United States Patent

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[54] **CLOSING OF CONTAINERS**
5 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **53/42,** 215/40
[51] **Int. Cl.** **B65d 41/02**
[50] **Field of Search** 215/39, 40, 43, 44; 53/41, 42, 344

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ABSTRACT: A closure having a depending skirt with a compressible liner material adhered to its inner surface is secured on a threaded container finish by reforming the skirt of the closure against a threaded container finish to form threads in the compressible material. The closure so secured can be rotatably removed from the container. Knurling may be formed in the closure skirt during application.

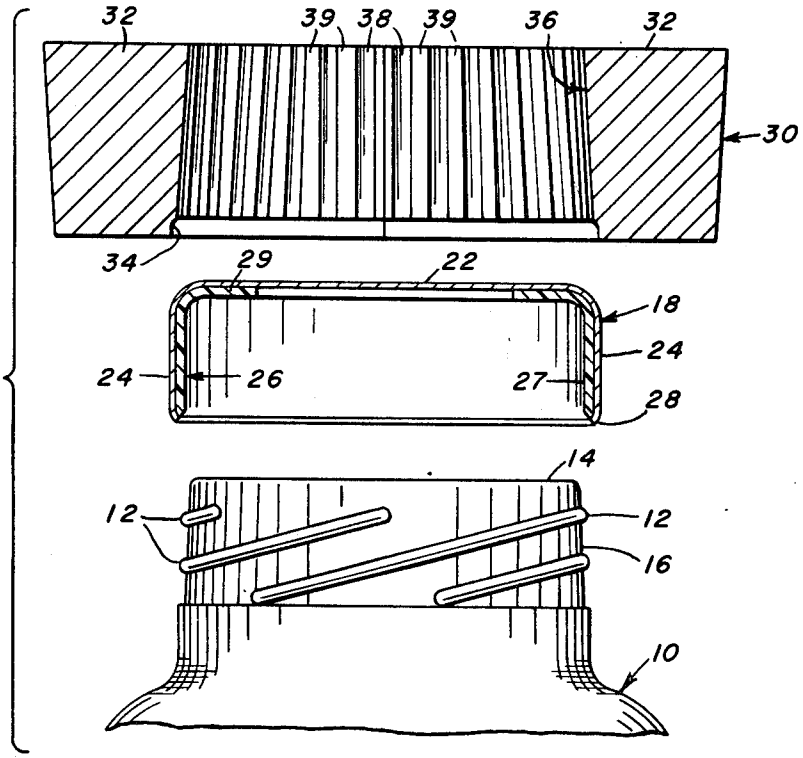


FIG. 1.

