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[54] **CHILD SAFETY CLOSURE**

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[52] **U.S. Cl.** **215/222**; 215/341; 215/348; 215/350

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

[58] **Field of Search** 215/9, 222, 341, 348, 349, 215/350

[56] **References Cited**

UNITED STATES PATENTS

3,451,576	6/1969	Lewis	215/222
3,557,985	6/1971	Denis	215/222
3,749,270	7/1973	Affleck	215/222

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[57] **ABSTRACT**

This invention relates to a safety closure which is relatively safe in the hands of children as it requires a simultaneous downward shifting with a force in excess of five pounds and a simultaneous rotational torque to release and remove the enclosure for the container. The closure has lugs thereon biased into locking engagement with surfaces in downwardly opening notches on projections formed on the container by means of a foam plastic disk which is compressed to 50 to 80 percent of its original uncompressed thickness when the closure is secured on the container. The displacement to compress the foam disk and to lower the locking lugs for release requires a force of at least four pounds and a force not greater than 14 pounds.

7 Claims, 4 Drawing Figures

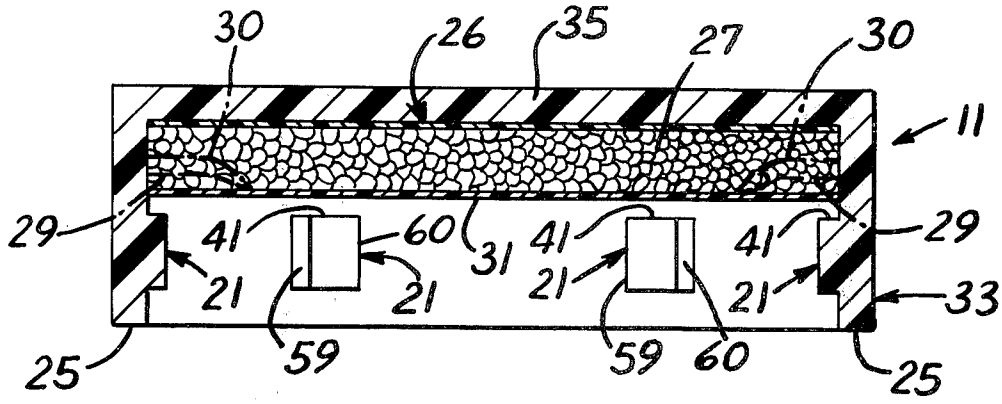


FIG. 1

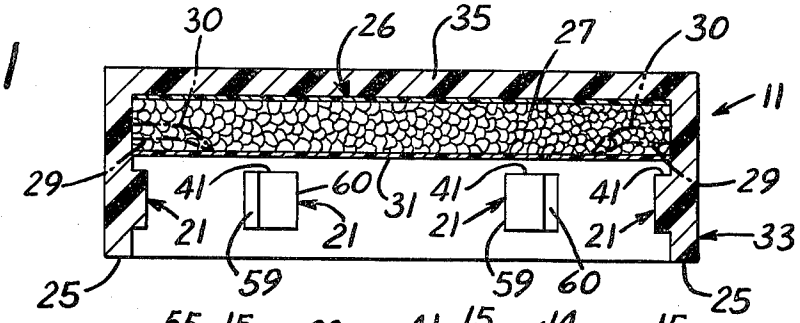


FIG. 2

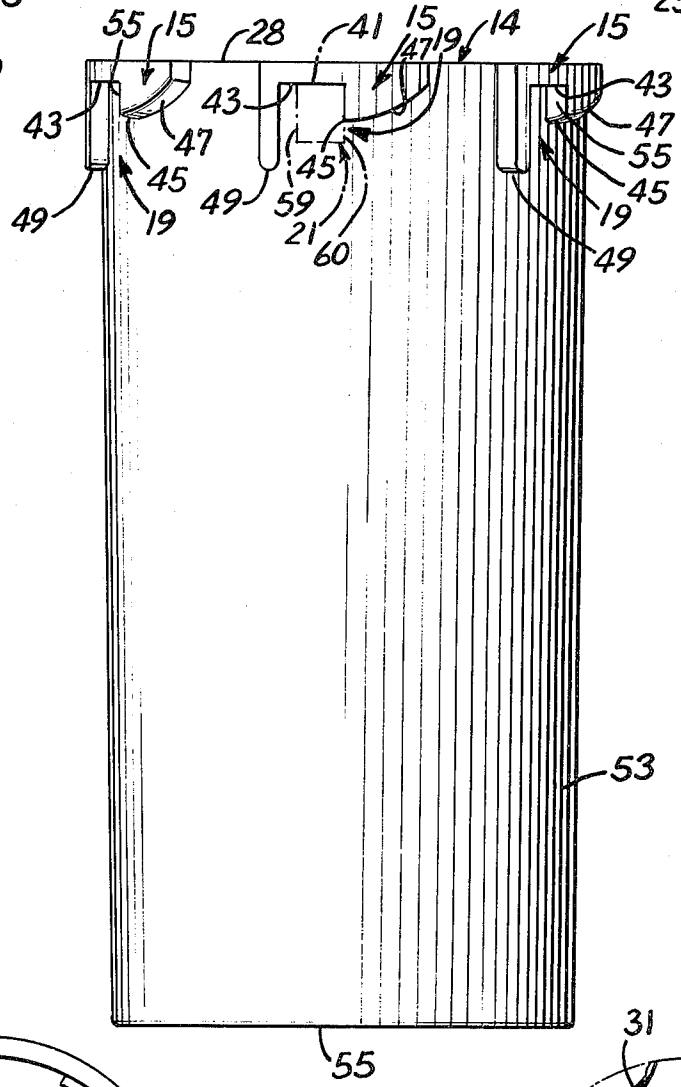


FIG. 3

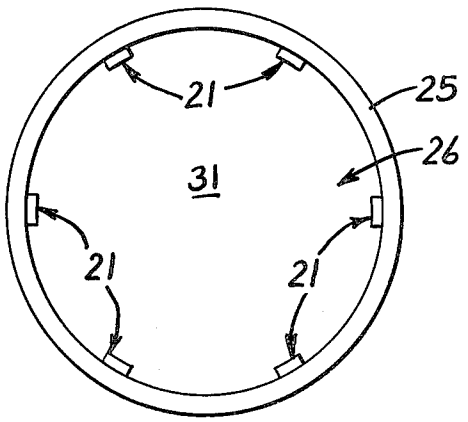
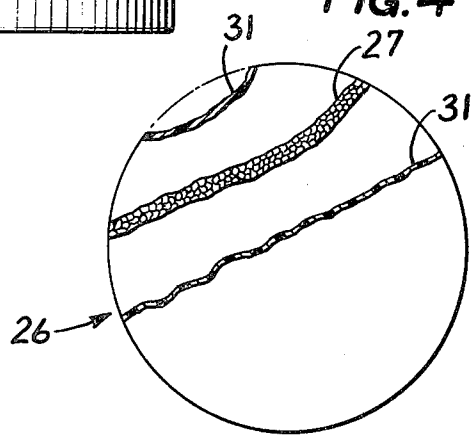


FIG. 4



CHILD SAFETY CLOSURE

This invention relates to safety closures and containers and more particularly to safety closures and containers which are relatively safe in the hands of children.

Various constructions of safety caps and containers in the prior art require a simultaneous application of a downwardly directed axial force on the closure and a rotationally directed torque in order to release the closure for removal from the container. For instance, a number of closures have lugs thereon which are biased upwardly into bayonet-like grooves formed in the upper end of the container and it requires a downward shifting of the lugs and a simultaneous turning of the closure in order to move the lugs to positions for passing upwardly past the projections. Generally speaking, children will apply either a rotational torque trying to unscrew the cap or an outward pulling force on the closure; but generally will not be able to accomplish a downward axial movement through a sufficient distance and also a concurrent rotational movement of the closure.

