

### [54] SAFETY CLOSURE

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

### [56] References Cited

#### UNITED STATES PATENTS

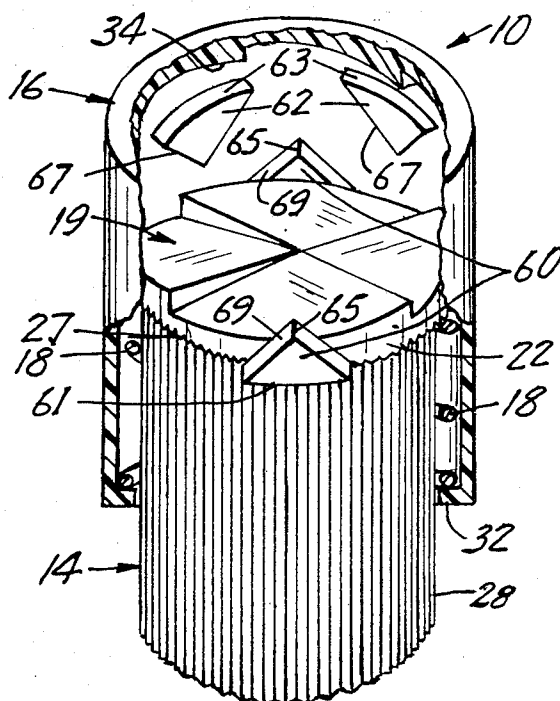
3,628,679	12/1971	Armour	215/9
3,422,978	1/1969	Quackenbush	215/9

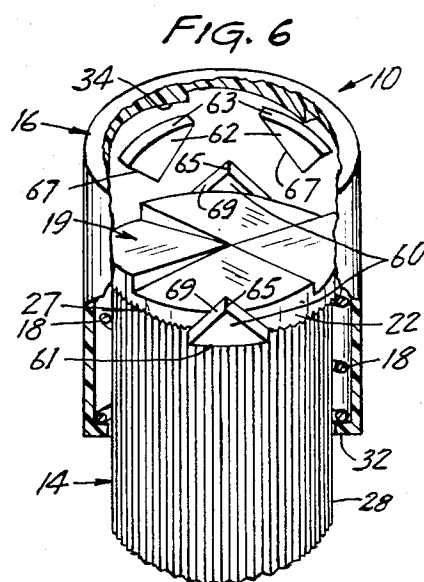
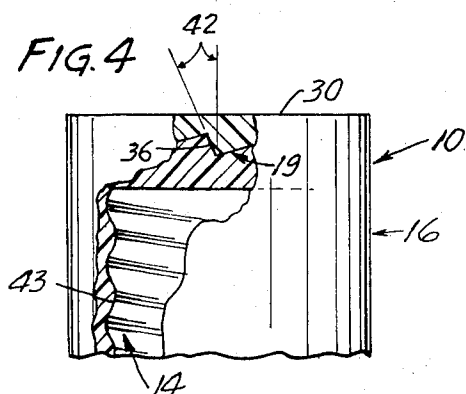
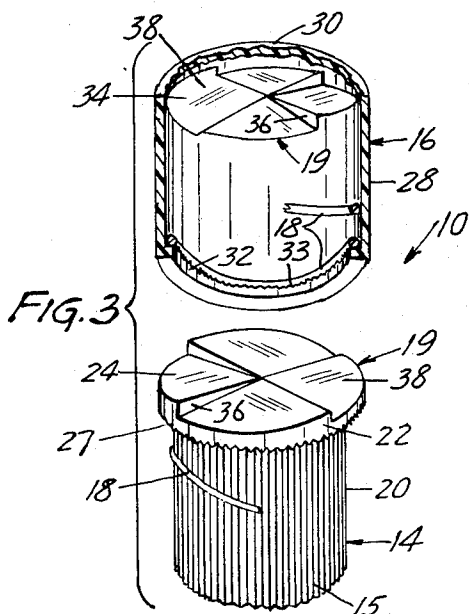
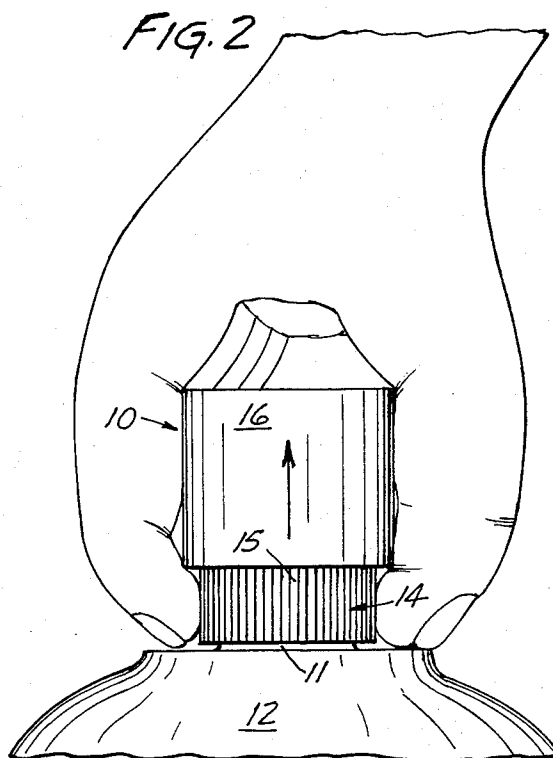
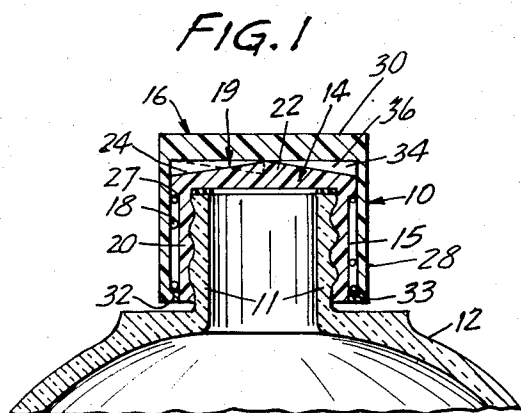
Primary Examiner—George T. Hall  
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### [57] ABSTRACT

