PRESS-ON TURN-OFF CLOSURE CAP
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ABSTRACT OF THE DISCLOSURE

A press-on turn-off cap including a shell lined with a gasket compound, the gasket being shaped to include a plurality of radially projecting ribs having the outer surface tapering inwardly toward the top panel of the shell. This provides for more even application of the cap to a container and greater security through being less readily subject to accidental impact. The cap has a novel design to assist in cap removal and provide greater package security. Additional objects other than those specifically enumerated will become apparent to the man skilled in the art who reads the description and studies the drawings.

In the drawings:
FIG. 1 is a perspective view looking down into the interior of an inverted closure cap of the present invention;
FIG. 2 is an enlarged diametric section of the closure cap of FIG. 1;
FIG. 3 is an enlarged cross sectional view of the closure cap of FIG. 2 at the initial stage of application to a known form of container finish which is also shown in section;
FIG. 4 is a view similar to FIG. 3 with the closure cap in an intermediate stage of application;
FIG. 5 is the cap of FIGS. 3 and 4 in the finally applied position;
FIG. 6 is a diametric cross section of the cap of FIG. 5 after removal from the container finish of FIGS. 3—5;
FIG. 7 is an enlarged cross sectional view of the left-hand portion of FIG. 6 illustrating the reformation of the gasket material;
FIG. 8 is a further enlarged cross sectional view of the right-hand portion of the closure cap of FIG. 6 illustrating the reformation of the gasket material at the center of a rib;
FIG. 9 is an enlarged fragmentary cross sectional view taken generally along the lines 9—9 of FIG. 2; and
FIG. 10 is a view taken along the lines 10—10 of FIG. 9 generally showing the shape of the ribs after the threads have been formed.

Referring now to FIG. 1, a closure cap of the present invention is shown at 10 and includes a shell 11 and gasket 12. The shell 11 is inverted, illustrating a cup-like shape formed by a top panel 13 which is bordered by a cylindrical skirt 14 projecting axially from the periphery of the top panel 13. As seen in FIG. 2, the lower end of the skirt 14 may be outwardly flared as at 15 and curled into a reinforcing bead 16 of conventional design.

Referring to FIGS. 2 and 3, the material lining the shell 11 and forming the gasket 12 is disposed around the inner circumferential wall surface 17 of the skirt 14 and extends axially from the flare 15 to the top panel 13. A gasket groove or channel 18, formed by the skirt 14 and a shoulder 20 is also filled with the gasket material which may extend inwardly beyond the shoulder 20 and terminate on the depressed center panel 31, or if desired, may cover the entire center panel 21. If needed, a suitable coating (not shown) may be provided on the interior of the shell to protect the metal and enhance the adherence of the gasket material to the skirt 14 and top panel 13.

The gasket 12 is molded to the shape shown in FIGS. 2 and 3 within the shell 11 to provide a thread forming surface area 22, a side sealing surface area 23 and a top sealing surface area 24. The thread forming surface area 22 is disposed at an angle of about 6° to the cylindrical wall forming the skirt 14. About two-thirds of the way up the skirt, the thread forming surface 22 intersects the side sealing surface which is formed at an angle of about 20° to the skirt. The top sealing surface 24 of the gasket 12 is disposed generally at right angles to the skirt 14.

Formed in the gasket material 12 along the inner circumferential wall surface 17 is a plurality of radially projecting ribs 25. As best seen in the left-hand portion of FIG. 2, each rib 25 is formed with a finish engaging surface 26 which is disposed at an angle of about 10° to the skirt 14 or central axis of the shell, which angle is between that of the thread forming and side sealing surfaces. While the ribs appear to have a single configuration when viewed in front elevation, it is apparent from the cross sectional view of FIG. 9 that before application the surface 26 is generally arcuate when viewed in cross section.
The ribs 25 are spaced circumferentially around the inner periphery of the closure cap and are appropriately dimensioned, as will be seen, to engage the helical thread on a container finish of known form. It has been found that tapered ribs will provide for more even application of the closure cap to the container finish due to the redirection of material to be displaced. When capping at the usual high speeds, cocking or uneven application cannot be tolerated.