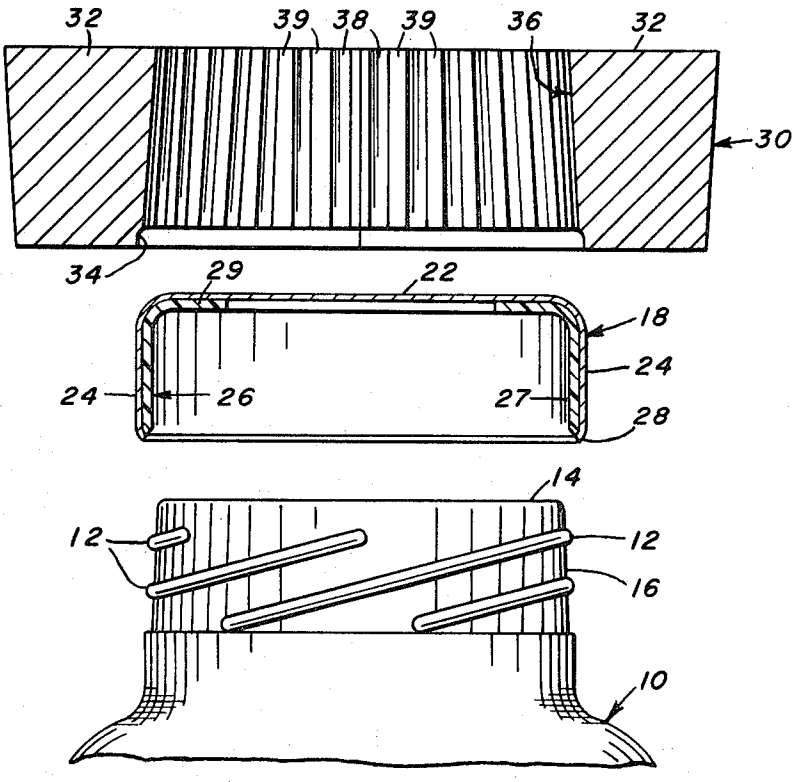
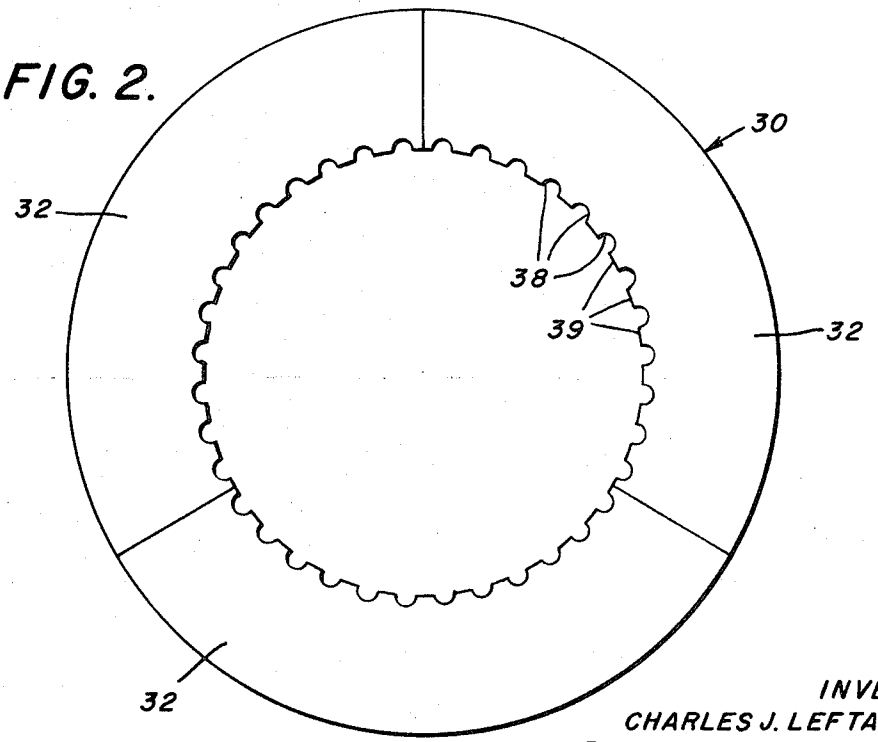


FIG. 2.



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FIG. 3.

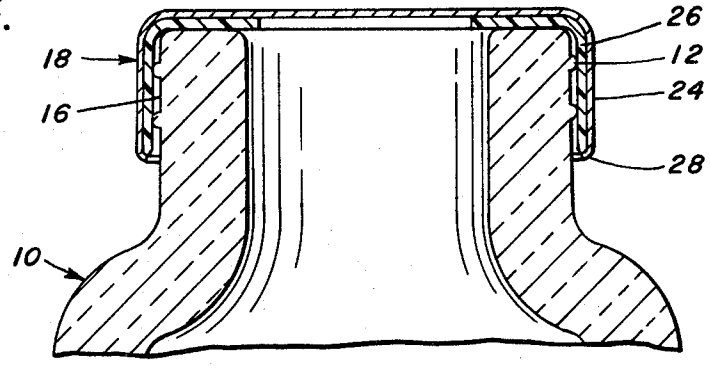


FIG. 4.