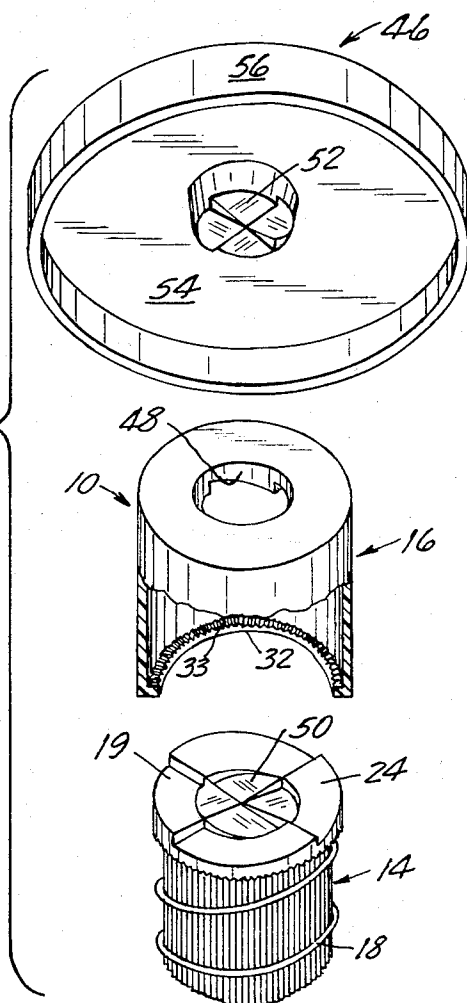
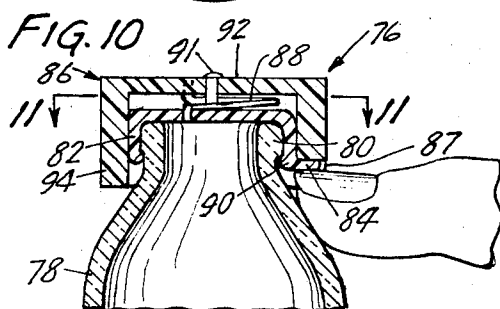
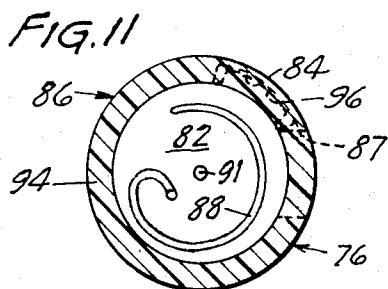
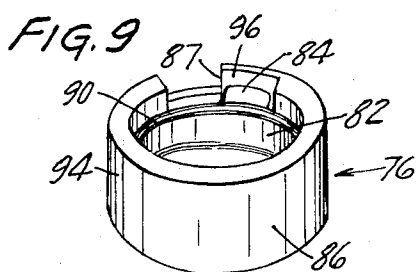
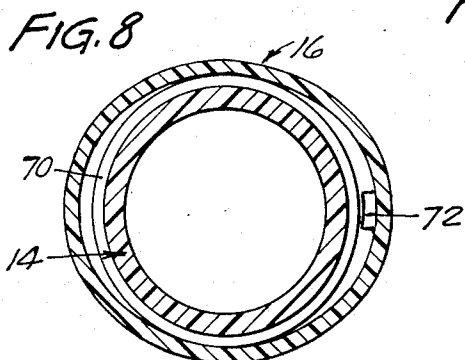
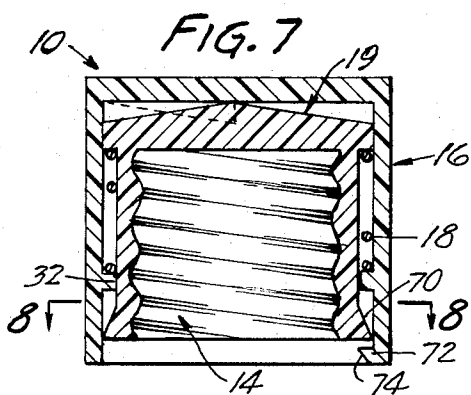
A safety closure to restrict the opening of containers by children. The closure has an inner cap which is operable to open the container upon manual manipulation of a grasping surface on the inner cap. The closure also includes an inseparable outer cap which will not operate directly to open the closure, but which must be moved against the bias of a spring from a position at which it encloses the grasping surface to a position at which the grasping surface may be manually manipulated. The outer cap may be engageable with the inner cap to move the inner cap to a sealing position on the container by manipulation of the outer cap, or the inner cap may be spring biased to its closed position.

22 Claims, 19 Drawing Figures





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FIG. 12

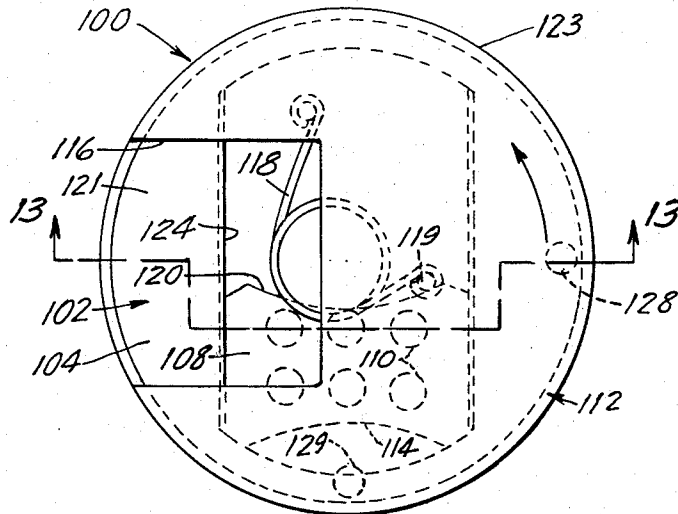


FIG. 13

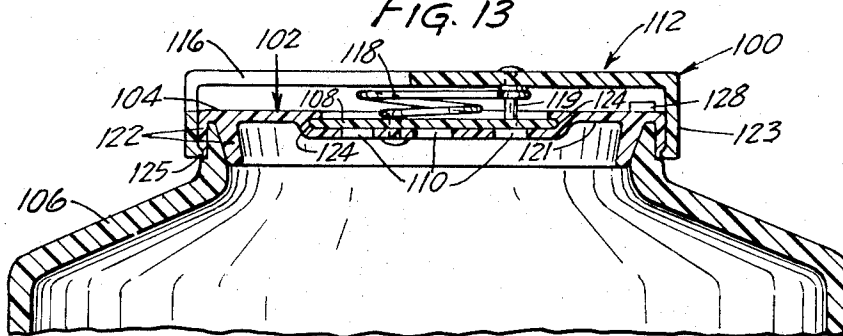
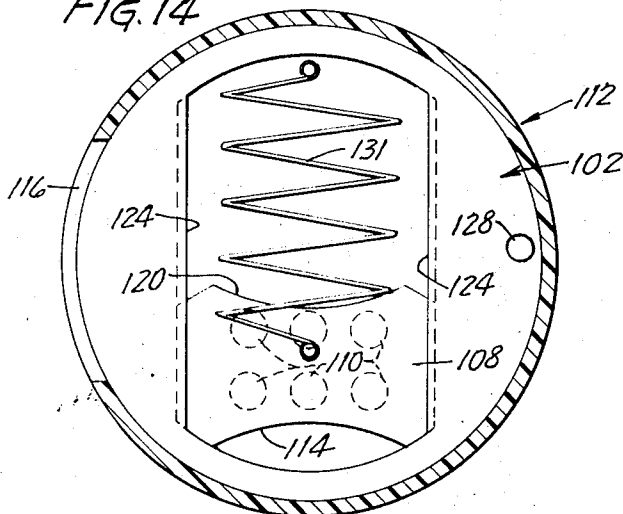
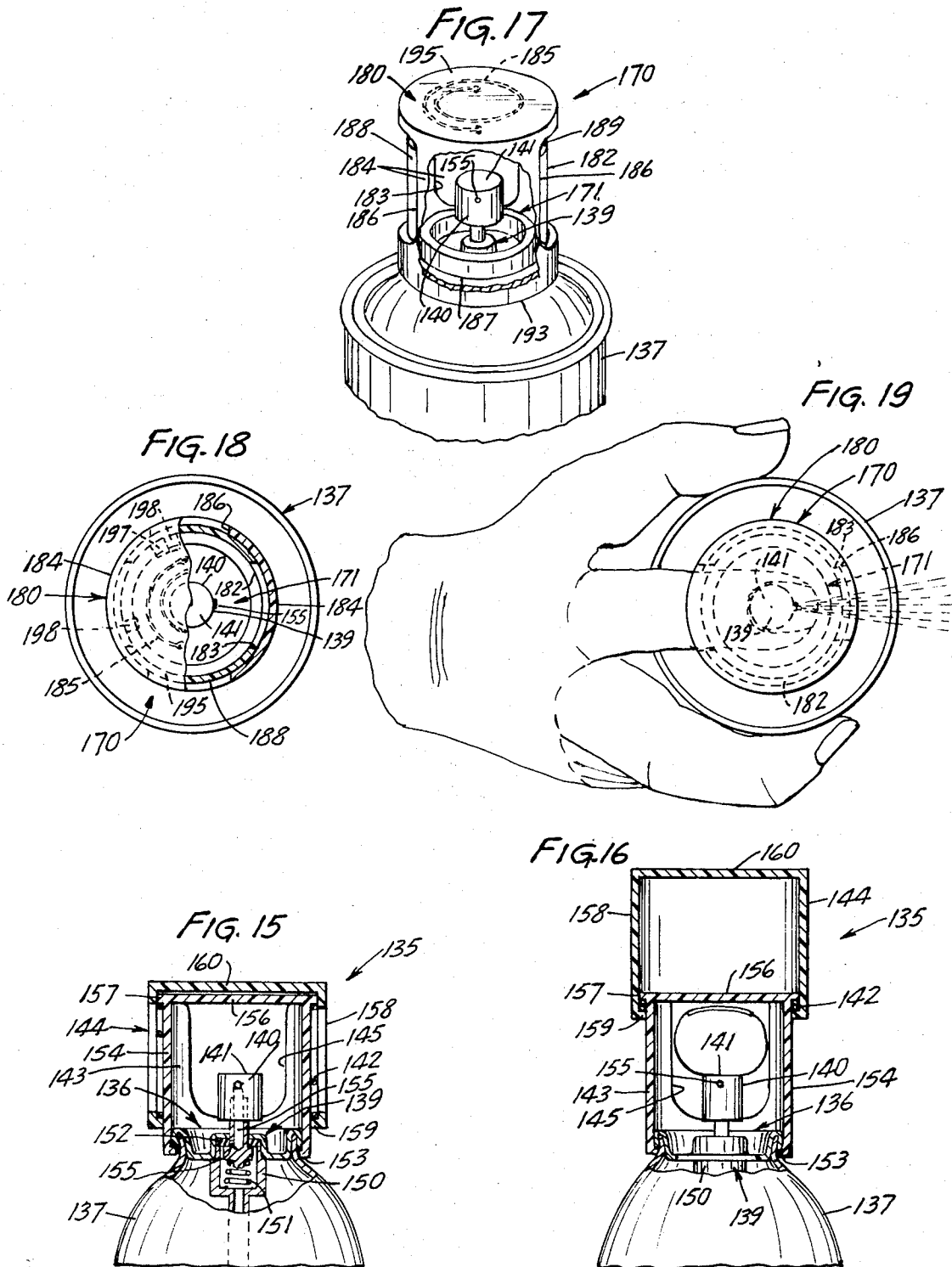


