

[54] **CONTAINERS AND SAFETY CLOSURE THEREFOR**

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[58] Field of Search **215/9, 41, 42, 46 R; 220/60 A, 27; 229/7 A; 222/541**

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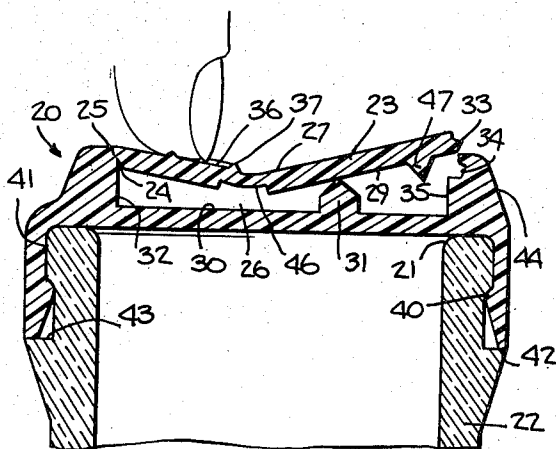
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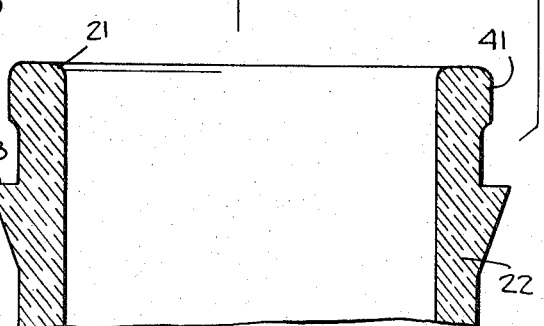
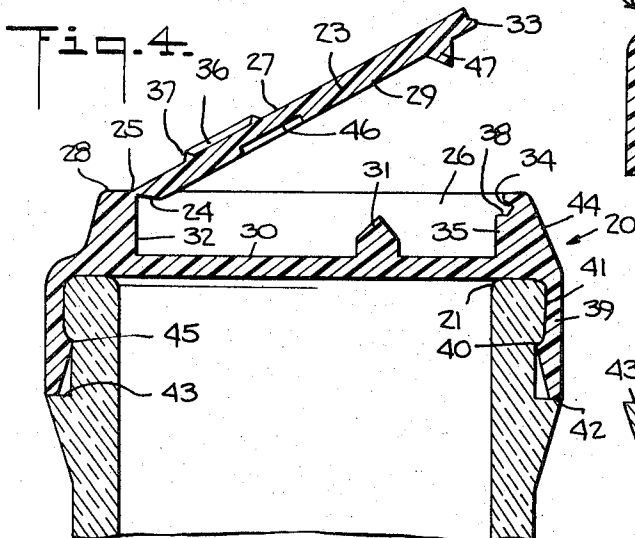
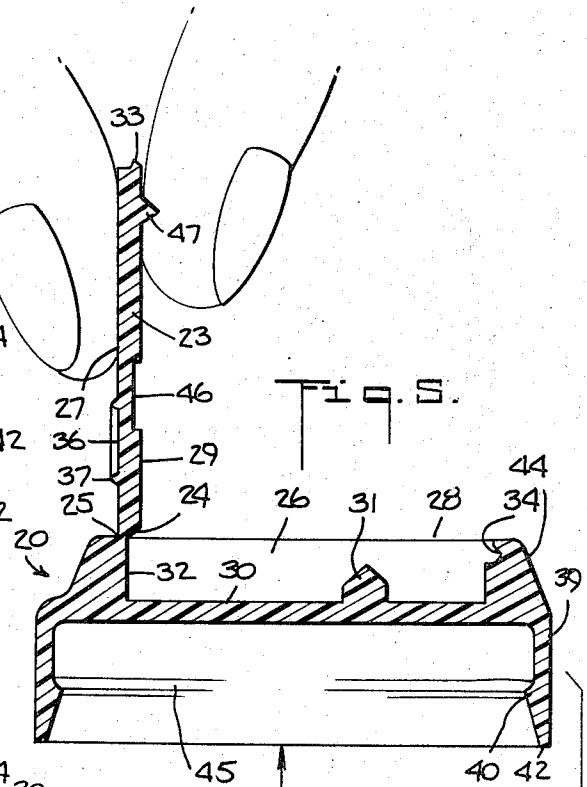
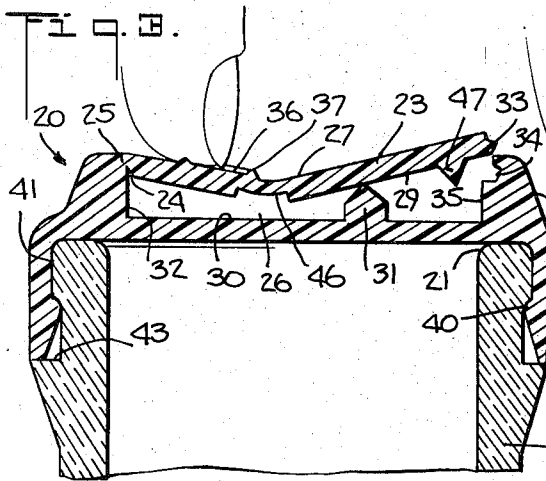
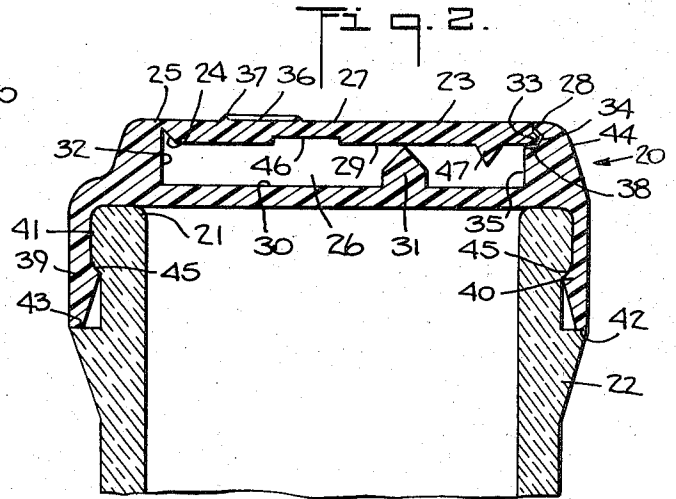
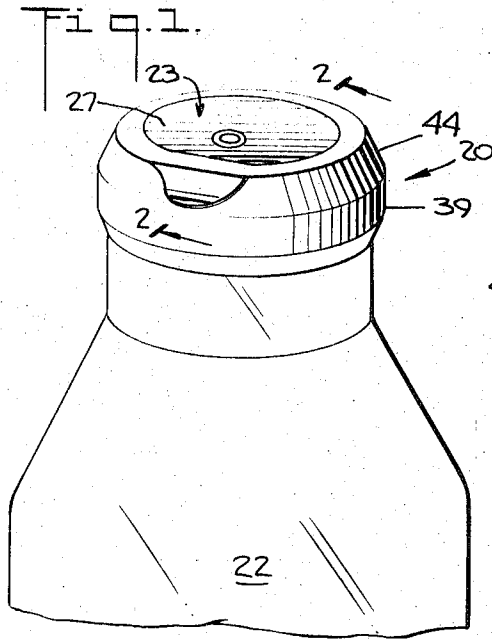
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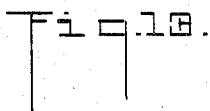
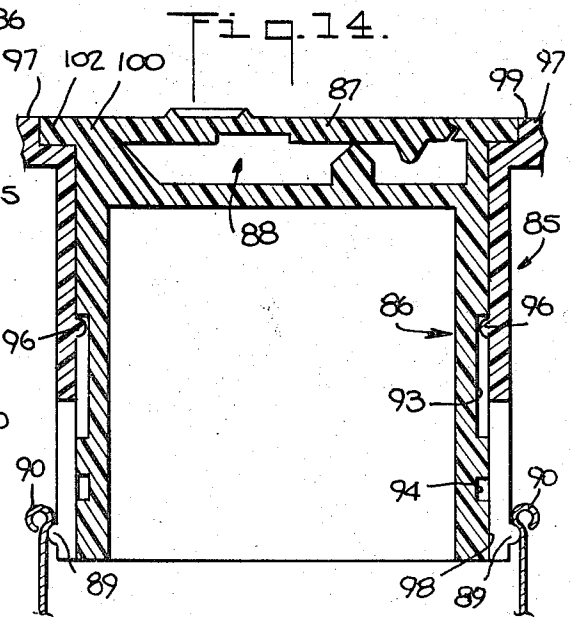
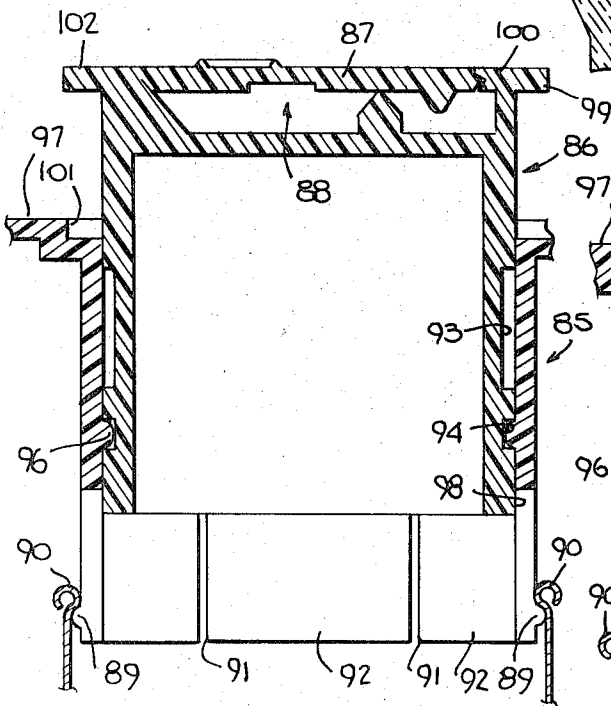
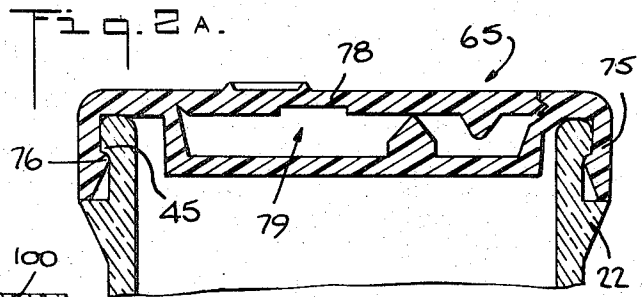
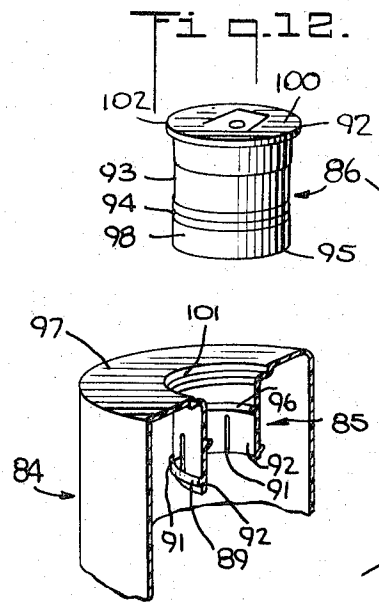
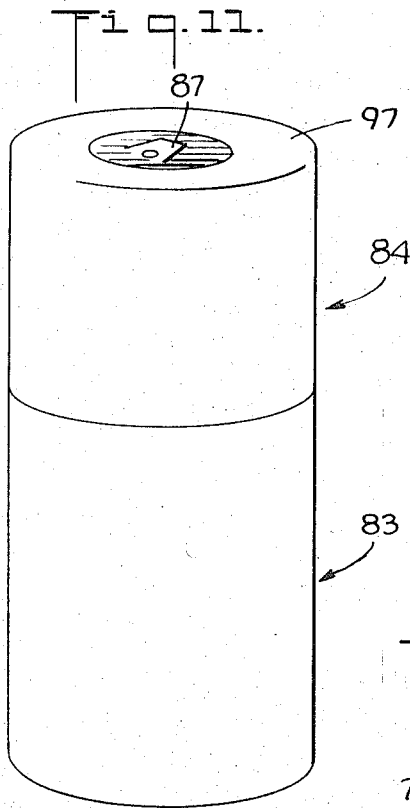
[57] **ABSTRACT**

