or more cam elements on its interior which are contiguous to the rib when the parts are in the "off" condition. However, the movable memeber comprises relatively rigid, but shape-retaining material, i.e., having a plastic memory, so that rotation of the movable member, without more, merely results in the cam elements being displaced outwardly when moved with respect to the rib. However, if sustained squeezing of the skirt in the region of the cam elements accompanies the rotational force the cam element or elements and ribs are maintained in engagement and the elements will ride up the helical rib to cause separation of the bead and groove. Preferably the bead is provided with a chamfered outer edge to facilitate re-engagement thereof with its companion groove upon application of axial thrust to the cap.

In still another aspect it is possible to terminate the skirt close to a shoulder provided near the base of the fixed part to define a narrow space into which a coin or other prying means may be inserted to force the cap off. By so doing an adult, e.g., an arthritic, who is incapable of exerting the force necessary to sustain squeezing of the skirt concurrently with rotation thereof, may use a coin or other implement to effect removal of the cap.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a side elevational view of a preferred form of the invention closure assembled on a container;

FIG. **2** is a view similar to FIG. **1** but with the cap detached from the fixed part of the closure;

FIG. **3** is a combined cross section and side elevation of the cap attached to the fixed part;

FIG. **4** is a cross section taken on the line **4—4** of FIG. **3**;

FIG. **5** is a view similar to FIG. **3** showing the cap in the process of removal from the fixed part;

FIG. **6** is a cross section taken on the line **6—6** of FIG. **5**;

FIG. **7** is a vertical, medial cross section of a modified form of the invention closure;

FIG. **8** shows the cap of FIG. **7** in the process of removal;

FIG. **9** is a combined vertical, medial cross section of another modified form in which the exit opening from the closure is somewhat smaller than the opening in the container;

FIG. **10** shows the closure of FIG. **9** in the process or removal;

FIG. **11** shows still another embodiment in combined elevation and cross section;

FIG. **12** is a bottom plan view of the cap only, as seen on the line **12—12** of FIG. **11**; and

FIG. **13** is a cross section on the line **13—13** of FIG. **11**.

DESCRIPTION OF PREFERRED EMBODIMENTS

Turning now to the drawings there is shown a metal container **10** having a pouring opening **11** which may be simply pierced or provided with a circumferential flange, as is common. Alternatively, the container and the fixed part of the closure may be blow-molded in one piece. Other common means of attaching the fixed part to the container may be utilized.

In a preferred embodiment the invention closure comprises a fixed part **15,** sometimes referred to herein as the neck, and a detachable part **16,** referred to herein as the cap. The neck **15** has an annular attaching portion **17** arranged to interfit with the opening **11.** Engagement between the portion **17** and opening **11** may, alternatively, be screw threads or a bayonet joint. For reasons to appear, the neck **15** is desirably molded of a rigid plastic composition, e.g., polypropylene, and the cap **16** of a resilient composition, e.g., polyethylene, having a plastic memory.

The neck **15** comprises attaching means **21** from which a tubular member **22** protrudes outwardly. A right-hand helicoid **23** of, say, two turns, is formed on the exterior of the member **22.** A groove **25** is located adjacent the outermost end of the member **22** and the

end is chamfered as at **26.** The groove **25** defines a bead **27.**

The cap **16** comprises a top wall **31,** from the periphery of which depends a skirt **32,** preferably of frusto-conical configuration, with the larger diameter at the inner end. In order to rigidify the free end of the skirt **22** to some extent and for esthetic considerations, a flange **33** may be provided. On its interior the cap **16** has a peripheral rib **34,** defining, with the wall **31,** an annular groove **38.** Also, on its interior surface **41** there are provided protuberances **42** shown, in the example, as fins having a principal plane inclined to the horizontal at substantially the helix angle of the helicoid **23.** By way of example two protuberances are shown on opposite sides of the skirt.

It will be noted that the axial extent of the bead **27** and groove **38** are respectively calculated to provide a running but snug fit therebetween. That is to say, the play therebetween is a minimum to yield fluid-tight sealing of the container but not so little as to unduly restrict rotation of the cap **16** in the manner to be described.

The exterior of the skirt **32** in the region of the fins **42** is provided with means to implement digital grip at diametrically opposed points and squeezing thereat. For example, there is shown a plurality of vertically disposed ribs **51.**

Referring particularly to FIGS. **3** and **4** the closed condition of the closure is seen to entail engagement of the bead **27** in the groove **38.** For clarity of exposition the clearance X between the bead **27** and the inner face **52** of the top wall **31** has been exaggerated. In practice the clearance may be regarded, for all practical purposes, as virtually zero. Since polyethylene is preferred for the cap **16** the waxy or slick surface of this plastic facilitates relative rotation between the surface **52** and bead **27.** Therefore, a child, attempting to remove the cap, might be able to rotate the same but the snug engagement of the bead **27** and the groove **38** is such that only an adult having the requisite strength in his fingers might be able to remove the cap by a straightforward axially-directed pull. The frusto-conical configuration of the skirt combined with its waxy surface renders successful removal somewhat problematical.