Closures of this kind are usually constructed with a sealing flange or separate sealing disk biased against the rim of the container to provide a seal between the closure and the rim of the container wall at the opening for the container. The closures are formed of plastic and use a plastic sealing disk or flange which is flexed by the rim of the container when the lugs on the closure are engaged in the bayonet slots, and this flexed sealing disk or flange provides the upwardly directed biasing force for holding the lugs in the bayonet slots.

Closure constructions of this kind are in commercial usage but some of them are experiencing difficulties and others are being abandoned. Some constructions have been proposed but never have been adopted commercially for the reasons that they were too costly or they proposed to use materials not meeting the Food and Drug Administration's standards. In general, the plastics used and constructions suggested are often failing because of excessive compression set of the flexed or compressed plastic material which results in insufficient biasing forces and insufficient resistance to axial movement of the closure to its release position. More specifically, the plastic materials being flexed are thin in cross section and are often subjected to additional weights or loads during shipping, and then a compression set occurs and the closure becomes loose and rattles or requires only a minimal force to cause the closure to be shifted axially and opened.

Other problems are experienced where the containers are formed of glass as it can readily occur that the projections having the bayonet slots therein are formed of glass without a sharp definition, that is, the projections are formed with rounded edges which serve as cams allowing a too easy turning and removal of the closure from the glass container. Also, glass containers are not usually held to tolerance dimensions as close as the tolerances for plastic containers and thus may result in relatively loose fitting closures. Also, some closure materials have experienced sharp reductions in effectivenees after the closures have been removed and replaced several times. As such closures and containers are often used for packaging medicines, the closure must be capable of being reapplied a number of times without losing its effectiveness.

Accordingly, an object of the invention is to provide a new and improved closure for containers of the foregoing kind.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is an enlarged, cross-sectional view of a closure embodying the novel features of the invention;

FIG. 2 is an elevational view of a container having projections with notches for receiving and interlocking with the closure shown in FIG. 1;

FIG. 3 is a bottom view of the closure of FIG. 1; and

FIG. 4 is a partially broken away and sectional view of the preferred material for biasing the locking lugs and for resisting downward movement of the closure.

As shown in the drawings for purposes of illustration, the invention is embodied very generally in a closure **11** which is adapted to be applied in locking and sealing engagement with an upper end of a container **12** having an open upper end **14** with a series of radially outward projections **15** on the outer circumferential surface **17** of the container. The projections **15** are formed with surfaces defining downwardly facing notches **19** for receiving therein a set of locking lugs **21** carried on an inner side **23** of a depending skirt wall **25** for the closure **11.**

Conventional closures and containers have employed various materials and constructions which are flexed or placed in compression between the container rim and the remainder of the closure to bias the lugs upwardly and hold the lugs in locking positions within the bayonet slots in the projections on the containers. Often, a depending flange integrally formed on the closure is used. Other constructions include a flat plastic disk backed by a central post and spaced from the top end wall of the cap. Another suggested construction, which is not in commercial use, is to use a foamed plastic integrally formed with the closure. Other suggestions include a resilient rubber disc which is faced with a hard material to limit the compression set of the rubber. Such multiple piece fabrications with facing disks are found to be too expensive. Whatever the construction, the materials employed must have known or proven non-toxicity for packaging medicines or other materials.

In accordance with the present invention, a suitable plastic foam disk means **26** comprising a disk-shaped plastic foam body **27** is compressed between 50 to 80% of its original thickness by the container rim **28,** as indicated by dotted lines **29** in FIG. 1; and requires a force in the range of 4 to 14 pounds to compress it to the position, shown by the dotted lines **30,** to lower sufficiently the lugs **21** to release positions below the notches **19.** The foam body **27** also provides the biasing force urging the lugs **21** into the notches **19.** The plastic foam body is a non-toxic foam, such as closed cellular polyethylene, preferably with a skin or non-cellular outer impermeable layer **31** for engagement with the container rim **28.** The skin layer **31** provides an essentially impermeable layer to the contents of the container and reduces the likelihood of adherence of any granular material in the container to the foam disk body.