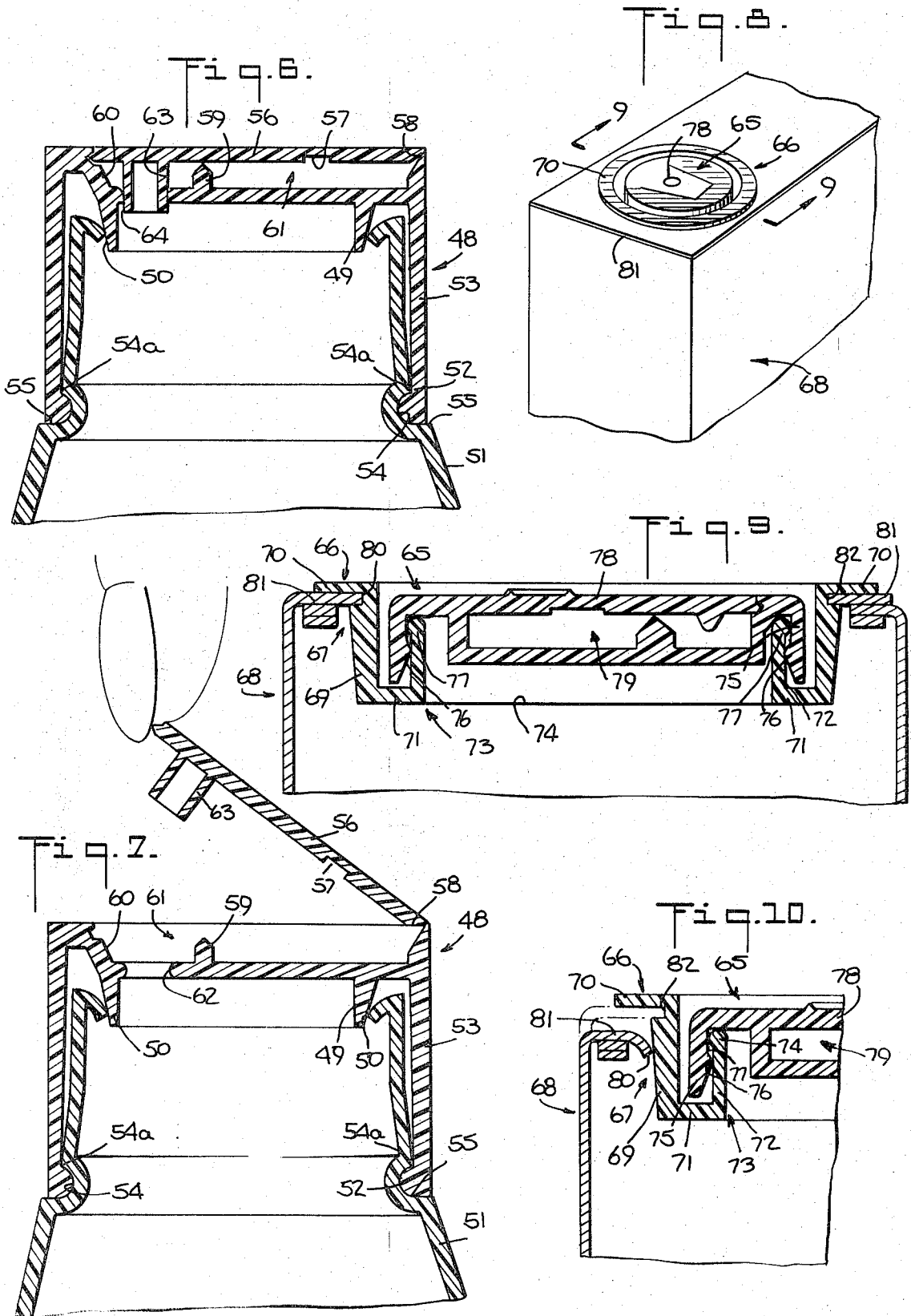
An improved safety closure for containers with harmful contents includes a member carrying an integral tab hingedly connected at one edge for swinging from a shut position in which it is flush-mounted within a close-fitting recess in the member to an open, grasping position. The depth of the recess is greater than the thickness of the tab, and a fulcrum means, spaced from the hinged edge, supports the tab flush with the surface of the member. Tongue and groove interengagement means secures the tab in a closed position. Inward force of at least four pounds must be applied to the tab between the fulcrum and the hinged edge to release the tongue and groove interengagement means and cause the tab to deflect and thus pivot about the fulcrum, the tab thereby obtaining a partially upright position, determined by the memory of the plastic in the hinge, above the surface of the member to facilitate grasping thereof. Preferred embodiments of the safety closure incorporate the tab-carrying member in combination with a depending skirt to form a snap cap or a stopper for bottles, with an adapter insert to form a recessed closure for box containers, and with a locking overcap for pressurized spray cans.