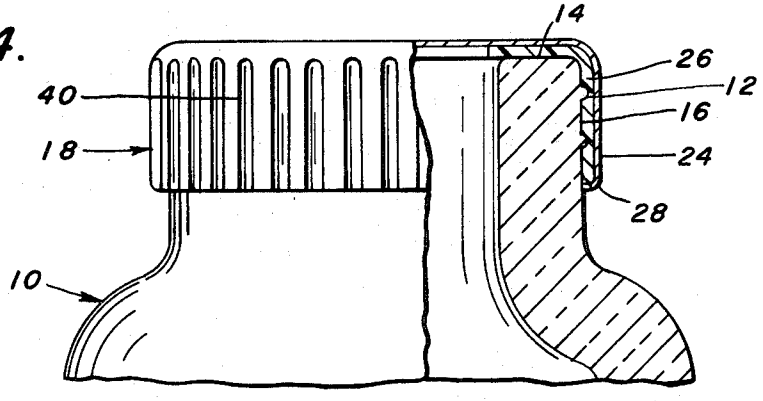
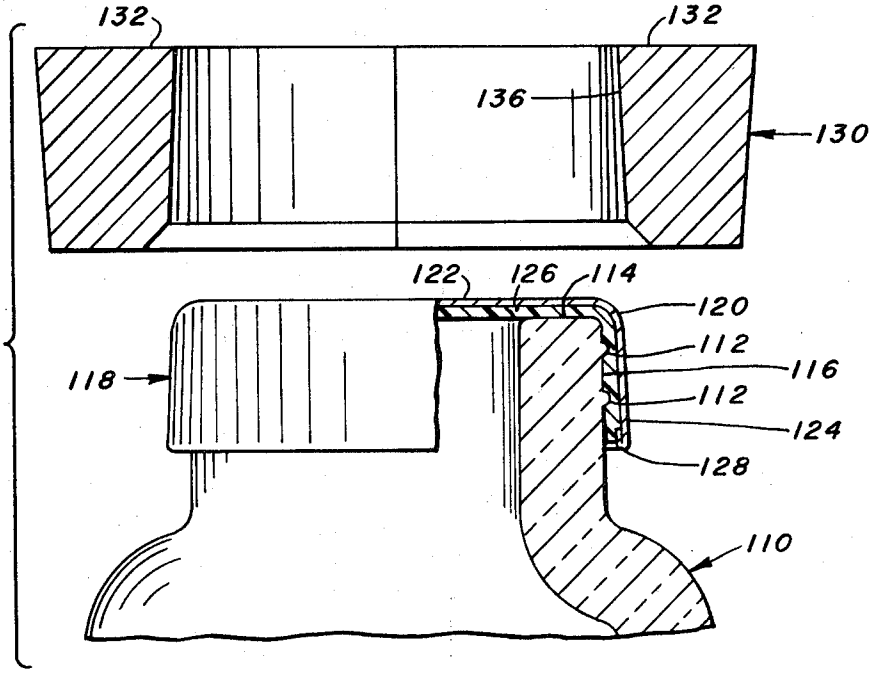


FIG. 5.



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CLOSING OF CONTAINERS

BACKGROUND OF THE INVENTION

In providing and securing closures on containers, factors which are frequently considered include (1) the ease of application of the closure on a container, (2) the effectiveness of the seal provided by the closure, (3) the ease of removal of the closure from the container by the consumer, and (4) the cost of the sealed package. A variety of closures are known which provide optimum conditions for two or three of these factors, but not for all four factors. The crown-type closure or cap, for example, can be simply applied by a single stroke of a vertically reciprocating sealing head. The sealing head may have a tapered throat which allows for dimensional tolerances in both the container finish and cap dimensions and assures reforming of the cap and liner downwardly about a container mouth to secure or lock the cap on the container. The typical crown cap, however, is difficult to remove and usually requires a prying tool or opener. On the other hand, the conventional threaded closure having a threaded skirt which matches threads on a container finish is more easily removed, but is usually not adapted for simplicity of application of the closure to the container. The application of such closures usually requires progressive affixation by revolving parts of the sealing machine, which accordingly cannot be operated at capping speeds attainable in the application of crown caps.