FIG. 14



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## SAFETY CLOSURE

## BACKGROUND OF THE INVENTION

The National Center for Health Statistics of the Public Health Service reported that in 1968 420 poison control centers reported over 105,000 ingestions of drugs and potentially toxic household products. Children under 5 years of age were involved in 71,563 of these ingestions, 4,129 hospitalizations occurred within this age group as a result of these accidents and many of these accidents resulted in the death of the children involved. Thus, it can be seen that a reliable, convenient, and economically feasible safety closure is needed to protect children from the potentially dangerous products necessarily brought into households.

## DESCRIPTION OF THE PRIOR ART

The prior art is replete with designs for safety closures for containers intended to protect children from the contents therein. While many of these closures have, with varying degrees of versatility, been able to perform their function, these devices have had various limitations which make their use and public acceptance less than adequate to effectively reduce accidents.

For example, some prior art safety closures require a first closing motion to attach the safety closure to the container and then a separate conscious locking motion to insure that the safety protection is afforded. This type of safety closure allows the adult user to seal the container without taking the additional step or steps required to make the closure safe against opening by children.

Other safety closures have utilized separable parts, thus affording the loss of portions of the safety closure and thereby reducing or eliminating the safety aspect of the closure.

Still other prior art safety closures have required opening devices or tools separable from the safety closure to effect their opening. With closures of this type, the danger exists that an adult user will misplace or not have access to the tool required. This may cause the user to damage the closure to effect its opening and thereby compromise the safety features of the closure. Also, this type of closure may direct the customer to a brand of the product which does not use a safety closure. Additionally, the use of tools to open the closure promotes the possibility that children may gain access to the tool and thereby the contents of the container.

Some prior art closures have required a complex or secret method of closure manipulation to afford opening thereof. This type of manipulation may be forgotten by adult users or may be discovered by children either by random manipulation of the closure or by observing adult users.

Additionally, some known prior art safety closures require unconventional motion patterns for removal, and in their closed position are attached in a fixed position with relation to the container. The user may mistake these safety closures for a tightly sealed conventional cap, and may exert sufficient rotational force to free the cap, thereby damaging or destroying the safety locking ability of the closure.

Some safety closures of the prior art have required modifications of containers to adapt their use. These safety closures are undesirable as their use requires that specially modified containers be produced which result in added expense.

A safety closure made according to the present invention overcomes the disadvantages of these earlier closures in that it requires no separate locking steps, the closure is not disassembled during either opening or closing manipulations, no secret combination need be memorized, and a separate tool is not required for opening of the closure by unhandicapped adults. Additionally, the safety closure of the present invention is designed to be used on conventional containers, requires a conventional manipulation pattern for attaching it to the container, and is designed so that manipulation of the closure in a conventional opening pattern will not damage the closure. During opening, the present invention requires a series of manual manipulations which are easily remembered and performed by normal adults but which require dexterity and physical abilities which a child does not normally possess, thus preventing most children who would not realize the gravity of this act from opening the closure even where the child knows the required series of manipulations.

The present invention provides an inner sealing cap which is engageable with the container in a conventional manner, and an outer cap movably mounted on the inner cap. The outer cap is movable from a first position at which the user is denied access to a surface on the inner cap which must be manually manipulated to open the closure to a second position at which the surface of the inner cap is accessible for the manual manipulation and an opening of the closure. The present invention further provides a spring for urging the outer cap toward its first position. Thus, to open a container utilizing a safety closure according to the present invention, the user must maintain the outer cap in its second position against the bias of the spring, while at the same time manipulating the inner cap. While children may be able to move the outer cap to its second position, they tend to be incapable of the dexterous motions required to maintain the outer cap in the second position while transferring their fingers to a position suitable for manual manipulation of the inner cap. Additionally, by proper selection of the spring and the physical size of the outer cap, children are prevented from opening the safety closure of the present invention because of their lack of finger length and strength, while adults are able to open the container with a minimum of inconvenience.

The present invention also provides means which cooperate between the outer cap and the inner cap so that manual manipulation of the outer cap will provide engagement of the inner cap to place it in its proper sealing position. Thus, users will replace this closure on containers in a manner already familiar to them to insure proper sealing, and containers may be automatically closed by existing commercial closure application machinery.

The broad concept of the inner action between an inner sealing cap and an outer cap to effect a safety closure is not new. For example, in Pat. Nos. 3,531,008 and 2,816,677 there are disclosed safety closures which utilize this concept. U.S. Pat. Nos. 3,531,008 and 2,816,677 disclose safety closures comprising an inner sealing cap and an outer cap rotatably mounted on the inner cap. The outer cap is movable between a first position at which the potential opener of the closure is denied access to manually manipulate the inner cap and a second position which allows the potential opener access to the inner cap.

In U.S. Pat. No. 3,531,008, however, the cap is not biased toward its first position, and in fact is provided with a groove and bead for retaining the outer cap at the second position to afford opening of the inner cap. Thus, once the child has discovered or observed that the outer cap is movable to its second position, he may so position it, and have free access to the inner cap to effect its removal. Additionally, the outer cap of this safety closure may be left in its second position by adult users to afford the child access as no biasing means to move the cap to its first position is provided.