The relation between the helicoid **23** and the fins **42** in the normal, i.e., "closed" condition is as shown in FIGS. **3** and **4.** It will be observed that the fins **42** are not in full driving relation with the helicoid, but do occupy an overlapping relation therewith. That is to say, simple rotation of the cap **16** will be ineffective to cause the fins **42** to ride up the helicoid **23** since the material of the parts is of a flexible nature. On the contrary, the fins will simply be forced away from the helicoid since the skirt **32,** being elastic, will deform by reason of the reactive forces between the fins and helicoid as supplemented by the engagement between the bead **27** and groove **38.** Stated otherwise, the skirt **32** will ovalize in accordance with the reaction between the fins and helicoid. This will be the abortive situation if an attempt is made to separate the cap **16** from the neck **15** by simple relative rotation.

To separate the cap from the neck the former must be squeezed simultaneously with rotation To this end the thumb and index finger will be applied to the ribbed regions **51—51,** with sufficient force of apposition to nullify the forces tending to disengage the fins **42** from the helicoid **23** (FIGS. **5** and **6**) and such apposition will be maintained while rotating the cap. By so doing the cap will be displaced axially to separate the bead **27** from the groove **38** whereupon the cap may be lifted off to allow pouring.

If desired, the helicoid and fins may be left-handed so that, if a child is of such age as to be familiar with right-hand threaded elements but, as may be expected, unfamiliar with left-hand threads, a still further impediment is placed in his path. However, an adult reading the directions would be under no such handicap. To replace the cap the same is simply thrust axially on to the neck until the bead **27** seats in the groove **38.** Because of the resilience of the skirt **32** the bead **38** will stretch sufficiently to permit such re-engagement and, similarly when separating the cap from the neck in the manner described. For conciseness such engagement is sometimes referred to as a "snap fit."

It is not essential that engagement of the cap **16** with the neck **15** in response to the transverse squeezing force be through the medium of the fins **42** since, alternatively, any suitable protuberance inwardly of the skirt **32** may be used, for example, a simple hump or post on one side or opposite sides of the skirt. For balanced action, two are preferred, one on each end of a diameter.

A modified form of the invention is illustrated in FIGS. **7** and **8** wherein the cap **16*a*** and neck **15*a*** are provided respectively with fins **42*a*** engageable with a helicoid **23*a***. Sealing of the container is obtained by a plug **61** tightly engaged in an aperture **62** which may be implemented by snap fit of beads **63** and **64** in the cap **16*a*** and neck **15*a*** respectively. Operation is believed to be apparent in view of the preceding description. One or more apertures **65** are provided in the top wall **31*a*** through which the contents may be discharged. In this embodiment it is not necessary that the cap be fully removed but displaced axially only sufficiently to withdraw the plug **61** sufficiently from the aperture **62.** FIG. **8** shows the closure in "open" condition.

FIGS. **9** and **10** depict still another embodiment in which the plug **61*b*** is arranged to obturate the interior **65** of the neck. Operation is believed to be apparent in view of what has preceded. In this form of the invention the neck **15*b*** has two principal diameters: one, **15*x***, small enough to permit pouring without gushing and two, **15*y*** having attaching means dimensioned to suit the container **10*a*** which, for commercial reasons, is designed to receive attaching means which may be too large for incorporation of the principles of the invention, without waste of material.

FIGS. **11** to **12** illustrate still another embodiment in which the flexibility inherent in the skirt **32** is confined to a pair of fingers **71,** the remainder **72** of the skirt in this case being cylindrical. These fingers are molded in a normal condition inclined outwardly from the remainder **72** of the skirt. At its inner end the skirt, actually comprising two substantially semi-cylindrical shells, had a bead **77** adapted to snap under a bead **78** with a snap fit to retain the cap in the off position. Fluid-tight sealing is desirably accomplished by abutment of the upper edge **81** against an annular pad **82** on the interior of the skirt. An acceptable seal is obtained by so dimensioning the beads **77** and **78** as to apply requisite sealing pressure at the area of contiguity between the parts **81** and **82.**

To remove the cap the fingers **71—71** are pressed radially inwardly by the thumb and index finger to en-

gagement of the fins **42***b* on the fingers with the helicoid **23**, while the cap **15***b* is rotated. In this embodiment release of the beads **77** and **78** allows separation of the cap and neck.