Attempts have been made heretofore to combine the advantages of closure application by a single vertical stroke of a sealing head, as with a crown cap, with provision for the easy removal of a threaded closure. The press-on, turnoff closure caps disclosed in Foster et al. U.S. Pat. No. 3,270,904 and Owen et al. U.S. Pat. No. 3,371,813 are exemplary of such a combination. These patents disclose caps which have plasticlike material around the inner surfaces of their skirts and which are adapted to have an interference fit with the threaded finish of a container. When the cap is axially pressed onto the container finish the plasticlike material will flow around the threads on the finish and conform thereto so that the caps can be rotatably removed from the containers.

There is lacking, however, a closure which can be applied to a container by the vertical stroke of a sealing head and be rotatably removed from the container, and which provides a reliable seal on pressurized containers. There is also lacking such a closure which will permit escape of the gases from the container's head space during application of the closure to a container.

SUMMARY OF THE INVENTION

This invention provides a closure comprising a metal shell having a depending skirt with a compressible liner material adhered to its inner surface for application to a threaded container entrance mouth by the vertical stroke of a sealing head. The closure is initially loosely positioned over the threaded entrance mouth of a container and the closure skirt drawn and reformed against the threaded finish of the container mouth to compress the liner material around the screw threads and thereby sealingly secure the closure to the container mouth. This sealed container assembly permits rotational removal of the closure. The application of such a closure can be simply effected by the axial stroke of a sealing head having a die with an upwardly tapered throat. The die initially circumferentially continuously engages the top panel and upper portion of the closure skirt during the sealing stroke, to draw the edge of the top panel of the closure downward around the upper sealing surface of the container. Thereafter, relative downward movement of the die with respect to the closure skirt progressively deforms the closure skirt inward against the container finish. Vertical grooves and ribs may also be provided in the inner surface to the die to form knurling around the closure skirt during application of the closure to a container.

Accordingly, it is an object of the invention to provide a closure having a compressible plastic material adhered to its inner surfaces for draw-on application to a threaded container finish.

Another object of the invention is to provide a method of securing a closure to a threaded container finish by the vertical stroke of a collet or capping head.

A further object of the invention is to provide a method of knurling the skirt of a closure during application of the closure to a container.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and purposes of the invention will be more fully understood with reference to the following description and drawings appended thereto wherein:

FIG. 1 is a sectional elevation view showing a container, closure blank and sealing head prior to closure affixation;

FIG. 2 is a top plan view of the sealing head of FIG. 1;

FIG. 3 is a sectional elevation view of the closure of FIG. 1 positioned loosely on a container entrance mouth before sealing;

FIG. 4 is an elevation view, partly in section, showing the closure sealed on the container entrance mouth; and

FIG. 5 is an elevation view in partial section showing an alternative form of sealing head positioned above a sealed package.

DESCRIPTION OF THE PREFERRED MODE

Referring to FIG. 1, a container **10** to be sealed or closed in accordance with the invention has an entrance mouth having threads **12** or other elongated closure retaining cam means thereon which are angled upwardly for rotational removal of a closure secured thereto. Preferably, the entrance mouth tapers slightly inwardly towards its top, with a taper of approximately 1° to 2° being preferred, to facilitate removal of a closure from a container, but small enough to ensure positive securement of a closure on the container. The container entrance mouth includes a top sealing surface **14** and a side sealing surface **16**. As illustrated, side sealing surface **16** may be slightly smaller in diameter than the container neck therebelow. The thread means on the container entrance mouth may be any one of a great variety of such means well known in the art.