In U.S. Pat. No. 2,816,677, while the outer cap is biased so that it will automatically return to its first position after use, the direction of movement of the outer cap to its second position is toward the container on which the closure is used, and thus this closure requires sufficient clearance for the outer cap between the inner cap and the top of the container. This clearance is not present in many common commercial containers.

Additionally, the outer cap on both the closure of U.S. Pat. Nos. 3,531,008 and 2,816,677 can only be installed on a container by manipulation of the inner cap, thus making these closures difficult to use during closure of the containers and unsuitable for use with presently existing cap application equipment.

U. S. Pat. Nos. 3,472,411 and 3,343,697 disclose a safety closure comprising an inner sealing cap and an outer cap rotatably mounted on the inner cap and disclose means engageable between the caps which allow movement of the inner cap toward its closed position by manual manipulation of the outer cap. The outer caps of these closures, however, are not movable to a second position to allow manipulation of an inner cover, but rather at least a portion of the outer cap is movable to engage a mating portion of the inner cap to lock the inner and outer caps together. Thus, with either of these safety closures a child may gain access by merely pressing the top of the closure against a surface such as a table, and rotating the container or cap in the normal fashion to open the container.

### SUMMARY OF THE INVENTION

The safety closure of the present invention may be adapted to produce an audible signal upon rotation of the outer cap relative to the inner cap so that manipulation of the safety closure by children may be signaled to nearby adults.

Safety closures according to the present invention which are adapted for engagement with containers having threaded openings may be adapted to limit the torque transmitted between the outer and inner caps to prevent over-tightening of the closure.

One form of the safety closure is adapted for use by persons handicapped by arthritis, age, or otherwise. This form is provided with an alternative method of removing the closure. The alternative method of removal utilizes an auxiliary tool designed to make one-way driving engagement with the inner cap to allow removal of the closure. The tool is designed, however, so that it may not be coupled to the closure during engaging of the closure with a container so that the handicapped user will not leave the tool mounted on the closure, and thus will be encouraged to store the tool in some safe position remote from the container.

To afford additional security against opening of the safety closure of the present invention, it may be provided with various locking means which require special

motion paths for, or special manipulations of, the outer cap before it may be moved to its second position.

The improved safety closure of the present invention comprises an inner cap engageable with the opening of the container, with at least a portion of the inner cap being mounted relative to the container for manual movement between a sealing position with respect to the container at which the contents of the container are sealed within the container, to an open position with respect to the container at which the contents of the container may be removed.

The safety closure also provides an outer cap movably mounted on the inner cap and being movable with respect thereto between a first position at which the movable portion of the inner cap is enclosed by the second member to prevent manual movement thereof, to a second position with respect to the inner cap at which the movable portion of the inner cap is exposed thereby permitting manual manipulation of the movable portion between a sealing and an open position. Means are also provided which cooperate between the outer cap and the movable portion of the inner cap to provide engagement to move the movable portion of said inner cap to said sealing position by manual manipulation of said outer cap, along with means which bias the outer cap toward the first position with respect to the inner cap.

### DESCRIPTION OF THE DRAWING

The invention will be further described with reference to the accompanying drawing wherein like numbers refer to like parts in the several views and wherein:

FIG. 1 is a vertical sectional view of a safety closure according to the present invention which is shown mounted on a fragment of a container;

FIG. 2 is an elevational view of the safety closure shown in FIG. 1 which has been grasped by a user to remove it from the container;

FIG. 3 is an exploded view of the safety closure shown in FIG. 1 with parts thereof in section for purposes of illustration;

FIG. 4 is a fragmentary view partially in section showing modifications which may be made on the closure shown in FIG. 1;

FIG. 5 is an exploded view of the safety closure according to the present invention illustrating a further modification which is shown together with an auxiliary tool for removing the closure with parts thereof broken away to illustrate internal features thereof;

FIG. 6 is a perspective view, partially in section, of the safety closure illustrating a further modification;

FIG. 7 is a vertical sectional view of the safety closure illustrating a further modification;

FIG. 8 is a horizontal sectional view taken approximately along the line 8—8 of FIG. 7;

FIG. 9 is a bottom perspective view of a second embodiment of a safety closure constructed according to the present invention;

FIG. 10 is a vertical sectional view of the safety closure shown in FIG. 9 illustrated in an inverted position and mounted on a fragment of a container;

FIG. 11 is a sectional view taken approximately along the line 11—11 of FIG. 10.

FIG. 12 is a plan view of a third embodiment of a safety closure made according to the present invention;

FIG. 13 is a vertical sectional view taken approximately along the line 13—13 of FIG. 12; which shows

the third embodiment mounted on a fragment of a container

FIG. 14 is a plan view of the inner cap of the third embodiment illustrating a modification which may be made on the closure shown in FIG. 12;

FIG. 15 is a vertical sectional view of a fourth embodiment of a safety closure constructed according to the present invention shown mounted on a fragment of a container; and

FIG. 16 is a vertical sectional view of the safety closure shown in FIG. 18.

FIG. 17 is a perspective view, partially in section, of a fifth embodiment of a safety closure according to the present invention which is shown mounted on a fragment of an aerosol container;

FIG. 18 is a plan view partially in section of the safety closure of FIG. 17; and

FIG. 19 is a plan view of the safety closure of FIG. 17 showing manipulation of the closure by a user.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The directions of rotations referred to herein are with respect to a view looking downward from the top of the drawing upon the closure as illustrated in FIG. 1.

Referring now to FIGS. 1, 2 and 3 there is shown a first embodiment of a safety closure generally designated 10 constructed according to the present invention for engaging the threaded neck 11 of a container 12.

The safety closure 10 comprises an inner cap 14 adapted for sealing the container 12 and having an exterior cylindrical grasping surface 15 which is fluted or otherwise adapted for grasping by the fingers to remove it from the container 12. An outer cap 16 is mounted for free rotation in the clockwise direction, and for movement from a first position surrounding and/or enclosing cap 14 as shown in FIG. 1 to a second position as shown in FIG. 2 exposing the grasping or engageable surface 15 of the inner cap 14 to allow engagement of the grasping surface 15 by the fingers. A spring 18 is provided for biasing the outer cap 16 toward its first position. A one-way clutch 19 operable between the outer cap 16 and the inner cap 14 is provided to allow driving of the inner cap 14 to engage it with the container 12 and move it to its closed position by manipulation of the outer cap 16 in a normal, i.e., the clockwise, direction.

The inner cap 14 is formed with a tubular side wall 20 internally formed for engagement with the conventional threads on the neck 11 of the container 12. The inner cap 14 has an end closure 22 formed on its interior surface. Conventional rotation of the inner cap 14 will move it between a sealing position at which the end closure 22 is in sealing engagement with the end of the threaded neck 11, and an open position out of engagement with the neck 11 at which the contents of the container 12 may be discharged. The end closure 22 is formed on its exterior surface with a first portion 24 of the one-way clutch 19. The end closure 22 is of a larger diameter than the sidewalls 20 and thus provides a bearing surface 27 for one end of the spring 18.