While the seal provided between the foam disk body and the container rim is generally excellent, the primary purpose of this foam disk body is to provide in a

disk having a thickness in the range of 0.100 to 0.180 inch the physical characteristics of not readily taking a compression set and retaining its resilience and requiring a compressibility force of 5 to 14 pounds in order to shift the lugs **21** from the notches **19.** This is a relatively thick cross section as compared to thinner cross sections used for the non-foam plastic used in the prior art closures. It has been found that after a 50 to 80% initial compression of the foam body disk, that the additional axially directed force to displace the lugs **21** downwardly, e.g., about 0.070 inch in this instance, to turn from alignment with the notches **19** will be in the range of 4 to 14 pounds. Conversely, a smaller force will provide the same displacement of 0.070 inch of the foam body **27** when the foam has not been precompressed. Thus, the precompression makes the foam more firm. Herein, a precompression displacement of about 0.040 inch is used, these dimensions being by way of example only and not by way of limitation.

In accordance with the preferred embodiment of the invention, the foam disk body **27,** which meets with the Food and Drug Administration's approval, is a flat disk in the range of 0.100 to 0.180 inch thick made of Hercules Minicell 600 manufactured by Hercules Powder Company of Wilmington, Del. The density of this particular foam is within the range of 4.5 to 9 pounds per cubic foot. It has a compression set of 22% of the original when subjected to a load in accordance with ASTMD 395B for 22 hours followed by a relaxation of 24 hours. This plastic material has good resiliency, e.g., a Bayshore of 42%. Its integral skin layer **31** and closed cells provide good water-vapor barriers and the foam body is a low water absorber. The preferred foam is an extruded, low density polyethylene foam having a density of 6 lbs./ft.^{3}.

Referring now to the preferred closure in greater detail, the closure **11** is formed of two pieces, namely, the inner plastic foam body **27** and an outer one-piece plastic cap **33** of harder material such as polystyrene. The cap **33** comprises a circular top end wall **35** integrally joined to the depending cylindrical skirt wall **25.** Herein, the top end wall **35** is flat and planar; but the outer side of the skirt wall **25** is usually provided with grooves or other indentations to improve the application of a turning torque to the cap.

The locking lugs **21** are integrally formed on the inner side **23** of the skirt wall **25** of the cap **33** and project radially inwardly therefrom for a distance of about one-sixteenths of an inch in this instance. The number of projecting lugs **21** may be varied; but there will usually be four or six lugs. Preferably, the lugs **21** are spaced equally about the circumferential skirt wall **25.** However, the spacing of the lugs may also be varied from that disclosed herein. In this instance, the lugs are generally square in shape and measure about one-eighth inch on a side including the top side **41** of the lug which will abut surface **43** defining the top of the notch **19** in the projection **15.** Herein, the top side **41** of each lug **21** must be displaced 0.070 inch in order to clear a lower point **45** on a cam wall **47** of its associated projection. The projections each have a long stop wall **49** extending downwardly and forming another side for the notch and extending below the points **45** to prevent turning of the closure in the clockwise direction when the lugs are lowered beneath the points **45.** Thus, the lugs **21** can be turned in the counterclockwise direction as viewed in FIG. **2,** and only for a short distance before abutting vertical side of an adjacent projection's stop wall **49.** The spacing between adjacent projections **15** readily allows each of the lugs **21** to pass upwardly between a pair of projections **15** when removing the closure from the container.