Closure **18** comprises a metal shell, preferably made of aluminum or an aluminum alloy, having a flat end wall **22** and a skirt **24** depending therefrom. As shown in FIG. 1, a liner **26** made of compressible plastic material is disposed on the inner surfaces of the closure skirt and marginal edges of the closure end wall. Liner material **26** is adhered to the inner surface of closure skirt **24** and has a skirt portion **27** of uniform thickness over the length of the closure skirt. Liner **26** also has an annular top portion **29** around the marginal edge of the closure end wall **22** for forming a top seal against top sealing surface **14** of container **10**. While a ring-type liner is shown, it will be understood that a liner having a full top panel may be used. In the preferred embodiment, the liner is made of a plastisol or foamed plastisol material, but may be thermoplastic or elastomeric in nature. Preferably, the terminal edge of the closure skirt is turned inwardly to form a lip **28** which reduces the possibility of a sharp edge of the closure which could injure the fingers of the user. Lip **28** may also help to assure retention of the plastic liner **26** within closure **18**.

The inner diameter of closure **18** is slightly larger than the outer diameter of the container entrance mouth taken along the extent of the threads thereon. Closure **18** can therefore be placed loosely over the container entrance mouth as shown in FIG. 3. This loose fit of closure **18** on the container entrance mouth, among other things, facilitates exhausting of air and gases from the head space of the container during sealing. Contrariwise, with an interference fit between the closure skirt and container mouth as employed in the application of some previously known closures, air is entrapped in the closure and the container's head space during application of the closure on the container. Such methods of application may therefore cause doming of the applied closure, and may make vacuum sealing difficult.

The sealing head or die for applying the closure **18** to a container entrance mouth preferably comprises a segmented collet **30** consisting of three or more sectors **32** as shown in FIG. **2**, so that the head can be spread after application of a closure on a container for ease of head retraction. The die may also be a one-piece sealing ring having a tapered throat as is well known in the art. Collet **30** has an enlarged entrance portion **34** for assuring proper location of the closure **18** with respect to the collet during application, and has an interior throat portion **36** tapered slightly inwardly from bottom to top with a plurality of grooves **38** and ribs **39** therein. Collet **30** selected for illustration, has an inward taper of approximately 5° in the throat to provide for dimensional variances in the diameter of the containers to be closed. Vertical grooves **38**, and ribs **39** therebetween, form vertical knurling **40** (FIG. **4**) in closure skirt **24** during application to facilitate gripping by a consumer for removal of the closure from a container. Knurling **40** has an advantage primarily for small diameter closures which are sometimes difficult to grip. By way of example, grooves **38** in collet **30** illustrated in FIGS. **1** and **2** for forming a closure 28 millimeters in diameter, are approximately 0.010 inch deep and 0.060 inch wide, leaving an upstanding rib 0.050 inch wide between grooves. It is noted, however, that grooves and ribs in collets for forming closures may be of varying dimensions. If knurling is not desired, the collet for applying such closures may be devoid of knurling grooves and ribs in its throat. Collet **30** may be received in an adapter not shown which is vertically reciprocated in the head of a sealing machine which applies the necessary force for securing closures **18** to containers **10**.

In the sealing operation, a closure blank **18** is positioned loosely on a container entrance mouth as shown in FIG. **3**. As stated above, closure **18** and the container entrance mouth are so dimensioned that little if any resistance is encountered in positioning the closure on the entrance mouth. Container **10** with closure **18** thereon is then positioned under a capping head in preparation for sealing. The capping head is next moved downward to engage and reform closure **18** about the container mouth, and thereby secure and seal the closure on the container. Such securement and sealing is effected by collet head **30** drawing and deforming skirt **24** radially inward. This inward drawing of skirt **24** reduces the diameter of closure **18** and lengthens closure skirt **24** without measurable thinning thereof. Plastic liner material **26** is compressed and urged tightly against side sealing surface **16** of the container entrance mouth during such drawing and deforming of skirt **24**. This compression of plastic liner material **26** against side sealing surface **16** impresses threads **12** into liner material **26** to form threads therein of complementary configuration with respect to threads **12** to thereby lock or secure closure **18** on container **10**.