The outer cap 16 of the safety closure 10 is formed with a cylindrical side wall 28 bonded, i.e., by adhesive or ultrasonic sealing, to a circular disk forming an end wall 30. The side wall 28 is internally shaped and sized to provide a rotatable and slidable fit about the periph-

ery of the end closure 22. The outer cap 16 is formed at its open end with an inwardly extending annular flange or ring 32, which rotatably and slidably fits about the surface 15 and provides a bearing surface 33 for the end of the spring 18 opposite the end supported by the surface 27. Thus, the spring 18 urges the outer cap 16 toward its first position at which the outer cap 16 encloses the inner cap 14. The outer cap is slidable axially of the inner cap 14 to a second position at which the ring 32 is moved near the surface 27 against the bias of the spring 18. At the second position of the outer cap 16 a large portion of the exterior grasping surface 15 of the inner cap 14 is exposed so that it may be grasped by the fingers as illustrated in FIG. 2 to afford removal of the safety closure 10 from the container 12. A second mating portion 34 of the one-way clutch 19 is formed on the inner surface of the end wall 30. The first and second mating portions 24 and 34 of the one-way clutch 19 are formed with mating surfaces 36 which provide driving engagement between the outer cap 16 and the inner cap 14 when the outer cap 16 is rotated in the clockwise direction while in its first position. The first and second portions 24 and 34 of the clutch 19 are also formed with ramps 38 which cause relative rotation between the portions 24 and 34 of the clutch 19 when the outer cap 16 is rotated in the counterclockwise direction, thereby preventing driving engagement between the inner cap 14 and the outer cap 16 when the outer cap 16 is rotated in the counterclockwise direction.

The operation of the safety closure of the present invention will be described. When it is desired to remove the safety closure 10 from a container 12, the outer cap 16 is grasped and is moved from its first position as shown in FIG. 1 to its second position as shown in FIG. 2. After the outer cap 16 has been moved to its second position, the fingers are manipulated to grip the exterior grasping surface 15 of the inner cap 14 to allow removal of the inner cap 14 by conventional counterclockwise rotation. To replace the safety closure 10 on the container 12, the outer cap 16 is grasped by the fingers and the inner cap 14 is engaged with the threads on the neck 13 of cap 16 in the conventional manner. If a child or one not familiar with the operation of the safety closure 10 attempts to remove the closure from a container 12 by manipulation of the outer cap 16, the outer cap 16 will rotate freely in the counterclockwise rotation, except for a slight lifting action caused by the camming action of the ramps 38 in the one-way clutch 19.

Means are provided on the safety closure 10 to produce an audible signal when the outer cap 16 is rotated relative to the inner cap 14. As is best shown in FIG. 3, serrations are formed on the surfaces 27 and 33 which support the ends of the spring 18. Upon rotary movement of the outer cap 16 relative to the inner cap 14, at least one end of the spring 18 will be drawn across the serrated surfaces 27 and 33 and will thereby produce an audible signal. This will become recognizable to nearby adults to alert them that a child is working on the closure 10 in an attempt to open it.

Referring now to FIG. 4 there is illustrated a modification of the safety device 10 which further provides means for preventing over-tightening of the inner cap 14 on a container 12 by manual manipulation of the outer cap 16. By adjusting the angle 42 of the mating surfaces 36 of the one-way clutch 19 with respect to a



plane parallel to the axis of the inner cap 14, the outer cap 16 will slip with respect to the inner cap 14 when clockwise torque in excess of a predetermined amount is applied to the outer cap 16. The limiting torque will be dependent upon the magnitude of the angle 42 and upon the coefficient of friction of the materials from which the one-way clutch 19 is made. As an example, a limiting torque of 2.5 to 3.0 inch-pounds has been achieved in an aluminum one-way clutch 19 at an angle 42 of 25°.

The closure 10 may be further modified to insure that it may not be removed from the container by counterclockwise rotation of the outer cap 16 when the inner cap 14 has not been fully engaged and tightened onto the container 12. The normal class of fit used for threads between a container and a cap provides little frictional drag upon engagement. If this class of fit were used between the inner cap 14 and the threads on the container 12, the slight drag caused by slipping in the one-way clutch 19 during counterclockwise rotation of the outer cap 16 might remove the inner cap 14 when it is only partially engaged with the container 12. To prevent this possibility, the threads internally formed on the inner cap 14 may be modified as illustrated at 43 in FIG. 4 to represent an oversized portion of the thread on the cap thus insuring an interference fit with the standard threads on the container, and insuring that the closure 10 must be manipulated in its intended manner even when it has been only partially engaged with the container 12. Modification of the threads may alternatively be done by not forming them to the normal pattern as by distorting their crest, root or pitch.

In FIG. 5 there is shown a modification of the present invention which allows use of an auxiliary tool 46 for removal of the inner cap 14. The outer cap 16 is formed with an orifice 48 to expose a one-way clutch surface 50 on the inner cap 14 for engagement by the tool 46 to cause counterclockwise rotation of the inner cap 14 by similar rotation of the tool 46.

As illustrated in FIG. 4, the inner cap 14 is formed with the centrally disposed ramped surface 50 of a second one-way clutch which is centered in the portion 24 of the one-way clutch 19. The surface 50 has ramps and driving surfaces disposed for driving engagement in a rotational direction opposite to the rotational direction of engagement for the one-way clutch 19. The orifice 48 has essentially the same diameter as the surface 50, and is aligned with it to allow facile engagement between the surface 50 and a mating reversed surface portion 52 of the one-way clutch formed on the tool 46. The tool 46 is formed with a circular plate member 54 to support the portion 52, which plate 54 may be formed of a transparent plastic material to afford visual alignment of the portion 52 with the surface 50, and a cylindrical wall 56 about the plate member 54 to provide a convenient gripping surface for a user. The diameter of the tool 46 is sized to provide an easy gripping surface for adults, but is of a size and shape not easily grasped by young children (i.e., 2 to 4-½ inches in diameter). The tool 46 may be modified to prevent rotation of the portion 52 by grasping other than the exterior surface of the wall 56 by rotatably mounting two disks of the same diameter as the wall 56 about the portion 51 with one disk positioned at each end of the wall 56.

FIG. 6 illustrates a further modification of the present invention shown in FIGS. 1, 2 and 3 to provide

locking means between the inner cap 14 and the outer cap 16 to restrict movement of the outer cap 16 from its first to its second position unless a predetermined angular relationship is first established between the inner cap 14 and the outer cap 16.

Formed in an equally spaced relationship about the peripheral surface of the end closure 22 of the inner cap 14 are four protrusions 60 which are generally shaped in cross-section like an isosceles triangle and are positioned with their base surfaces 61 in a common plane and parallel to surface 27. Equally spaced about the interior of the cylindrical side walls 28 of the outer cap 16 are four inwardly projecting projections or abutments 62. The abutments 62 are also generally shaped in cross-section like an isosceles triangle having a larger apex angle than the protrusions 60. The base surfaces 63 of the abutments 62 are positioned in a plane parallel to the surface 61 of the protrusion 60. The protrusions 60 and abutments 62 are sized and spaced to allow the abutments 62 to pass between the protrusion 60 if the inner and outer caps 14 and 16 are in the correct angular relationship to each other. The abutments 62 are spaced relative to the mating surfaces of the one-way clutch 19 and the protrusions 60 to allow rotation of the outer cap 16 in the counterclockwise direction without interference between the surfaces 61 and 63 of the protrusions 60 and abutments 62 during the slight relative axial movement so caused. The protrusions 60 and abutments 62 are positioned relative to the one-way clutch 19 so that when the clutch 19 is in driving engagement, at least a portion of the surfaces 61 are positioned over the surfaces 63. Thus, after the inner cap 14 has been engaged with the container 12 by manipulation of the outer cap 16, the outer cap 16 must be rotated counterclockwise while in its first position to align the protrusions 60 between the abutments 62 before the outer cap 16 may be moved axially to its second position to afford manual manipulation of the inner cap 14 to effect its removal.