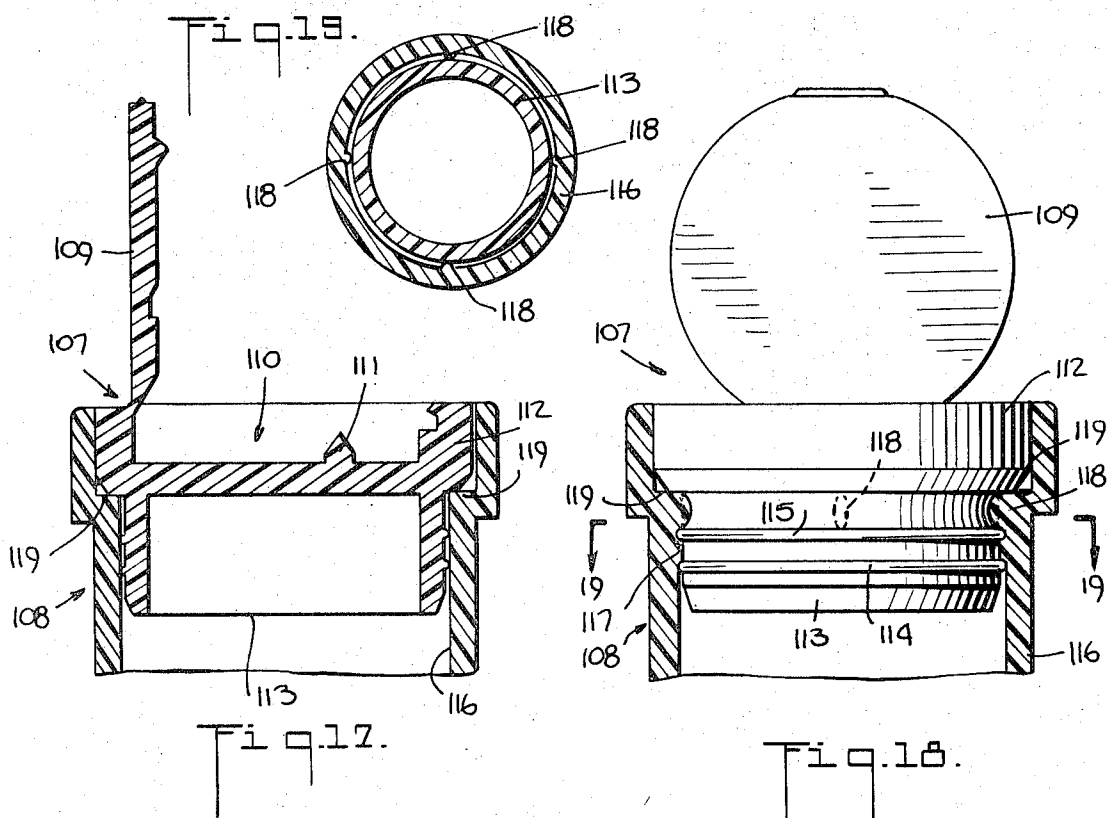
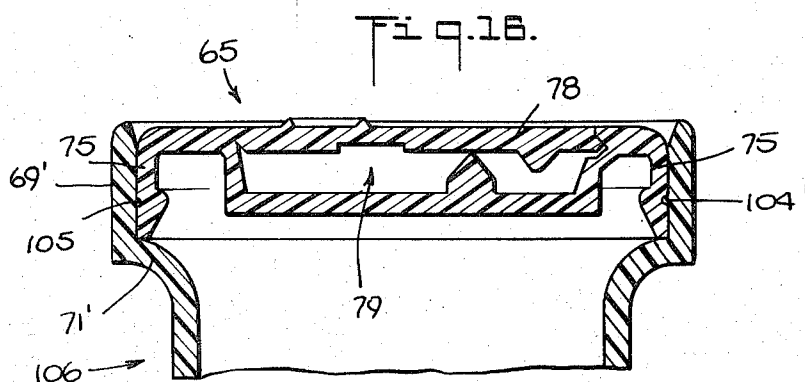
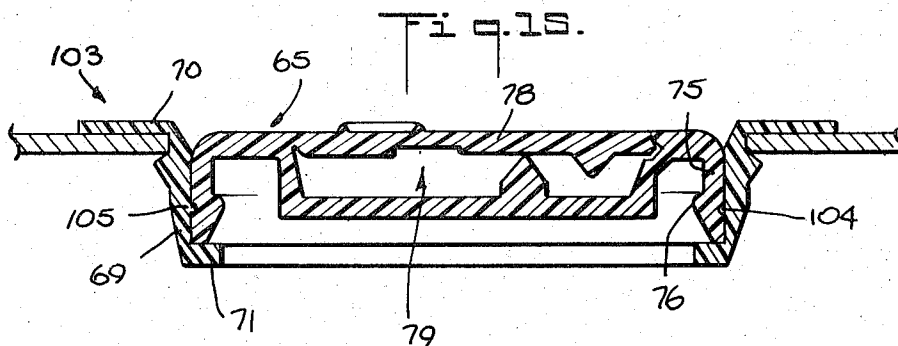
19 Claims, 20 Drawing Figures