As seen in FIG. 3, a typical glass container 30 of the type briefly described above is fragmentarily illustrated in cross section. The container 30 includes a finish 31 having a circumferential bead 32 above which is provided a generally cylindrical wall 33. The wall 33 forms the minor diameter of a helical thread 34 which is integrally embossed on the finish 31. The helical thread 34 may comprise one continuous turn with the ends overlapping slightly as shown, or may consist of a discontinuous helical thread or the like. The former type of finish is a standard in the industry and is particularly adapted to receive baby nipple adapters or the like.

The problem of cocking encountered during application of caps having the gasket material formed to a continuous inner circumferential surface were solved through the provision of the ribs 25, the number of which may be varied down to as low as about 15% of the total inner circumferential area of the gasket 12 without adversely affecting the capping speed. In particular, the ribs 25 assist the cap in being properly and evenly located on finish during the press-on type application because they reduce the total amount of gasket material to be displaced initially and during cap application. As seen in FIG. 3, the lower end of the finish engaging surface 26 of the rib 25 touches the threads initially while the balance of the gasket remains spaced thus minimizing the amount of gasket material to be deformed.

In FIG. 4, the closure cap 10 is in an intermediate stage of application such that the top of the thread 34 has begun to deform the thread forming surface 22 in the gasket 12. Obviously, greater deformation occurs in the area of each of the ribs 25 causing the material to begin expansion into the void or space above and below the thread 34. On the right-hand side of FIG. 4, at the lower portion of the threads 34, the finish engaging surface 26 on the rib 25 engages the lower end of the thread 24 to assist in maintaining the cap properly oriented relative to the finish throughout application.

As seen in FIG. 5, when application of the closure cap 10 to the container 30 is complete, a hermetically sealed package is formed due to the embedding of the top surface 35 of the finish 31 in the top sealing surface 24 of the gasket material 12. The gasket material undergoes deformation to flow in and around the inner circumferential margin of the top of the finish while the tapered side sealing surface 23 engages the outer circumferential margin extending part way down the cylindrical wall 33 of the finish 31 to form an additional side seal for good package security.

In the finally installed position, the continuous thread 34 is embedded in the thread forming surface 22 of the gasket material proper as well as being embedded in the finish engaging surface 26 of the radially projecting ribs 25. Obviously, near the top of the thread 34 the embedment will be slightly greater than at the lower portion as is evident in the left-hand portion of FIG. 6. The additional gasket material provided by the ribs 25 assists in forming a radially deeper thread especially along the top of the helical thread 34 to provide better cam off properties facilitating easy removal of the closure cap 10 by rotation relative to the container 30.

A recent additive feature of the increased ability of the newly formed threads to hold the cap properly located while the package is cooling so that a vacuum may be formed to permit atmospheric pressure to assist in holding the closure cap 10 to the container 30 until the package is opened. It has been found that by controlling the number of ribs, the hermetic security of the package can be increased. Shock resistance can be increased when the ribs 25 occupy somewhere between 30% to 70% of the total circumferential side surface area, excluding of course, the gasket material which cooperates with the top of the finish 31. In practice, a closure cap for a 40 mm. finish, is this equivalent to between about 12 to about 20 of the ribs 25. Obviously, this number will be adjusted depending upon the dimensions of the container finish, size of ribs or changes in other variables.

The gasket material used in the present closure cap may consist of a pured plastisol of known type and may be capped at room temperature or under heated conditions. Ordinarily, the closure operation is greatly facilitated by the use of heat at the time of application to the container finish. As the material cools the thread impressions formed in the ribs and thread forming surface become sufficiently rigid to permit removal of the closure cap 10 by rotation, yet the gasket material is still sufficiently resilient to permit the cap to be prised off by known methods, this being desirable where a large number of caps are to be rapidly removed. In the use of this application, the cold flow properties of the gasket material serve to provide the thread forming function. The preferred material as noted is a pured or foamed plastisol composition, but other plastomer compositions having requisite resilience and flow and set properties are also suitable.

In the formation of the gasket lining, molding temperatures will be of the order of 325° F. to about 425° F. A final heat treatment of about 350° F.-420° F. for a period of 30 to 200 seconds finally fluxes the plastomer material by completely dissolving the resin particles in the plasticizer in a well known manner. Obviously, these temperatures and times will vary with type and amount of compound used.