The outer cap 16 is self-aligning with the inner cap 14 to afford movement of the protrusions 60 past the abutments 62 for movement of the outer cap 16 from its second position to its first position. This occurs first by guiding of the points 65 of the protrusions 60 along the edge surfaces 67 of the abutments 62, and subsequently by the guiding of one end of the bases 63 along surfaces 69 of the protrusion 60, thereby optimizing the use of the energy provided by spring 18, to guide and return the outer cap to its first position whenever it is released.

Referring now to FIGS. 7 and 8 there is shown a modification of the safety closure of FIGS. 1, 2 and 3 which provides a latching means for restricting movement of the outer cap 16 between its first and second position until the latching means is released.

For this modification the annular ring 32 is formed in a position axially spaced from the open end of the outer cap 16 and a generally flared outwardly extending protrusion 70 is formed about the open end of the inner cap 14. At least one inwardly projecting hook 72 is formed spaced from the ring 32, and adjacent to the open end of the outer cap 16, which outer cap 16 for this modification is preferably made of a resilient, flexible material. The hook 72 is formed with a bevel surface 74 shaped to slide over the protrusion 70 to allow engagement of the hook 72 with the protrusion 70 when the outer cap is moved from its second to its first

position. The hook 72 is spaced relative to the mating surfaces of the clutch 19 and the protrusion 70 to allow the slight axial movement of the outer cap 16 relative to the inner cap 14 caused by the camming action of the ramps 24 so that the outer cap 16 may be freely rotated in a counterclockwise direction when in the first position. The hook 72 may be disengaged from the protrusion 70 to allow movement of the outer cap 16 to its second position to afford disengagement of the safety closure 10 by squeezing the flexible outer cap 16 near its open end below the ring 32 at opposing positions spaced approximately 90° about the periphery of the outer cap 16 from the hook 72, so that the periphery of the outer cap 16 will assume a generally oval configuration as shown in FIG. 8 to allow passage of the hook 72 past the protrusion 70.

Referring now to FIGS. 9, 10 and 11 there is shown a second embodiment of a safety closure, generally designated 76, and constructed according to the present invention. The closure 76 is adapted for engaging a container 78 having an annular ring 80 formed about its opening.

The safety closure 76 comprises an inner cap 82 adapted for sealing the container 78. The cap 82 is formed with a protrusion or tab 84 having a grasping surface adapted for manual manipulation by the fingers to remove the inner cap 82. An outer cap 86 is rotatably mounted on the inner cap 82 for movement against the bias of a spring 88 between a first position shown in FIG. 9 at which the tab 84 is enclosed within the outer cap 86 to a second position as shown in FIG. 10 at which the grasping surface on the tab 84 is exposed and engageable by the fingers through an opening or slot 87 to remove the inner cap 82. The spring 88 is a coil spring connected at its opposite ends to the outer cap 86 and to the inner cap 82 to bias the outer cap 86 to its first position. The inner cap 82 may be pressed into engagement with the container 78 by manipulation of the outer cap 86.

The inner cap 82 is generally a cup-like structure having an inwardly extending annular ring or lip 90 formed about the open end thereof. The inner cap 82 is formed of a resilient, flexible material so that the ring 90 may be pressed over the annular ring 80 on the container 78 to provide sealing engagement. The outwardly extending tab 84 is formed on the open end of the inner cap 82 to afford engagement by the finger to press a portion of the annular ring 90 over the annular ring 80 formed on the container 78, thereby causing removal of the inner cap 82 from the container 78. The inner cap 82 is formed with an axially extending stem 91 centered on the outer surface of the inner cap 82 opposite its open end. The stem 91 forms a bearing surface for rotatably mounting the cap 86, and may be staked at its distal end to prevent separation of the caps 82 and 86. The outer cap 86 is formed with a circular end wall 92 rotatably mounted on the stem 91 about an orifice formed at its center. The outer cap 86 is also formed with a cylindrical side wall 94 to enclose the inner cap 82 and extend beyond the open end of the inner cap 82 and the tab 84. The side wall 94 is formed with a groove 96 extending partially around its inner surface from the opening 87 for a distance at least sufficient to position the entire width of the tab 84 within the groove 96 when the outer cap 86 is rotated to its first position, which first position is defined by the edge

of the tab 84 abutting the end of the groove 96 opposite the opening 87.

To remove the closure 76, the user must rotate and maintain the outer cap 86 in its second position against the bias of the spring 88 while the tab 84 is engaged or grasped with the fingers to remove the inner cap 82. If a user attempts to remove the closure by lifting the edge or the center of the outer cap 86, the lifting force will be transmitted to the center of the inner cap 82 through the stem 91, thereby tending to clinch the annular ring 90 about the container 78 to firmly resist such removal attempt.

Referring now to FIGS. 12 and 13, there is shown a third embodiment of a safety closure generally designated 100 and constructed according to the present invention. The closure 100 is adapted for use on the type of container commonly used for dry materials.

The closure 100 includes an inner cap 102 comprising a fixed portion 104 attached to the opening of a container 106 and a movable portion or plate 108 slidably mounted on the fixed portion 104. The plate 108 is movable between a sealing position covering a series of openings 110 formed in the fixed portion 104 and an open position at which the plate 108 is spaced from the openings 110 so that the contents of the container 106 may be discharged through the openings. An outer cap 112 is rotatably mounted on the fixed portion 104 of the inner cap 102 and is movable with respect thereto between a first position at which a grasping surface or edge 114 on the plate 108 is enclosed by the outer cap 112 to a second position at which an orifice 116 formed in the outer cap 112 is positioned over the plate 108 to allow manual grasping or manipulation of the edge 114 to move the plate 108 to its open position. A biasing means or spring 118 is attached between the fixed portion 104 of the inner cap 102 and a pin 119 extending inwardly from the interior surface of the outer cap 112 to bias the outer cap 112 toward its first position. The surface of the pin 119 is disposed to make contact with an edge 120 on the plate 108 and provides a means cooperating between the outer cap 112 and the plate 108 to move the plate 108 from its open to its sealing position upon rotation of the outer cap from its second to its first position.

The fixed portion 104 of the inner cap 102 is formed of a circular plate 121 having a pair of concentric flanges 122 formed about its periphery for engagement with the open end of the container 106. The fixed portion 104 is formed with grooves 124 in which the plate 108 is guided. The outer cap 112 is formed with a circular plate having a flange 123 formed around its periphery and having an inwardly extending annular ring 125 formed about the distal edge of the flange 123. The ring 125 is guided in a groove formed between the end of the outer flange 122 and the surface of the container 106 and the flange 112 rotatably mounts about the periphery of the outer flange 122. The outer cap 112 is thus rotatable from its first position defined by the pin 119 pressing the plate 108 to one end of the grooves 124 over the openings 110, and at which the orifice 116 is oriented at a position approximately 90° from the plate 108, to a second position defined by the abutment of a stop 128 attached to the exterior of the fixed portion 104 and a stop 129 attached to the interior of the outer cap 112 at which the orifice 116 is positioned above the closure member 108 in its sealing position and at which the pin 119 has been moved to a position

to allow movement of the plate 108 to its open position.

To remove the contents of the container 106 the user must maintain the outer cap 112 in its second position against the bias of the spring 118 and manually grasp or manipulate the edge 114 of the plate 108 to slide it to its open position. When the user releases the outer cap 112, the spring 118 will urge the outer cap 112 to its first position thereby causing the pin 119 to urge the plate 108 to its sealing position.

Referring now to FIG. 14 there is shown a modification which may be made in the embodiment shown in FIGS. 12 and 13. In the modification shown, the pin 119 has been modified so that it will not contact the edge 120, and a spring 131 has been provided to urge the plate 108 to its sealing position, thereby requiring a user to maintain the outer cap in its second position against the bias of spring 118 and the plate 108 in its open position against the bias of spring 131 before material may be discharged from the container 106.