CONTAINERS AND SAFETY CLOSURE THEREFOR

This application is a continuation in-part of application Ser. No. 262,419, filed June 13, 1972, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to safety closures for containers and more particularly to improved safety closures of the type having an integral pull tab that is normally flush-mounted in a recess and is swung out to an open, grasping position to facilitate removing the closure from the container.

Increasing public concern over injuries to children caused by harmful materials such as medicines, strong cleansers, hair sprays, and other products commonly found in the home has recently led the federal government to promulgate regulations governing the acceptability of safety closures proposed for containers of such products. These regulations set forth specific testing procedures that include controlled attempts by representative samples of children and adults to open the containers in a given period of time.

Under current regulations, the child effectiveness of a safety closure is determined by the percentage of children unable to open the container without instruction within a first five-minute period and by the percentage of children still unable to open the container during a second five-minute period following a visual demonstration by the tester, and an instruction that the children may use their teeth in attempting to open the container.

Opening effectiveness of the closure, on the other hand, is defined as the percentage of adults in the sample able to open the container within three minutes after reading accompanying instructions.

To be acceptable, the closure must achieve a child effectiveness of at least 85 percent in the first period and at least 80 percent in the second period, at the same time it must have an opening effectiveness of at least 90 percent, said percentage being the minimum requirements specified in the referenced regulations.

Several different safety closures designs have been developed, both of the snap cap and screw cap type, but to date few have achieved an acceptable rating in these stringent federal tests. Prior forms of safety snap caps that include an integral pull tab, flush-mounted in the top, are disclosed in U.S. Pat. Nos. 3,398,847; 3,556,331; and 3,604,585, respectively, issued on Aug. 27, 1968; Jan. 19, 1971; and Sept. 14, 1971 to Edward J. Towns, the coinventor of the present invention.

The pull tabs of these prior caps are joined integrally to the top of the caps to form a hinge connection. When shut, each tab fits snugly within a shallow recess in the cap, with the upper surface of the tab flush with the top surface of the cap. A small space between the end of the tab opposite the hinged end and the adjacent side of the recess permits insertion of a fingernail or other thin object to pry up the tab and swing it about the hinged end to an open, grasping position. The safety cap can then be removed by firmly tugging on the pull tab.

To discourage prying, biting, or removing the cap otherwise than by use of the pull tab, these prior caps have a skirt portion that snaps snugly over a mating flanged container mouth, and the bottom of the skirt

closely abuts a circumferential ledge on the container neck. The outside neck. The outside diameter of the ledge is at least as great as the outside diameter of the cap skirt; so no crack or surface is presented to receive an upward-directed force tending to push the cap off the container mouth.

Although children find it difficult to remove these prior safety caps, their child effectiveness is not high enough to meet the new federal standards. The major problem is that the pull tabs on these caps are too easy to open, once the visual demonstration by the tester of how to open the container has been given. Even the addition of an interengaging tongue and groove means on the edges of the tab and corresponding sides of the recess does not make this type of closure sufficiently child proof to meet these federal standards because a small child will quickly appreciate that the tab can be pried up by inserting a sharp object in the slot, which must be provided to lift the tab.

Pull tabs on non-safety caps disclosed in the prior art offer no solution to this problem either. For example, U.S. Pat. No. 3,419,198 issued to G. N. Pettersen on Dec. 31, 1968, discloses a screw-on type bottle cap with a flexible tab having a stopper plug formed at one end. The plug can be removed from its seat by flexing the tab or by prying the tab up by inserting a sharp object into the recess which the tab partially spans (FIGS. 3, 4) or into the slot formed between the tab's hinges (FIGS. 6, 7, 13).

BRIEF SUMMARY OF THE INVENTION

The present invention is an improvement over the previous Towns safety caps that eliminates the fingernail slot. In the improved version, all edges of the tab are in close-fitting abutment to the edges of the recess when the tab is shut. Tongue and groove interengagement means are provided between at least one edge of the tab and one wall of the recess to positively lock the tab. In this way, the top surface of the cap is absolutely smooth with no indentation or protrusion to provide a purchase for prying up the tab.

To lift the free end of the tab above the surrounding surface of the cap, a novel opening means is provided that requires the use of an inwardly-directed force on the tab. This is opposite the force one would normally use in attempting to pry up the tab.

Moreover, the width and thickness of the tab, the depth of the recess in which it is mounted, the rigidity of the walls of the recess, and if necessary, in respect of safety caps which are seated inside the mouth of a container, the strength of the wall forming the container mouth and the relative depth of the safety cap seated therein, are so proportioned that a force of at least about 4 and preferably about 4½ pounds is required to open the tab. A high percentage of children of age less than 51 months simple do not possess sufficient bimedial strength to apply a force of this magnitude with their fingers. Furthermore, the foregoing dimensions are selected so that sufficient force cannot be applied at the proper location by such children by means of their teeth.

As a result, this improvement has proved not only baffling to children, but, as proven by numerous tests conducted in accordance with Federal Regulations, beyond the physical capability of a high percentage of children of age less than 51 months, yet easy for adults to open by following simple printed instructions.

Briefly, the invention includes a recess, deeper than the tab thickness, and a fulcrum means, spaced from the hinged end between the bottom of the recess and the underside of the tab, that supports the top of the tab flush with the surface of the closure. Hence, the tab is supported at the hinge connection and at the fulcrum point, with no support in between.

Downward force of at least 4 pounds and preferably in the range from 5 to 12 pounds must be applied to the top of the tab between the fulcrum and the hinged end to cause the tab to deflect at that point and pivot about the fulcrum, thereby raising the other end of the tab above the surrounding surface to a partially upright position determined by the "memory" of the plastic in the hinge. The amount of force required as a minimum from a safety standpoint varies with the surface area of the tab, the larger tab requiring the higher minimum force, and vice versa.

Moreover, the tab and recess have tongue and groove interengaging means, such as a bead on the end of the tab and a mating groove in the end wall of the recess, for positively locking the tab shut while allowing it to snap open upon application of sufficient force between the hinge and the fulcrum.

The improved pull tab arrangement of the present invention is adaptable to a snap cap of the type disclosed in the above-mentioned Towns Pat. No. 3,398,847. Alternatively, it may be equipped with an integral sealing plug to mate with a dispensing outlet in the bottom of the recess for use in a squeeze bottle safety closure similar to those shown in Towns Pat. Nos. 3,556,331 and 3,604,585. In another embodiment, a snap cap incorporating the pull tab of this invention in combination with a plastic insert member provides a recessed safety closure for cardboard containers of the type commonly used for granulated cleansers, and for metal cans or containers of the kind commonly used for charcoal lighter fluid. In still another embodiment, a tubular pull tab member slidably mounted in a slotted casing within an overcap provides a safety locking means for a conventional pressurized push button spray can.