Collet **30** is moved downward to reform substantially the full length of closure skirt **24** inwardly toward the container side sealing surface. It is noted that lip **28** on the terminal edge of closure skirt **24** may be straightened slightly, during such sealing as shown in FIG. **4**. Lip **28** does not project far enough inward to interfere with container threads **12** during removal of closure **18** from container **10**. After closure **18** has been secured to container **10**, sectors **32** of collet **30** are spread by means not shown, and collet **30** is moved vertically upward leaving container **10** with closure **18** sealed thereon. As secured, closure **18** cannot be axially removed from container **10** except by relative rotational movement of closure **18** with respect to container **10**. The left-hand side of FIG. **4** shows knurling **40** which has been formed in skirt **24** of closure **18** during the sealing operation.

As shown in the right-hand side of FIG. **4**, a seal has been produced between the upper sealing surface **14** of the container entrance mouth and liner material **26** thereover. This seal has been produced by the compression of liner material **26** between the upper sealing surface **14** of the container entrance mouth and closure **18** by the downward force of collet **30** against closure **18** which results from resistance of the skirt **24** of the closure to drawing and reforming during application. Additional sealing is also provided by the compression of liner material **26** against side sealing surface **16** of the container. A package having a closure sealed on a container by means of the method of this invention has been found to have a tight seal and is well suited to sealing containers having either pressurized contents or contents sealed under a vacuum. Drawing closure skirt **24** against the container entrance mouth permits the use of a container entrance mouth having little or no inward taper towards its open top, whereas an interference fit, press-on application requires a much larger degree of taper in the container entrance mouth. A substantially vertical side sealing surface on the container's entrance mouth produces a package having a high resistance to blow off of a closure, and to other accidental axial removal of a closure as may sometimes happen when a package is sealed with a relatively high pressure therein. Consequently, the draw-on method of application is advantageous for containers sealed under pressure.

While it is not required that heat be employed to enhance the flow of the plastic liner material **26** around threads **12** on a container entrance mouth, and setting of the material upon cooling, heat is beneficial to forming permanent impressions of threads **12** in plastic liner material **26**. By forming a more permanent impression of the threads in the plastic material, use of closure **18** for reclosing a container is facilitated. It is noted, however, that there are many plastics and plastisol materials that will assume a permanent set at room temperature. This is particularly true where the packages are allowed to sit for a period of several weeks or months. Preferably, the plastic liner material is heated after application of closure **18** to a container, but may also be heated before such application and applied while at such elevated temperature.

FIG. **5** shows an alternative sealing head **130** and a container **110** having a closure **118** secured thereto by means of a sealing head **130**. Sealing head **130** is comprised of a plurality of sectors **132** so that it may be expanded after sealing and has an entrance portion **134** and a throat portion **136** for drawing the skirt **124** of closure **118** inwardly against side sealing surface **116** and threads **112** of container **110**. Closure **118** has a liner **126** adhered to the inner surfaces thereof which spans the full end wall of the closure and extends for substantially the full length of the closure skirt **124**. Threads **112** are impressed into liner **126** to secure the closure on the container. Closure **118** also has an inwardly folded or lapped bead **128** around the terminal edge of closure skirt **124** to eliminate the possibilities of a sharp edge on the skirt which might injure the fingers of the user. Bead **128** may also help to retain liner material **126** in the metal closure shell. Liner material **126** is slightly thicker than is the metal in bead **128**, so that with a slight taper on skirt **124** as shown, lip **128** will not interfere with threads **112** during removal of closure **118** from container **110**. Liner material **126** may also extend to the bottom edge of skirt **124** if desired. End wall **122** may have a downwardly recessed groove, not shown, inwardly of top sealing surface **114** of container **110** and have a ring-type liner in the closure outwardly of such a groove. It is noted that collet sealing head **130** does not have grooves and ribs in its inner surface to provide knurling in the closure skirt **1124**. Consequently, the sealed closure has a smooth uninterrupted skirt as shown. Knurling may be provided, however, if desired.