As seen in FIG. 6, the thread 40 formed in the gasket 12 through press-on application of the closure cap 10 is self-maintaining with removal from the container finish 31. The upper edge 41 of the thread 40 extends over the top of the thread 34 to provide increased thread depth or surface area, especially in the regions of the ribs 25 to reduce the force per unit area during cap removal thus reducing shear modulus requirements of the material. The taper of the gasket material 12 as well as the taper of the ribs 25 insures that a greater amount of gasket material will be present at the top margin of the thread as opposed to the lower margin at the same location, however, at the lower end of the thread 40, as shown in section at the right-hand portion of FIG. 6, a sufficient amount of gasket material is present to overlie the threads to provide good cam off properties even at the lower ends of the threads.

As seen in the enlarged view of FIG. 7, the lower portion of the thread makes an impression in the thread forming surface 22 adjacent the lower extremity of the skirt 14. The over-all depth of the thread increases, as is evident in both FIGS. 7 and 8, as the helix advances towards the top panel 13. As seen in FIGS. 7, 8 and 10, where the thread groove 40 intersects each of the ribs 25, the thread depth is greater than in the compound adjacent each side of the rib. The increase in thread depth provides a greater cam off surface area and holding power on application. The reduced amount of gasket material to be displaced during the initial stages of application to a container finish, permits the cap to be properly oriented and easily located on the container finish before it is pushed "home" or to the fully applied position as shown in FIG. 5. As the cap travels downward an ever increasing amount of gasket compression is forced in and around the threads to form the co-operating thread groove 40 in the manner shown. In a typical application of the closure cap 10 to a 40 mm. finish, a cap having between about 12-20 ribs will form a side.
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5 seal along the side of the finish for about .200 inch at the ribs and for about 0.100 to about 0.125 inch between the ribs thus obtaining the advantages stated above. Obviously, these dimensions are only exemplary of one application and will be varied with changes in the container and closure cap dimensions, the quantity and type of compounds and like parameters.

It is obvious that the ribs 25 will maintain the gasket proper spaced from the container finish during the initial stages of application to avoid pumping as pointed out in the commonly assigned depending application of Zipper, Ser. No. 462,475, filed June 9, 1965. Accordingly, a hermetic seal is not established until the cap is almost fully applied thereby eliminating entrapment of air in the head space of the container.

The novel package formed by applying the closure cap of the present invention to a known form of container finish provides the advantage of permitting press-on application and removal by rotation or prying off with reaplication possible in either case. As additional advantages, the ribs add to package security when they comprise from about 20% up to about 60% of the gasket area. Also, hot and cold application can be accomplished with the present cap with better cam off properties. Obviously, other advantages in the form of expedient application and minimum expense in capping are also present.

Upon a consideration of the foregoing, it will become obvious to those skilled in the art that various modifications may be made without departing from the invention embodied herein. Therefore, only such limitations should be imposed as are indicated by the spirit and scope of the appended claims.

We claim:

1. A package comprising a closure cap and container, said container including a finish portion having a continuous helical thread embossed thereon, said closure cap including a top panel and a skirt, a compressible gasket material lining an inner peripheral portion of said skirt and extending radially inward over at least a part of said top panel, said gasket material providing a radially facing inner circumferential surface for engagement with said continuous thread on said container finish when said cap is applied thereto, said radially facing inner circumferential surface of said gasket material having a plurality of circumferentially spaced and radially raised ribs engaging said continuous threads in advance of the remainder of said gasket during capping to assist in locating said cap at application and said ribs being tapered radially inwardly towards the top panel to provide increased radial thickness of said gasket material adjacent a top portion of said container finish.

2. The package of claim 1 wherein said ribs form from about 30% to about 70% of the total circumferential surface area of said gasket material to provide increased package security and greater cam off force against said container threads.

3. The package of claim 1 wherein said radially facing inner circumferential surface intermediate said ribs is divided into a side sealing surface area and a thread forming surface area and said areas are disposed at an angle to each other.

4. The package of claim 3 wherein said side sealing surface area is at a greater angle than said ribs to provide increased gasket material adjacent the top of said finish portion, and said thread forming area is at a lesser angle than said top of said ribs.