Referring now to FIGS. 15 and 16 there is shown a fourth embodiment of the safety closure generally designated 135 and constructed according to the present invention. The closure 135 is adapted for use on an aerosol spray can.

The safety closure 135 comprises an inner cap 136 engageable with the opening on a container 137. The inner cap 136 comprises a spray valve assembly 139 having a movable portion or nozzle 140 biased toward a sealing position. The nozzle 140 is formed with a grasping surface 141 adapted for manual engagement to move the nozzle 140 to an open position to discharge the contents from the container 137. The inner cap 136 also includes a support structure 143 formed with a passageway 145 aligned to allow manual manipulation of the valve 139 and exit of the spray materials from the nozzle 140. The safety closure 135 also includes an outer cap 144 slidably mounted on the inner cap 136 for movement from a first position at which the outer cap 144 blocks the passageway 145, thereby enclosing the grasping surface 141 on the nozzle 140 as shown in FIG. 17, to a second position at which the passageway 145 is not obstructed by the outer cap 144 thus allowing manual engagement of the grasping surface 141 as shown in FIG. 16 to open the container. A biasing means or spring 142 is attached between the inner cap 136 and the outer cap 144 to provide a biasing force on the outer cap 144 urging it toward its first position.

The spray valve assembly 139 is of a conventional type, having a fixed portion 150 securely attached to the opening of the container 137, and having the nozzle 140 biased by a spring 151 to the sealing position at which an orifice 155 formed through the nozzle 140 is blocked by a seal 152 positioned between the fixed portion 150 and the nozzle 140. The fixed portion 150 is formed with an edge to engage a flat surface formed on the nozzle 140 to prevent rotation of the nozzle 140 relative to the passageway 145. The nozzle 140 is movable by manually pressing the grasping surface 141 toward the container 137 to the open position at which the orifice 155 in the nozzle 140 is in communication with the interior of the container 137 to allow discharge of the contents of the container 137.

The structure 143 includes a circular base plate 153 formed with an orifice for attachment around the opening of the container 137. A cylindrical wall member 154 extends from the base plate 153 and is formed with the passageway 145. A circular closure plate 156 is

formed at the end of the structure 143 opposite the plate 153, and is of a larger diameter than the wall member 154 to provide an outwardly extending annular ring 157. The outer cap 144 is formed of a cylindrical member 158 with an end closure 160 and is formed at one end with an inwardly extending flange 159 slidably mounted about the wall member 154. The ring 157 and flange 159 guide and limit the movement of outer cap 144, with respect to structure 143 and provide bearing surfaces for the spring 142.

To operate the valve assembly 139 the user must raise the outer cap 144 to its second position against the bias of the spring 142 and maintain the outer cap 144 in its second position while the user manipulates the grasping surface 141 of the nozzle 140 by his finger to move the nozzle 140 from its sealing to its open position and discharge the contents of the container 137. Upon removal of the user's finger from the nozzle 140, the nozzle 140 will be moved to its sealing position by the spring 151, and the outer cap 144 will be moved to its first position by the spring 142.

Referring now to FIGS. 17, 18 and 19, there is shown a fifth embodiment of a safety closure generally designated 170 and constructed according to the present invention for use on an aerosol spray container essentially identical to the spray container 137.

The safety closure 170 comprises an inner cap 171 engaged with the opening on the container 137. The inner cap 171 comprises a spray valve assembly essentially identical to the valve assembly 139 shown in FIG. 15. The inner cap 171 also includes a support structure 182 formed with a passageway 183 to allow manual manipulation of the valve 139 and exit of the spray materials from the closure 170. The safety closure 170 also includes an outer cap 180 rotatably mounted relative to the inner cap 171 for movement from a first position at which a cylindrical side wall 184 blocks the passageway 183, thereby enclosing the grasping surface 141 on the nozzle 140 as shown in FIGS. 17 and 18, to a second position (FIG. 19) at which a passageway 186 formed through the side wall 184 in the outer cap 180 aligns with the passageway 183 to allow manual engagement of the grasping surface 141 as shown in FIG. 19. A biasing means or spring 185 is attached between the inner cap 171 and the outer cap 180 to provide biasing of the outer cap 180 toward its first position.

The structure 182 includes a circular base plate 187 formed with an orifice for attachment around the opening of the container 137. A cylindrical wall member 188 extends from the base plate 187 and is formed with the passageway 183. A circular closure plate 189 is formed at the end of the structure 182 opposite the plate 187. The wall 184 of the outer cap 180 is sized for rotatable engagement over the periphery of the wall member 188, and formed at one end with an inwardly extending annular ring 193 for engagement beneath the circular base plate 187 of the structure 182. A circular closure plate 195 is attached to the wall 184 on the end opposite the ring 193 and is positioned above the closure plate 189. The outer cap 180 is thus rotatable about the structure 182 and is limited for rotation between the first and second position by movement of a stop 197 formed on the inner surface of the plate 195 between a pair of stops 198 formed on the outer surface of the closure plate 189.

To operate the spray valve 139 a user must rotate the outer cap 180 against the bias of the spring 185 and

maintain the outer cap 180 in its second position while moving the nozzle 140 from its sealing to its open position by manipulation of the grasping surface 141. When the user releases the outer cap 180 and removes his fingers from the grasping surface 141 the nozzle 140 returns to its sealing position under the influence of the spring 151 and the outer cap will be returned to its first position by the spring 185.

What we claim is:

1. A safety closure for sealing the opening of a container, said safety closure comprising in combination: an inner cap adapted for engagement with the container about the opening for sealing said container, said inner cap having a grasping surface adapted for manual engagement to move at least a portion of said inner cap from a sealing position with respect to said container opening and its contents to an open position with respect to said container opening at which open position the contents of said container may be discharged;

an outer cap substantially enclosing said inner cap; means mounting said outer cap on said inner cap for relative movement with respect thereto between a first position, at which said grasping surface of said inner cap is enclosed by said outer cap to prevent manual engagement thereof, and a second position at which said grasping surface is exposed to permit manual manipulation of said grasping surface and movement of said movable portion of said inner cap from sealing to said open position;

force transfer means on said outer cap engageable with cooperating means on said inner cap for moving at least said movable portion of said inner cap toward said sealing position when said outer cap is in said first position for affording movement of said movable portion of said inner cap to said sealing position by manipulation of said outer cap and which force transfer means and cooperating means is not effective to move said movable portion to said open position by manipulation of said outer cap; and

means on said inner cap and on said outer cap for biasing said outer cap toward said first position with respect to said inner cap to enclose said grasping surface.

2. A safety closure according to claim 1 further comprising means in engagement between said inner and said outer cap for producing an audible signal upon movement of said outer cap relative to said inner cap.

3. A safety closure according to claim 1 adapted for sealing the opening of a said container of the type having external screw threads about said opening wherein:

said inner cap comprises a tubular member having internal threads adapted for threaded engagement with the external screw threads of a said container, and a sealing member at one end of said tubular member adapted to close and seal said opening upon sufficient engagement between said threaded portions of said inner cap and said container, the outer surface of said tubular member affording said grasping surface for manual manipulation thereof; said outer cap is mounted on said inner cap for movement axially of said tubular member from said first to said second position to expose said grasping surface of said inner cap and afford manual manipulation thereof; and

said force transfer means and cooperating means affords engagement between said inner cap and said outer cap to move said inner cap to said sealing position by rotation of said outer cap in one direction and affords free relative rotation between said outer cap and said inner cap upon rotation of said outer cap in the opposite direction.