In the practice of the present invention, the compressible plastic material can be adhered to the inner surfaces of the closure shell by a variety of means well known in the art. Preferably, the inner surfaces of the closure shell are first coated with a light coat of lacquer and the compressible plastic material is deposited in the shell and formed against the surfaces thereof by means of a heated plunger. The method of the present invention, because of the direct compression of the plastic material during drawing of the closure on a container shell, permits the use of a relatively thin coating of plastic material in the closure shell as compared to an interference fit, press-on-type closure which requires a considerably greater thickness of plastic material on the closure

shell to flow around the container threads. Closure shells having coatings or liners of plastic material therein of a thickness in the range of 0.015 inch to 0.045 inch have provided very good seals on container entrance mouths by application by the method of this invention. Thicker liners are acceptable, but are less economical to produce. Aluminum and aluminum alloy shells are particularly well suited for draw-on applications by the present method since the skirts of aluminum shells are relatively easily drawn and reformed as compared to the skirts of steel closure shells. An aluminum closure shell also retains its reformed shape with little spring back.

While the invention has been described and several practices for the employment thereof have been set forth, it will be obvious to those skilled in the art that many modifications of the invention are possible without departing from the scope thereof. For example, the closure shell can be of a variety of different shapes such as including a recessed end panel therein or having a straight depending skirt rather than having a curl or bead on its terminal end. The closure retaining means on the side sealing surface of the container can also be given a variety of configurations all well known in the art, including upwardly inclined grooves in the side sealing surface as well as projections as illustrated in the drawings.

Having thus described my invention and certain embodiments thereof, I claim:

1. A method of securing a closure to a container entrance mouth comprising the steps of:

a. providing a metal closure having an end wall and a depending skirt with compressible liner material adhered to at least a portion of the inner surface of the skirt,

b. loosely positioning the closure on a container entrance mouth having a side sealing surface with inclined, elongated closure retaining means thereon, and

c. reducing the diameter of the closure by moving a die having an inner diameter less than the outer diameter of the closure, downward around the closure skirt to draw a substantial length of the closure skirt in toward the side sealing surface and compress the liner material around the closure retaining means, thus forming elongated depressions in the liner material of complementary configuration with respect to the closure retaining means to secure the closure on the container, whereby the closure so secured can be rotatably removed from the container.

2. A method as set forth in claim 1 including heating the liner material to enhance flow of the material, and setting upon cooling thereof, around the closure retaining means of the container entrance mouth.

3. A method as set forth in claim 1 in which the metal of the closure is aluminum.

4. A method as set forth in claim 1 in which the container entrance mouth has a substantially vertical outer surface having screw threads thereon and the liner material is compressed around the screw threads.

5. A method of securing a closure to a container entrance mouth comprising the steps of:

a. providing a metal closure having an end wall and a depending skirt with compressible liner material adhered to the inner surface of the skirt and to at least an outer portion of the undersurface of the end wall,

b. loosely positioning the closure on a container entrance mouth having a top sealing surface and a side sealing surface with screw threads thereon, and

c. reducing the diameter of the closure by moving a collet sealing head having an inner diameter less than the outer diameter of the closure and having vertical ribs on its inner surface, downward around the closure skirt to draw a substantial length of the closure skirt in toward the side sealing surface, to form vertical knurling in the closure skirt, and compress the liner material around the screw threads and against the upper sealing surface to sealingly secure the closure on the container entrance mouth, whereby the closure so secured can be rotatably removed from the container.

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