Accordingly, it is a principal object of the present invention to provide a safety closure of the pull tab type adaptable to a variety of containers that meets federal standards for both child effectiveness and opening effectiveness.

It is a related object to provide a safety closure that retains its effectiveness for the dispensing life of the container. In its continuous use provision, the regulations require that the closure retain its effectiveness through the life cycle of the container to which it is applied.

These and other objects and features of the invention will be readily apparent from the drawings and following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a safety snap cap incorporating the improved pull tab of the invention shown mounted on the mouth of a bottle; which can be of plastic or glass.

FIG. 2 is a section view of the embodiment of FIG. 1 taken along lines 2—2, with the pull tab in its shut position.

FIG. 2A is a section view of an alternative embodiment in which the pull tab recess lies inside the mouth of a container or bottle.

FIG. 3 is a section view showing the result of applying a downward force on the pull tab between the hinged end and the fulcrum means.

FIG. 4 is a section view showing the tab in its partially upright position, determined by the memory of the plastic in the hinge.

FIG. 5 is a section view showing the snap cap of FIG. 1 removed from the bottle by means of the pull tab.

FIG. 6 is a section view of an alternate snap cap embodiment incorporating a dispensing outlet in the bottom of the tab recess.

FIG. 7 is a section view showing the embodiment of FIG. 6 with the tab open.

FIG. 8 is a perspective view of another snap cap embodiment combined with a plastic insert for a fill opening in a cardboard container.

FIG. 9 is a section view of the embodiment of FIG. 8 taken along the lines 9—9. FIG. 10 is a fragmentary section view of the combination of FIG. 9 showing the insert being pressed into the container.

FIG. 11 is a perspective view of a spray can overcap incorporating an alternate safety lock embodiment of the invention.

FIG. 12 is an exploded perspective view showing the components of the locking overcap of FIG. 11.

FIG. 13 is a fragmentary section view of the safety overcap embodiment of FIG. 11 shown assembled ready for initial installation on a spray can.

FIG. 14 is a fragmentary section view of the embodiment of FIG. 11 shown in locked position on a spray can.

FIG. 15 is a section view of a cap and insert combination similar to that of FIG. 9 but in which the outer surface of the cap skirt engages the inner surface of the insert wall.

FIG. 16 is a section view of a cap similar to that of FIG. 2A fitted inside the mouth of a container.

FIG. 17 is a side section view of a stopper-type cap fitted inside the neck of a container.

FIG. 18 is a front view in partial section of the embodiment of FIG. 17, FIG. 19 being being a plan section of the former.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 through 5, a snap cap 20 fits snugly on a mouth 21 of bottle 22. Snap cap 20 is preferably injection molded of a resilient plastic material such as polypropylene, polyethylene, or copolymers of the two.

An integral pull tab 23 is joined to the top of cap 20 at one end 24 to form a flexible hinged connection 25 that allows the tab to be swung from a shut position (FIG. 2) to an open, grasping position (FIG. 5). In its shut position, tab 23 lies within a recess 26 in the top of the cap with the edges of the tab closely abutting the sides of the recess and the upper side 27 of the tab flush with or slightly below the top surface 28 of the cap.

Recess 26 is deeper than the thickness of tab 23 so that the underside 29 of the tab is spaced from the bottom 30 of the recess when the tab is shut.

A fulcrum means 31, spaced from hinge end 32 of the recess, supports the tab flush with the surface of the cap. Although shown as a transverse bar integrally molded in the bottom of recess 26, fulcrum means 31 could as effectively be one or more rounded knobs or other shapes protruding either upward from the bottom

of the recess or downward from the underside of the tab.

Interengaging means such as bead 33 on the free end of the tab and mating groove 34 in end wall 35 of the recess 26 lock the tab shut yet allow it to snap open when force in excess of about four pounds, is applied in the center of area 36 defined by circular bead 37. A ledge 38 underlying the free end of tab 23 provides additional support for maintaining the tab surface flush with the top of the cap.

Snap cap 20 further includes an integral circular skirt 39 depending from the top. The skirt has an inner circumferential bead 40 adapted to snap over a protruding circumferential lip 41 surrounding mouth 20 of bottle 22, and the bottom 42 of the skirt extends in close-fitting abutment with a circumferential ledge 43, spaced from lip 41. The outer diameter of ledge 43 is at least as great as the diameter of skirt 39, making it extremely difficult for a child to pry off the cap with his fingers or his teeth. For additional resistance to removal by biting, the junction 44 between skirt 39 and top 28 is bevelled, preferably at an angle equal to the angle of upper surface 45 of inner bead 40.

The snap cap embodiment of FIG. 2A is similar to the cap of FIG. 2 except that the recess for the pull tab is located within the skirt portion instead of above it. The cap of FIG. 2A is suitable for larger mouth containers, particularly where minimum overall height is a consideration; while the cap of FIG. 2 is particularly suited to small mouth containers, such as bottles for children's aspirin, where there is insufficient room for an internal recess within the bottle mouth.

If the FIG. 2A type of cap is to be used with a flexible container, such as a polyethylene bottle, it is desirable to round off the crown to prevent a child from partially collapsing the bottle and simultaneously pulling or biting off the cap without using the pull tab.

The sequence of operations for removing snap cap 20 from bottle 22 is shown in FIGS. 3 through 5. As shown in FIG. 3, downward pressure by a thumbnail, for example, causes tab 23 to deflect and pivot about the edge of fulcrum 31, thereby snapping bead 33 up and out of groove 34. The tab may have a region of reduced cross section, such as relieved portion 46, approximately midway between the hinged edge and the fulcrum to provide additional flexibility, if necessary.

Once open, it is a simple matter to swing up the tab with a finger, as in FIG. 5, for grasping between thumb and forefinger. Transverse ridge 47, integrally molded in the underside of the tab, prevents the fingers from slipping off the tab as the cap is pulled from the bottle.

It will be apparent to one of ordinary skill in the art of molding plastic articles that for proper operation through repeated removals and reclosures, the various dimensions of the snap cap, such as the thickness of tab 23, hinge connection 25, and skirt 39, as well as the size of tab bead 33 and skirt bead 40, are chosen to provide the necessary resilience and flexibility while ensuring sufficient strength to withstand the severe stress encountered when the cap is pulled off the bottle. Moreover, in accordance with the instant invention, said dimensions are so selected in respect of the specific plastic material incorporated in said cap, that a force of at least 4 pounds, and preferably on the order of from about 5 to 12 pounds, for example, or more than a child in the age group of concern is physically capable of ex-

erting with his fingertips alone, is required to deflect and open tab 23. Furthermore, it is to be understood that the force required to deflect and open the tab is sufficiently low that elderly persons, or arthritic persons are able to deflect and open the tab.