I claim:

1. A closure for attachment to means defining the pouring opening of a container for a fluent substance, said closure comprising a hollow cylindrical neck extending from the periphery of said opening and a cylindrical cap adapted to be engaged with, and disengaged from, said neck to effect open and closed conditions of the container opening, at least the cap being of resilient but generally shape retaining material, said cap having a top wall and a skirt depending from the periphery of said wall, the neck and skirt having respective confronting faces, one of said faces having a helicoid outstanding therefrom and the other of said faces having a cam element outstanding therefrom, adapted to be driven by the helicoid, said helicoid and cam element being in overlapping relation in the closed condition of the closure, said cap and neck having respective bead and groove means which are engaged with a snap fit when the closure is in closed condition to restrain axial movement of the cap in response to force applied axially outwardly of the cap and said bead and groove means are disengaged upon forcible relative axial shifting of the cap and neck, to free the cap for removal, the overlap being such in relation to the tightness of said snap fit that simple rotation of the cap will displace the cam element away from overlapping relation with the helicoid by reason of the elasticity of the material and, upon application of digital, radial, squeezing force to the exterior of the skirt in the region of engagement of the element and helicoid, the displacing force is nullified and the element and helicoid are maintained in driving engagement to translate rotation of the cap into axial displacement of the cap against the bias of the snap fit.

2. The combination in accordance with claim **1** wherein the cam element comprises a pair of projections spaced apart axially a distance which receives the helicoid with a running fit.

3. The combination in accordance with claim **1** wherein the helicoid has a substantially rectangular transverse cross section, two opposite sides of the rectangle being normal to the axis of the neck.

4. The combination in accordance with claim **1** further characterized in that the exterior of the lateral wall of the skirt is of substantially frusto-conical configuration.

5. The combination in accordance with claim **1** further characterized in that the thickness of said skirt is uniform, at least in the area coextensive with the helicoid.

6. The combination in accordance with claim **1** wherein the bead is at the outer end of the neck and the groove is adjacent the top wall of the cap, the snap fit providing a fluid-tight seal between the cap and neck.

7. A closure for attachment to means defining a pouring opening of a container for a fluent substance, said closure comprising a hollow cylindrical neck extending from the periphery of said opening, and a cylindrical cap adapted to be engaged with, and disengaged from said neck to effect open and closed conditions of the container opening, said cap having a top wall and a skirt depending from the periphery of said wall, said skirt comprising resilient material, a first cam element protruding outwardly from the exterior surface of said neck and a second cam element protruding inwardly from the interior surface of said skirt, said elements being mutually displaceable when the cap is rotated relative to the neck and the skirt is radially unrestrained, said first cam element being a helical flight, said second element riding on the incline of the first element when the cap is rotated and the skirt is radially restrained, as a result of which the cap is moved axially, retaining means on said cap and neck normally preventing relative axial displacement therebetween but capable of being overcome by torque applied to the cap of a degree sufficient to overcome the retaining means whereby separation of the retaining means frees the cap for removal from the neck.

8. The combination in accordance with claim **7** wherein the retaining means is a bead on one of the neck and cap and a groove in the other of the neck and cap, said bead and groove being engaged with a snap fit.

9. The combination in accordance with claim **8** wherein the bead has a frusto-conical surface on the side which enters the groove to facilitate thrust type reengagement of the bead and groove upon re-assembly of the cap and neck.

10. The combination in accordance with claim **7** further characterized in that the interior face of the top wall of the cap in the closed position abuts the end of the neck in fluid-tight relation.

11. The combination in accordance with claim **7** further characterized in that the top wall of the cap is provided with an inwardly extending plug forming a snug fit with the interior of the neck.

12. The combination in accordance with claim **7** further characterized in that the skirt has a frusto-conical configuration with the larger diameter toward the container.

13. The combination in accordance with claim **7** wherein the skirt, in zones where radial inwardly directed squeezing force is applied is flaccid to present low resistance to disengagement of the elements in the absence of such force.

14. The combination in accordance with claim **7** further characterized in that said top wall has a through opening adapted to provide passage for the contents of the container when the closure is in on condition and the neck has a transverse wall at its outer end provided with a perforation, said cap top wall having a plug adapted to intromit the perforation when the closure is in off condition to seal against passage of said contents.

15. The combination in accordance with claim **14** wherein that end of the plug confronting the perforation is conical.

16. The combination in accordance with claim **7** wherein the skirt of the cap carries at least one flap substantially co-planar with the skirt and radially displaceable relative to the principal plane of the skirt, said second element being carried on the interior of the flap, whereby said radially restraining force may be applied to the flap.

* * * * *