5. The package of claim 3 wherein said thread forming surface area is of greater axial extent than said side sealing surface area.

6. A closure CP particularly adapted for press-on application and subsequent removal by rotation, said closure cap comprising a shell having a top panel portion and a skirt portion, a layer of gasket material lining said shell around said skirt and a part of said top panel portions and being secured thereto, said gasket material having a radially facing circumferential surface formed with a plurality of circumferentially spaced radially projecting ribs, said ribs extending upwardly at an angle to said skirt portion prior to application to a container finish, and adapted to interfere with the threads on a container finish during application thereto, said radially projecting ribs being thicker adjacent said top panel than adjacent a lower part of said skirt portion and being deformed in an around the threads on a container finish after application to provide increased surface area for camming off of said closure cap on a rotation relative to said container finish, said circumferential surface intermediate said ribs being formed into two identifiable portions of said portions being at a greater angle to said skirt portion than said ribs and being disposed adjacent said top panel to form a side seal on press-on application to said container finish and the other of said portions being at a lesser angle to said skirt portion than said ribs and being disposed below said one portion and being adapted to engage the threads on said container finish whereby resilient complements of threads will be formed therein to permit rotational or pry-off removal.

7. In a press-on turn-off closure cap including a cup-like shell formed by a top panel portion and a depending skirt around the marginal edges, said cup-like shell being lined with a plastomeric composition at least around an inner circumferential surface of said skirt and a portion of said top panel portion, the improvement which comprises a plurality of upwardly extending ribs disposed around an inner peripheral surface of said plastomeric composition before initial application of said closure cap to a container, said ribs being tapered inwardly toward said top panel portion and comprising from 30% to 70% of the total circumferential surface area of said lining on said cylindrical skirt to provide for even application of said cap to a container, increased package security and enhance the ease in removal and application of said cap to a container, increased package security and enhance the ease in removal and application of said closure cap to a threaded finish.

8. The press-on turn-off closure cap of claim 7 wherein said inner peripheral surface of said plastomeric lining is formed at an angle to said skirt, and said ribs are formed a greater angle than a part of said plastomeric lining thereby to increase the depth of thread impressions therein on application to a container finish of generally cylindrical shape.

9. A closure cap particularly adapted for press-on application and subsequent removal by rotation, said closure cap comprising a shell having a top panel portion and a skirt portion, a layer of gasket material lining said shell around said skirt portion and being secured thereto, said gasket material having a radially facing circumferential surface formed with a plurality of circumferentially spaced radially projecting upwardly extending ribs, said ribs being formed in said cap prior to initial application to a container for interference with the threads of said container finish during application thereto, said radially projecting ribs being deformed in and around the threads on said container finish after application to provide increased surface area for better camming off of said closure cap on rotation relative to said container finish.

10. The closure cap of claim 9 wherein said gasket material comprises a puffed plastisol composition.

11. The closure cap of claim 9 wherein said radially facing circumferential surface of said gasket material is disposed at an angle to at least a part of the skirt portion of said shell to provide increased interference with a container finish in the final stages of press-on application.

12. The closure cap of claim 9 wherein said radially facing circumferential surface of said gasket material is divided into two identifiable distinct surfaces, one of said surfaces being a thread forming surface and the second of said surfaces being a side sealing surface.
13. The closure cap of claim 12 wherein said thread forming surface and said side sealing surface are disposed at diverse angles relative to said skirt on said shell, and said ribs are formed at a greater angle than one of said surfaces and a lesser angle than the other of said surfaces.

14. A closure cap particularly adapted for press-on application and subsequent removal by rotation, said closure cap comprising a shell having a top panel portion and a skirt portion, a layer of gasket material lining said shell around said skirt and a part of said top panel portions and being secured thereto, said gasket material having a radially facing circumferential surface formed with a plurality of circumferentially spaced radially projecting ribs, said ribs extending upwardly at an angle to said skirt portion prior to initial application to a container finish, and adapted for reformable interference with the threads on a container finish during application thereto, said radially projecting ribs being thicker adjacent said top panel than adjacent a lower end of said skirt portion and being deformed in and around the threads on a container finish after application thereto to provide increased surface area for cannning off of said closure cap on rotation relative to said container finish.

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DONALD F. NORTON, Primary Examiner.