An alternate embodiment of the improved pull tab of the present invention combined with a dispensing snap cap for use with a squeeze-type plastic bottle is shown in FIGS. 6 and 7. In this embodiment, a skirted snap cap 48 includes a tapered inner tubular portion 49 adapted to make a sealing fit with a bevelled mouth 50 of bottle 51 by deforming the bevelled mouth 50 (as illustrated in FIGS. 6, 7) when inner circumferential bead 52 at the bottom of skirt 53 is snapped into mating groove 54 around the neck of the bottle. The bottom of skirt 53 abuts closely against circumferential ledge 55 just below groove 54 to discourage insertion of a sharp object to pry off the cap. Furthermore, the bead 52 is locked beneath the sharp upper edge 54a of mating groove 54 so that cap 48 is permanently locked on the bottle 51.

The top of snap cap 48 includes an integral flush-mounted pull tab 56 having a relieved portion 57 to increase its flexibility between hinged edge 58 and fulcrum means 59. Between fulcrum 59 and the free end 60 of recess 61 is a dispensing outlet 62, which is sealed by plug 63 when the tab is shut.

The tab of FIGS. 6 and 7 is opened by the identical procedures described for FIGS. 3-5. When the tab is swung open as in FIG. 7, the contents of squeeze bottle 51 can be dispensed through opening 62. Reclosing the tab then reseals the bottle. It is important to note that a tongue 33 (FIGS. 3, 4) and undercut groove 34 are required at the end of the tab 23 to lock the tab down, as use of such tab in the arrangement shown in FIGS. 6, 7, i.e., on a cap for containers having liquid contents, prevents the plug 63 seal, which is lubricated by the liquid contents, from being opened by squeezing the bottle. Without the tongue and groove interengagement means 33, 34, the cap illustrated in FIGS. 6, 7 will not function as a safety cap.

FIGS. 8 through 10 illustrate another embodiment of the present invention which is particularly suitable for use with cardboard containers of dry, granulated materials and metal cans holding liquids because the tab and recess in which the tab lies are positioned within the mouth of the container or can. In this embodiment a safety snap cap 65, such as that illustrated in FIG. 2A, forms in combination with a molded plastic insert 66 a recessed safety closure for a dispensing opening 67 in the top of a container such as cardboard box 68.

Insert 66 is made preferably of one-piece molded plastic and includes an externally tapered tubular body 69 terminating at its upper end in an outer annular flange 70 and at its lower end in an inner annular base 71. A short, tubular neck 72 extends upward from inner opening 73 in base 71 coaxial with and inside body 69 and terminates in a mouth 74 approximately midway between the ends of body 69.

Snap cap 65 has a depending skirt 75 with an internal bead 76 sized to snap over a protruding lip 77 surrounding mouth 74. The skirt length is slightly less than the length of insert body 69 so that the top of snap cap 65 is flush with or slightly below the plane of outer flange 70 when the unit is assembled. A hinged tab 78 and mating recess 79 are formed in the top of snap cap 65 similar to the embodiment of FIGS. 1-5. The tab in

FIG. 8 is shown as rectangular instead of circular, as in FIG. 1, but it will be appreciated that the shape of the tab can be varied without departing from the concept of the invention.

In the embodiment of FIGS. 8-10, the open box will be filled automatically and the flaps folded over and sealed in the usual manner. The flaps will have precut holes located to align themselves when the flaps are sealed to form opening 67. Hole 80 in the top flap 81 is slightly smaller in diameter than the holes in the other flaps so that when tapered body 69 of the safety closure combination is inserted into hole 67, the top flap will yield slightly, as in FIG. 10, and then snap into a groove 82 in the outer wall of body 69 adjacent outer flange 70. In addition to the locking effect thereby obtained, the flange 70 of insert 66 should be cemented to the top flap of the box to withstand the force of removing cap 65 to dispense the contents through mouth 74.

Because snap cap 65 is completely recessed within insert 66, it is impossible to insert a sharp object to pry off the cap. In addition, this recessed design permits application of the conventional printed overwrap without bulges and also allows the boxes to be stacked without interference. The overwrap provides proof that the container has not been tampered with prior to initial opening, yet it can be removed easily in the region of the safety closure simply by running a fingernail or knife tip around the annular channel between the outside of skirt 75 and the inside surface of body 69. Tab 78 can then be raised and snap cap 65 removed by following the sequence described above in connection with FIGS. 3-5.

Referring next to FIGS. 11 through 14, a conventional spray can 83 carries a cylindrical plastic overcap 84 having an integrally molded, coaxial, inner tubular casing 85 in which is slidably mounted a cylindrical locking member 86 with an integral pull tab 87 flush-mounted in a recess 88 in its top.

Casing 85 is sized so that an outer circumferential bead 89 near the bottom will snap fit underneath an inner rolled lip 90 surrounding the valve well of spray can 83. Parallel slots 91 extend from the bottom of casing 85 for a portion of its length, and the resulting separate cantilevered sections 92 have sufficient flexibility to deflect inward when overcap 84 is snapped on and off the spray can.

The outer surface of cylindrical locking member 86 has a wide circumferential relieved portion 93 at about its midregion and a narrow circumferential groove 94 between the lower end of relieved portion 93 and bottom edge 95. The inner surface of casing 85 carries a circumferential bead 96 spaced from the upper surface 97 of overcap 84 by a distance slightly greater than the distance of the upper end of wide groove 93 from the top surface of locking member 86.

The safety overcap embodiment of the present invention is intended for installation on a spray can in an automatic filling line in the following sequence. After the separate overcap 84 and locking member 86 of FIG. 12 have been molded, they are coupled into a unitary assembly by sliding member 86 into casing 85 until bottom edge 95 contacts inner bead 96 and then exerting pressure to force bead 96 over surface 98 and into narrow groove 94 as shown in FIG. 13. The material and dimensions of the overcap and locking member is determined, by methods known to those skilled in the art,

to provide enough resiliency to accomplish above assembly step.

The over cap assembly of FIG. 13 is next fitted automatically onto a filled spray can with outer bead 89 snapped under rolled inner lip 90, and then locking member 86 is pressed down until its top is flush with top surface 97 of the overcap, as shown in FIG. 14. In this position, outer surface 98 at the bottom of member 96 provides a rigid backing behind cantilevered sections 92, thereby locking the overcap to the spray can.

To unlock the overcap, locking member 86 must be pulled up until inner bead 96 abuts the lower end of wide groove 93; then flexible sections 92 will deflect inward as the overcap is pulled off the can. Because outer edge 99 of flanged top 100 fits snugly within annular recess 101 in the overcap, the locking member cannot be pried up by inserting a sharp implement under flange 102. Thus, the only way to pull up locking member 86 is to snap open tab 87, swing it up, grasp it and tug firmly in the sequence described earlier in connection with FIGS. 3-5. To relock the overcap, it is merely replaced on top of the spray can, locking member 86 pushed down flush with top surface 97, and tap 87 snapped shut.

In the previously described embodiments of FIG. 1-10, the safety caps all fit over the mouths of their respective containers. The caps of the present invention are equally adaptable as stopper-type, internally fitting closures. FIG. 15 illustrates a cap 65 in combination with an insert 103 very similar to the combination of FIGS. 8-10 and bearing the same reference numerals on the same parts. As before, insert 103 is intended to snap permanently in a round hole in the top of a metal can or cardboard box, for example.