The container **12** in the illustrated embodiment of the invention is made of plastic and includes a generally cylindrical wall **53** joined at its lower end to a bottom wall **55** which is disposed opposite the upper opening **14.** With a molded plastic container **12,** the surfaces **43** and additional surfaces **55** and **57** defining the downwardly facing notches **19** may be molded with good definition, that is with sharp edges and with surfaces **55** and **57** which are in radial planes through the longitudinal axis of the container. Such radially extending surfaces **55** and **57** are abutted by vertical surfaces **59** and **60** on the locking lugs **21** which are also in substantial radially extending planes through the axis of the closure **11.** Therefore, the turning of the closure **11** in the clockwise direction as viewed in FIG. **2** will result in the abutment of the vertical lug surfaces **59** against the projection surfaces **57.** Likewise, the turning of the closure **11** in the counterclockwise results in the abutment of the surfaces **60** against the projection surfaces **55** which have good contact and substantial areas in engagement with each other to prevent release of the cap with a substantial torque applied thereto.

On the other hand, with containers formed of glass, the surfaces **43, 57,** and **55** for the notches may have less definition and have more generally rounded outer edges or more sloping surfaces, i.e., in non-radial planes. With prior closures experiencing a compression set of the plastic and a looseness caused thereby, the closure lugs could be cammed past the projections surfaces particularly if the notches were formed with poor definition. However, the foam body **27** does not experience such a compression set and will still maintain the lugs **21** upwardly in the best locking position and hence in a more effective position than in prior art closures, and therefore less subject to being cammed open by imprecisely defined notch surfaces. Also, glass containers **12** tend to have greater tolerance variations in the distance between the container rim **28** and the notch surfaces **43** in the projections **15.** The foam body **27** readily accommodates such tolerance differences in dimension as it may be compressed by the circular rim **28** within a relatively high range of 50 to 80 percent of its original thickness and still apply a good biasing force to hold the lugs **21** against the notch surfaces **43.** Moreover, the foam body **27** retains its resiliency for urging the lugs upwardly against the top surface **41** in the notches **19** even after several operations of removal of closure from the container and return thereto. The individual closed cells and the impervious skin facing **31** also assist in preventing compression set without the additional cost of another separate facing layer or an additional substrate layer.

To remove the closure **11,** a person will press downwardly on the top wall **35** of the closure **11** with a minimum of 5 pounds of pressure which causes the foam body about the rim **28** to be further compressed by a distance equal to the distance between the surfaces **43** and the lowest points **45** on the locking notches **19** whereby the top sides **41** of the locking lugs are disposed beneath the points **45.** The maximum force to achieve this compression for unlocking does not exceed 14 pounds as the closure would then become too

difficult for weak persons to open. With a concurrent turning of the closure **11** in the counterclockwise direction until engaging the following projection stop walls **49**, the axially directed force on the closure may be released and closure is allowed to move upwardly between pairs of adjacent projections **19** and from the container **12.**

When replacing the closure **11**, each of the lugs **21** is aligned with a slot between an adjacent pair of projections **15** and moved downwardly and may be turned in the clockwise direction to engage the sloped cam walls **47** and further turned while applying a downward force to slide the lugs along the cam surfaces to the points **45.** During this camming engagement, the foam body **27** is being compressed by the container rim **28.** When the top surfaces **41** of the lugs **21** slide past the points **45** and, usually they turn into engagement with the stop walls **49**, the person may release the closure and allow the compressed foam body **27** to expand and lift the lugs **21** upwardly into the notches **19** to abut the notch surfaces **43** with the impervious skin **31** of the foam body **27** being pressed against the container rim **28** and affording a sealing of container opening **14.** Herein, the sealing action is incidental to the provision of a low-cost resilience and biasing of the cover into locking engagement with a container without the undue precompression set and with sufficient resiliency and with a controlled compression range of 5 to 14 pounds of pressure to lower the closure lugs sufficiently for turning removal from the locking notches **19.**

From the foregoing, it will be seen that the foam disk body provides a simple and inexpensive means of providing the desired force for holding the closure in locking engagement within the locking notches and the resistance to opening until there is an axially directed force of at least 4 pounds applied to the closure simultaneously with a turning torque. The closed cell polyethylene foam body with the impermeable facing meets with the Food and Drug Administration's Standards for use with medicines or other ingestible materials and has a limited compression set when compressed between 50 to 80% of its original thickness.