4. A safety closure according to claim 3 wherein said threads on said inner cap are adapted for a predetermined interference fit with the threads on a said container.

5. A safety closure according to claim 3 wherein said force transfer means and cooperating means comprises a one-way clutch having a first portion on the exterior surface of said sealing member, and a second mating portion on the interior surface of said outer cap, said first and second portions of said one-way clutch providing engagement between said inner and outer caps to drive said inner cap to said sealing position by manual manipulation of said outer cap when said outer cap is in said first position.

6. A safety closure according to claim 5 wherein said portions of said one-way clutch each have surfaces oriented to mate with the surfaces on the other clutch portion when said outer cap is in said first position to provide driving engagement between said first and second portions upon rotation of said outer cap in a direction for engagement of said inner cap with a said container, and said portions of said one-way clutch each have ramp members oriented to afford sliding engagement with the ramp members on the other clutch portion to cause relative rotation between said first and second portion of said one-way clutch upon rotation of said outer cap in a direction for removing said inner cap from a said container.

7. A safety closure according to claim 6 wherein said surfaces on said first and second portions of said one-way clutch are oriented to afford relative movement between said portions of said one-way clutch when a rotational torque in excess of a predetermined amount is applied to said outer cap in a direction to engage said inner cap with a said container.

8. A safety closure according to claim 3, wherein said combination further includes an auxiliary tool adapted for manual engagement, and means for providing engagement between said auxiliary tool and said inner cap to afford removal of said safety closure by manual manipulation of said auxiliary tool.

9. A safety closure according to claim 8 wherein said auxiliary tool comprises a circular member designed for rotation about its axis upon engagement with said safety closure to remove said safety closure and wherein the diameter of said circular member is in the range of 2 to 4-1/2 inches.

10. A safety closure according to claim 8 wherein said means for affording engagement between said auxiliary tool and said inner cap comprises a second one-way clutch having a first portion on the exterior surface of said sealing member and oriented for engagement in a direction of rotation for removal of said inner cap from a said container, said outer cap is formed with an opening providing access to said first portion of said second one-way clutch through said outer cap, and said auxiliary tool has a second portion of said second one-way clutch sized for engagement with said first portion through said opening to afford driving said inner cap for removal of said safety closure from a said container.

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11. A safety closure according to claim 1 wherein said outer cap and said inner cap are generally cylindrical and said outer cap is mounted on said inner cap for axial movement relative to said inner cap from said first to said second position to expose said grasping surface of said inner cap for manual manipulation thereof. 5

12. A safety closure according to claim 3 further comprising means engageable between said inner cap and said outer cap for restricting said axial movement of said outer cap from said first position to said second position until a predetermined angular relationship is established between said inner cap and said outer cap. 10

13. A safety closure according to claim 3 further comprising latch means engageable between said inner cap and said outer cap for restricting movement of said outer cap from said first to said second position, and means on said outer cap for affording manual release of said latch means and movement of said outer cap to said second position. 15

14. A safety closure according to claim 1 adapted for sealing the opening of a said container of the type having an annular ring formed about said opening, wherein: 20

said inner cap comprises a pliable cup-like member, the open end of said cup-like member has an inwardly extending lip adapted to be pressed over said annular ring to move said inner cap to said sealing position over a said opening, and an outwardly projecting tab defining said grasping surface and adapted for manual manipulation to distort said pliable lip and move said inner cap to said open position removed from said container; and said outer cap is mounted on said inner cap for rotation about the cup-like member between said first position and said second position, said outer cap has a tubular section formed with a slot therein, said tubular section being positioned in said first position with said tubular member enclosing said tab thereby preventing manual manipulation of said tab, and being positioned in said second position with said slot adjacent said tab thereby exposing said tab and affording manual manipulation of said tab to remove said safety closure. 30

15. A safety closure according to claim 1 wherein: said inner cap comprises a fixed portion adapted to be fixedly attached to the opening of a said container and having an outlet opening formed therein, and said movable portion is mounted on said fixed portion for sliding movement between said sealing position over said outlet opening and said open position with said movable portion spaced from said outlet opening; and 35

said outer cap has an access opening therein, said access opening being displaced from said movable portion when said outer cap is in said first position and exposing said movable portion when said outer cap is in said second position. 40

16. A safety closure according to claim 15 wherein said outer cap is rotatably mounted upon said inner cap for movement between said first and said second position. 45

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17. A safety closure according to claim 16 wherein said operative means includes means engageable between said outer cap and said movable member for sliding said movable portion from said open to said sealing position during rotation of said outer cap from said second to said first position.

18. A safety closure for sealing the opening of a container, said safety closure comprising in combination: an inner cap adapted for engagement with the opening on said container, said inner cap including a movable portion having a grasping surface adapted for manual engagement to move said movable portion from a sealing position with respect to said container to an open position with respect to said container at which the contents of said container may be discharged; 5

means biasing said movable portion of said inner cap to said sealing position;

an outer cap mounted on said inner cap for movement with respect thereto between a first position, at which said grasping surface of said inner cap is enclosed by said outer cap to prevent manual engagement thereof, and a second position with respect to said inner cap at which said grasping surface is exposed to permit manual manipulation of said grasping surface and movement of said movable portion of said inner cap from said sealing to said open position; and 10

means for biasing said outer cap toward said first position.

19. A safety closure according to claim 18 wherein said inner cap comprises a spray valve having a fixed portion and a movable nozzle portion, said nozzle portion being movable between the sealing position at which said nozzle is blocked from the interior of said container and the open position at which said nozzle is in communication with the interior of said container, said means biasing said movable portion of said inner cap biases said nozzle portion of said valve toward said sealing position, and said inner cap further comprises a support structure fixedly attached to said inner cap for movably mounting said outer cap. 15

20. A safety closure according to claim 19 wherein said outer cap is rotatably mounted on said structure for movement between said first position and said second position. 20

21. A safety closure according to claim 19 wherein said outer cap is mounted on said structure for telescoping movement between said first position and said second position. 25

22. A safety closure according to claim 18 wherein said inner cap comprises a fixed portion adapted to be fixedly attached to the opening of a said container and having an outlet opening formed therein, and said movable portion comprises a plate slidably mounted on said fixed portion for reciprocating movement between the sealing position at which said plate covers said outlet opening, and the open position at which said plate is spaced from said outlet opening. 30

\* \* \* \* \*

**UNITED STATES PATENT OFFICE**  
**CERTIFICATE OF CORRECTION**

Patent No. 3,777,924

Dated December 11, 1973

Inventor(s) James H. Kayser and Gregory A. Younker

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

Column 1, line 17, after "DESCRIPTION OF THE PRIOR ART" add -- AND SUMMARY OF THE INVENTION -- as part of the title.

Column 2, lines 10 and 11, change "attaching it to" to -- closing --; and line 47, change "The" to -- Certain embodiments of the --.

Column 3, line 41, delete the title "SUMMARY OF THE INVENTION"; line 44, change "The" to -- In addition to the features already described, the --.

Column 4, delete lines 3 through 27.

Column 6, line 43, after "neck 13 of" insert -- the container 12 by clockwise rotation of the outer --.

Claim 1, column 13, line 31, change "sealing" to -- said sealing position --.

Claim 3, column 14, line 2, change "fords" to -- ford --, and line 5, change "affords" to -- afford --.

Claim 5, line 2, (column 14, line 13) change "comprises" to -- comprise --.

Claim 17, (column 16) delete lines 2 through 4 and insert -- said force transfer means on said outer cap engages said cooperating means to slide said movable portion from said open to said sealing --.

Signed and sealed this 23rd day of April 1974.

(SEAL)  
Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

C. MARSHALL DANN  
Commissioner of Patents