The principal between insert 103 and insert 66 of FIGS. 8-10 is the elimination of the inner coaxial tubular neck of the earlier embodiment. In the embodiment of FIG. 15, cap 65 fits snugly within the inner surface of tubular body 69 with the bottom of cap skirt 75 bearing against a stop means, for example, an inner flange 71 of the insert. The length of the insert body is sufficient so that top 78 of cap 65 will be flush or slightly below the surface of outer flange 70. Alternatively, the top portion of the cap can be shaped to be free of surfaces which can be grasped and held by teeth. For a tighter fit, the inner surface of insert body 69 may have a circumferential bead 104, and, optionally, skirt 75 may have a mating groove 105 for a snap fit.

In FIG. 16 the same type of cap 65 is shown fitted within the mouth of a glass or plastic container 106. As with the insert 103, the depth of inner ledge 71' from the rim of wall 69' should be sufficient so that the top of the cap is approximately flush with the rim to discourage prying the cap out with the teeth or a sharp object. Also, the inner surface of wall 69' may carry a circumferential bead 104' to provide an interference fit with the skirt of cap 65 as in the embodiment of FIG. 15.

Referring next to FIGS. 17, 18 and 19 an alternate style of stopper cap 107 fits within the counterbored mouth of a container 108. Cap 107 includes a pull tab 109, a recess 110, and a fulcrum means 111, according to the invention, within a circular body 112. A skirt or cylindrical portion 113 of reduced diameter depends from body 112 and carries external circumferential beads 114 and 115 to provide an interference fit with

inner wall 116 of container 108, said wall optionally having a corresponding circumferential bead 117. A means for bleeding air from the container 108 when the stopper cap 107 is fitted thereon, may also be provided. For example, the inner wall of the container 108 additionally includes at least one vertically oriented bead 118; four such beads 118 are shown in FIG. 19, equidistantly spaced around the perimeter of the container's mouth. The beads 118 allow air to bleed out of the container as the stopper cap is fitted thereon. It will of course be obvious to one of skill in the art that more or less than four beads 118 can be used, depending for example on the size of the container. Alternatively, tracks or valleys (not illustrated) can be provided in the container's inner wall, or axially along the skirt portion 113 of the stopper cap. As illustrated in the drawings, when fitted, the stopper cap fits snugly against stop means 119, in this embodiment, a ledge formed by the counterbored mouth of the container. One advantage of the stepped cap of FIGS. 17, 18 and 19 lies both in the fact that its added length makes it more difficult to pry out than the embodiment of FIG. 16, for example, and also in the dirt seal provided by the larger diameter body of the cap.

Functionally, this ledge or stop means 119 may be replaced by a taper or a radius, or equivalent mechanical means formed on the cap 107, or any equivalent structure for preventing the cap from being pushed too far down into the container 108.

Moreover, in respect of safety caps and closures of the kind illustrated in FIGS. 17-19, in accordance with the invention, the mouth wall of the container 108 serves the additional safety function of preventing a child of age less than 51 months from using his teeth to deflect the tab 109 sufficiently to open it. In this regard, the same function is performed by side walls of the recess 26 of the safety caps illustrated in FIGS. 1-5.

Each of the safety caps illustrated in the drawings, and fully described herein, have been constructed, and these successfully passed the safety tests set forth in the Federal Regulations. Some of these tests were carried out by the independent testing laboratory, Associate Testing Laboratories, Inc., Wayne, N.J. The results of these tests are tabulated on Table 1 below.

In each test, 200 children in the age group from 42-51 months, and 100 adults were used as test panalists. Furthermore in each test, the children were tested in pairs in their preschool or nursery school classrooms, while the adults were tested individually. The children were allowed 5 minutes to open the container, followed by a single visual demonstration and another five minute time period. Specially the children were each given a container enclosed with a safety cap constructed in accordance with present invention, and told to open it. Utilizing a stop watch the children were monitored for a 5 minute period. At this point a visual demonstration was given showing the children how to open the container, with the further instruction that they were allowed to use their teeth. The children were again monitored for a 5 minute period.

Next, the adults were tested individually. Each adult was given a container enclosed with a safety cap constructed in accordance with the present invention, instructed to read the printed instructions incorporated on the container, and allowed 5 minutes to open and secure the container. The adults tested were between

18 and 45 years of age with a minimum 70 percent of those being tested female.

In all respects, the foregoing tests were carried out pursuant to appropriate Federal Regulations, for example paragraph 295.10 of the Poison Prevention Packaging Act, as revised in the Federal Register, volume 36, No. 225, dated Nov. 20, 1971, and volume 37, No. 11, dated Jan. 18, 1972.

TABLE

Safety Cap Illustrated In the Drawings	Children		Adults: % Of Opening
	First Period % Effectiveness	Second Period % Effectiveness	
FIG. 2A (28 mm cap)	98.5	93.5	95
FIG. 2A (26 mm cap)	95	85	100
FIGS. 11-15	99	98	95
FIGS. 17-19 (16 mm cap)	96.5	86.5	99
FIGS. 17-19 (20 mm cap)	96.5	85.5	99

From the foregoing description of the preferred embodiments, it is apparent that the present invention provides a safety package, including safety closure and container, adaptable to a wide variety of uses, for example, medicines, detergents, fluids of all kinds and the like. Each embodiment can be opened only by operation of the integral flush-mounted pull tab, but, as demonstrated by the foregoing data in respect of safety requirements set forth in the Federal regulations, not by children of age less than 51 months. The improved safety package of this invention meets the strict Federal safety standards for both child effectiveness and opening effectiveness.

For example, as described above, in a controlled test performed in accordance with these Federal standards, of 200 children, half of them boys and the other half girls, evenly distributed between the ages 42 through 51 months, the first period child effectiveness of a snap cap identical to the embodiment of FIGS. 2A was 98.5 percent, and the second period child effectiveness was 93.5 percent. In a companion test of 100 adults, 70 percent women, also conducted in conformance with the above-mentioned federal standards, the opening effectiveness was 95 percent. In each case, therefore, the safety closure and package of the present invention exceeded the corresponding Federal child effectiveness standards of 85 percent and 80 percent and the opening effectiveness standard of at least 90 percent. In this embodiment, the thickness of the tab 78 was about 50 mils, reduced to about 34 mils in the region between the tab hinge and upstanding fulcrum, to assure that an inwardly directed force on the order of from about 4 to 12 pounds is required to deflect the tab about the fulcrum to a partially upright position.

While specific embodiments of the invention have been disclosed, variations in structural detail within the scope of the appended claims are possible, and are contemplated. There is, therefore, no intention of limitation to the abstract, or the exact disclosure herein presented.

What is claimed is:

1. In a safety closure made of plastic for a container of the type having a closure member with an integral pull tab mounted within a recess in the top surface of

the member and swingable about a hinged connection at one end to an open, grasping position, the improvement wherein:

all edges of the tab are in close fitting abutment to the edges of the recess when the tab is shut;
 tongue and groove interengagement means between the tab and at least one surface forming said recess are provided to hold the tab shut;
 at least a portion of the recess is deeper than the thickness of the tab; and
 a fulcrum means is located adjacent said deeper portion for supporting the tab,
 the dimensions of said tab, said recess and said fulcrum means being so proportioned in respect of the material from which said closure is made that an inward force on the tab at a point overlying said deeper portion of at least about four pounds is required to cause the tab to deflect inward at that point and thus pivot about the fulcrum means thereby raising an edge of the tab on the other side of the fulcrum means above the top surface of the closure to permit swinging the tab to the open, grasping position.