While the preferred embodiment has been shown and described, it will be understood that there is no intention to limit the invention to such disclosed embodiments. On the contrary, it is intended to cover all modifications and equivalent constructions falling within the spirit and scope of the invention as defined in the appended claims.

Various features of the invention are set forth in the following claims.

What is claimed is:

1. A combination comprising a container having a closed bottom wall and an upwardly extending wall terminating in an upper cylindrical end wall, a plurality of circumferentially spaced projections on said upper cylindrical end wall extending radially outwardly, each projection being formed with a downwardly opening notch and having surfaces defining said notches, a closure for securing to said container and closing the upper end of said container and to be child-resistant to opening, said closure including a one-piece plastic cap having a top wall and an integrally depending cylindrical skirt wall, a plurality of radially extending lugs on inner side of said depending skirt wall being spaced circumferentially about said skirt wall, said lugs having upper portions for fitting into said notches in said projections and for abutting said surfaces with attempted turning of said cap while in said notches, and a discrete foam disk means disposed between the inner side of said top wall of said cap and top portions of said lugs, said foamed disk means being resilient and being compressed between said container rim and said top end wall to within 50 to 80 percent of its uncompressed thickness, said foam disk means being free for further compression to shift said lugs axially downwardly from said notches with a compressive force of between 4 to 14 pounds to allow turning of said lugs to positions free of said notches for axially upward movement of the closure for removal from the container, said disk means comprising a flat foam disk body having an outer impermeable non-cellular skin layer for engaging the said upper cylindrical end wall and an integral closed cell foam layer for compression and resilience and having a low compression set.

2. A combination in accordance with claim **1** in which said foam disk means comprises a flat foam disk body of closed cellular polyethylene having a density between about 4.5 to 9 pounds per cubic foot.

3. A combination in accordance with claim **2** in which said foam disk body has a thickness between about 0.100 to 0.180 inch.

4. A combination in accordance with claim **1** in which said foam disk means comprises a foamed body formed of closed cellular polyethylene and an impervious non-cellular face on at least one side of said foamed body for engagement with said upper cylindrical end wall.

5. A combination in accordance with claim **4** in which said foam body has a density of between about 4.5 to 9 pounds per cubic foot, a thickness of between about 0.100 to 0.180 inch and a Bayshore resilience of about 42%.

6. A closure for securing to a container having projections on a side wall of the container with downwardly facing notches therein formed by surfaces on said projections, said closure comprising a one-piece plastic cap having a top wall and an integrally depending cylindrical skirt wall, a plurality of radially extending lugs on inner side of said depending skirt wall being spaced circumferentially about said skirt wall, said lugs having upper portions for fitting into said notches in said projections and for abutting said surfaces with attempted turning of said cap while in said notches, and a discrete foam disk means disposed between the inner side of said top wall of said cap and top portions of said lugs, said foamed disk means being resilient and being compressed between said container rim and said top end wall to within 50 to 80 percent of its uncompressed thickness, said foam disk means being compressible to shift said lugs axially downwardly from said notches through a predetermined distance to lower said lugs from said notches with a compressive force of between 4 to 14 pounds to allow turning of said lugs to positions free of said notches for axially upward movement of the closure for removal from the container, said disk means comprising a flat foam disk body having an outer impermeable non-cellular skin layer for engaging the said upper cylindrical end wall and an integral closed cell foam layer for compression and resilience and having a low compression set.

7. A combination in accordance with claim **6** in which said foam body is formed of closed cellular polyethylene having a density between about 4.5 to 9 pounds per cubic foot, a thickness between about 0.100 to 0.180 inch and a Bayshore resilience of about 42%.

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