2. The safety closure of claim 1 wherein said deeper portion of the recess is located adjacent to the hinged connection, and the fulcrum means is located in spaced relation to the hinged connection.

3. The safety closure of claim 2 wherein the pull tab has a region of reduced cross section intermediate its hinged end and the location of the fulcrum means for increasing its flexibility in said region.

4. The safety closure of claim 2 further comprising an opening in the bottom of said recess, between the location of the fulcrum means and the end of the recess opposite the hinged connection, and a means extending from the flap for sealing said opening when the flap is shut.

5. The safety closure of claim 4 wherein the means for sealing said opening comprises a plug.

6. The safety closure of claim 2 wherein said required force is in the range from about 4 to 12 pounds.

7. The safety closure of claim 3 wherein said required force is in the range from about 4 to 12 pounds.

8. The safety closure of claim 5 wherein said required force is in the range from about 4 to 12 pounds.

9. The safety closure of claim 1 wherein said interengagement means comprises a protrusion from the tab and a mating indentation in at least one surface forming said recess.

10. The safety closure of claim 9 wherein said protrusion comprises a bead extending from the end of the tab opposite its hinged end, and the indentation comprises a groove in the corresponding end wall of the recess.

11. The safety closure of claim 1 in combination with a container having a flat wall with a circular opening, wherein the closure further comprises:

a separate insert adapted to be secured in the circular opening of the container, said insert including a tubular body extending within the container when the insert is secured to the container and an inner stop means, the closure member being adapted to sealingly fit within the insert body against the inner stop means such that the surface of the closure member is approximately flush with the outer surface of the container.

12. The safety closure of claim 1 in combination with a container having a central well in the top with an internally projecting lip at the top of the well, wherein the closure further comprises:

a tubular portion depending from the closure member, said tubular portion having a wide outer circumferential groove extending for a portion of its length;

a flat-topped cylindrical overcap for the container, said overcap including an integral inner tubular casing extending from the top and adapted to slidably receive the tubular portion of the tab-carrying member, the casing having:

at least one axial slot extending upward from the lower edge for a portion of its length to permit inward flexure of the wall of the casing;

an outer circumferential bead adjacent the lower edge of the casing for snap engagement with an internally projecting lip on the top of the container; and

an inner circumferential bead spaced from the top of the casing by a distance such that it will engage the wide circumferential groove in the tubular portion near the top of the groove when the top of the tab-carrying member is flush with the top of the overcap.

13. The safety closure of claim 1 in combination with a container having a flat wall with a circular opening wherein the closure further comprises:

a tubular skirt depending from the top surface of the closure member and having an inner circumferential bead adjacent its lower end to form a snap cap; and

a separate insert adapted to be secured in the circular opening of the container, said insert including a tubular body extending within the container when the insert is secured to the container and an inner tubular neck, coaxial with and spaced from the inner wall of the insert body, extending from the inner end of the insert body for a portion of its length and terminating in a mouth having a protruding circumferential lip, the bead of said skirt being adapted to snap over said lip to close the mouth, and the length of said skirt being less than the length of said insert body, whereby the surface of the tab-carrying cap is recessed below the surface of the container surrounding said circular opening when the skirt is snapped over the mouth of the insert.

14. In a safety cap made of plastic and container combination of the type wherein the container has an open mouth, a protruding circumferential lip surrounding the mouth, and a circumferential ledge spaced from the lip, the portion of the container between the ledge and the lip forming a neck of reduced diameter; and wherein the cap has a top with an integral pull tab flush-mounted within a recess in the top and a tubular skirt with an inner circumferential bead adapted to snap over the container lip, the bottom of the skirt extending in close-fitting abutment with the ledge when the skirt bead is snapped over the lip to prevent insertion of a sharp object between the bottom of the skirt and the ledge so as to pry off the cap from the container the improvement wherein:

all edges of the tab are in close-fitting abutment to the edges of the recess when the tab is shut;

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tongue and groove interengagement means between the tab and at least one surface forming said recess are provided to hold the tab shut;

at least a portion of the recess is deeper than the thickness of the tab; and

a fulcrum means is located adjacent said deeper portion for supporting the tab flush with the top surface of the cap,

the dimensions of said tab, said recess and said fulcrum means being so proportioned in respect of the material from which said cap is made that an inward force on the tab at a point corresponding to said deeper portion of at least about four pounds is required to cause the tab to deflect and thus pivot about the fulcrum means, thereby raising at least one edge of the tab above the top surface of the cap to permit swinging the tab to an open, grasping position.

15. The safety cap and container of claim 14 wherein the upper surface of the inner skirt bead is bevelled, and the junction between the skirt and the tab-carrying member also has a bevelled surface, the angles of each of said bevelled surfaces being approximately equal, thereby rendering the cap more difficult to remove from the container except by use of the pull tab.

16. A safety closure made of plastic and a container combination wherein the container includes a round mouth, a first tubular portion extending axially inward from the mouth, and a stop means within the first tubular portion spaced from the mouth; and the safety closure comprises a round body with a flat top surface, the body fitting within the first tubular portion of the container against the stop means and having an integral pull tab mounted within a recess in its top surface and swingable about a hinged connection at one end to an

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open, grasping position, all edges of the tab being in close-fitting abutment to the edges of the recess when the tab is shut with tongue and groove interengagement means provided between the tab and at least one surface of the recess to hold the tab shut, at least a portion of the recess being deeper than the thickness of the tab, and a fulcrum means being located adjacent said deeper portion for supporting the tab,

the dimensions of said tab, said recess, and said fulcrum means being so proportioned in respect of the material from which said closure is made that an inward force on the tab at a point overlying the deeper portion of at least about four pounds is required to cause the tab to deflect inward at that point and thus to pivot about the fulcrum means thereby raising an edge of the tab on the other side of the fulcrum means above the top surface of the closure body to permit swinging the tab to the open, grasping position.

17. The safety closure and container combination of claim 17 wherein said required force is in the range from about 4 to 12 pounds.

18. The combination of claim 16 wherein the stop means in the container comprises an annular ledge, a second tubular portion of reduced diameter, coaxial with the first tubular portion, extending from the inside circumference of the ledge away from the mouth; and the safety closure further comprises a cylindrical portion of reduced diameter depending from the body for fitting in removable sealing engagement within the second tubular portion of the container.

19. The combination of claim 18 additionally including means for bleeding air from said container when said safety closure is fitted thereon.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,845,872 Dated November 5, 1974

Inventor(s) Edward J. Towns & Anthony T. Brindisi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 2 - delete "The outside neck."

Column 2, line 49 - delete "ridigity", insert --rigidity--.

Column 2, line 57 - delete "simple", insert --simply--.

Column 4, line 41 - delete "being ", 2nd occ.

Column 8, line 36 - insert after the word principal
--difference--.

Column 9, line 53 - delete "Specially", insert
--Specifically--.

Column 9, line 55 - delete "utilizating", insert
--utilizing--.

Column 11, line 37 - delete "flap" twice and insert --tab--.

Column 12, line 52 - delete "cobination", insert
--combination--.

Signed and sealed this 31st day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents