ABSTRACT OF THE DISCLOSURE

A tamper-proof container, sealed by means of a turn-off type cap. The cap includes a separable ring at the lower end of the skirt. The ring is connected to the skirt by circumferentially spaced frangible bridges. When the cap is turned for removal, the frangible bridges break, resulting in a free fall of the ring until it audibly strikes a large diameter neck or shoulder portion of the container to audibly and visually indicate the breaking of the seal.

BACKGROUND OF THE INVENTION

Field of the invention

The invention is in the general field of packaging, and in particular, in the field of packaging food products in hermetically sealed containers. Many food products and liquors are commonly packaged in glass containers that are hermetically sealed by means of turn-off type closure caps. In order to assure a purchaser that the package has not been previously opened, tamper-proof closures have been developed. Such tamper-proof closures are gaining acceptance in the packaging of such products as casks, sauces and syrups, and may shortly extend into the packaging of many other food and even non-food products.

The invention provides new and novel improvements in a specific type of tamper-proof, turn-off container closure construction that is in widespread use.

The prior art

Tamper-proof packages of the specific type under consideration include a container, usually made of glass, such as a bottle or jar, and a turn-off type metallic closure cap that is in engagement with inclined surfaces, such as the surfaces of threads on the container finish portion adjacent the container mouth opening. The cap includes a separable ring at the lower end of the skirt which is connected to the skirt by circumferentially spaced frangible bridges. Cooperating means are provided on the separable ring and container finish which provide detents to prevent the ring from rotating when the cap is turned for removal. The turning of the cap creates shearing forces acting on the frangible bridges resulting in the rupture of the bridges and the separation of the ring from the upper cap portion.

In early prior art designs still in use, the separable ring, after the breaking of the frangible bridges, remains captive on the container finish, substantially in the same position it was in prior to the breaking of the frangible bridges. It is thus possible for someone to break the seal and remove the cap and afterwards turn the cap back on the container mouth in such a manner so as to realign the fractured frangible bridges, to conceal the fact that the container had been opened, to all but particularly observant prospective purchasers.

In order to make it more apparent that the container was priorly opened, later designs provided for a slight sliding-down of the ring on the container finish subsequent to the breaking of the frangible bridges as shown in the U.S. patent to R. P. Knapp et al., 3,158,278, issued Nov. 24, 1964, and No. 3,235,155, issued to J. D. Duke on Feb. 15, 1966. With this arrangement, when the cap is replaced, it is more readily apparent to a prospective customer that the container was opened, in that the broken ring bridge edges will be spaced apart so that they will be more easily observed. Even though this was an improvement, the prospective customer still has to be rather observant to detect the slight downward sliding of the ring since the ring stays on the container finish in rather close proximity to the replaced upper cap portion and does not rattle against the finish when the container is handled so as to attract a prospective customer's attention.

At the time a customer opens either one of the types of package immediately above described, he may have some indication as to whether the package had been priorly opened. If the package was priorly unopened, it will require a relatively high turning force to fracture the frangible bridges between the separable ring and the upper cap portion. The bridges may be heard to snap and the sudden release in pressure may be felt by the fingers. In the event that the package was priorly opened, there will be no audible signal such as caused by the breaking of the frangible bridges, nor will there be the sudden lessening of the turning force as occurs immediately following the breaking of the bridges. The lack of these signals may be observed by the customer to indicate to him that the package was opened beforehand. However, here again, unless the customer is focusing his attention on the reception of the expected signals, he is apt to miss them.

The combination container and tamper-proof closure construction in accordance with the present invention provides better signals, both visible and audible, at the time of purchase and at the time of opening than is achieved by the aforementioned prior art designs. A good audible signal is provided at the time the package is opened in that the separable ring is permitted to drop free of the finish and free-fall downwardly until it strikes either an enlarged neck or shoulder portion of the container with sufficient impact to make a clearly heard noise. The neck of the container immediately beneath the finish is made substantially smaller than the inside diameter of the separable ring so that when a priorly opened container is removed from the retailer's shelf for purchase or for inspection, the ring is clearly visible since it has dropped a considerable distance away from the top portion of the cap. It will also move about freely on the reduced diameter container neck which attracts the eye and which also results in audible rattling sounds being made by the ring.

Non-tamper-proof caps of modern design having a smooth sidewall or skirt are now widely accepted in the field.

In accordance with the tamper-proof constructions of the prior art, the detents on the separable ring which prevent the ring from rotating during removal of the cap are in the form of embossments pressed into the side of the skirt of the cap.

On the other hand, in accordance with the invention, no such embossed detents in the side of the skirt are necessary; the detents on the cap being hidden from view as the container is normally viewed so that the popular modern unembossed sidewall may be achieved.

A further feature of the present invention not found in prior art designs is that the cooperating detents on the separable ring of the cap on the container finish which prevent turning of the ring are placed in keeping the cap tightly on the finish. This is of particular importance when the cap is of the prest-on turn-off type, such as disclosed in U.S. Patent 3,270,904, issued Sept. 6, 1966, to Charles N. Foster et al. The detents also cooperate when
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the cap is turned for removal to create a downward reaction force on the separable ring to propel the ring downwardly at high velocity against the ring intercepting portion of the container which results in a good audible signal.

SUMMARY OF THE INVENTION

To overcome the problems encountered with the prior art tamper-proof packages, a package in accordance with the present invention includes a plurality of circumferentially spaced apart detents around the container finish. The detents are generally disposed at an angle with respect to the container axis. These detents cooperate with a plurality of detents on the tamper-proof ring to provide resultant generally vertical reaction forces tending to hold the closure cap tightly seated on the container finish.

When the upper portion of the closure cap is rotated, the resultant forces exerted by the surfaces of the detents on the container finish against the surface of the detents on the separable ring are increased and caused to tilt so as to have a horizontal component that prevents the separable ring from rotating. This results in the snapping of the frangible bridges connecting the separable ring to the cap skirt.

In addition, the resultant forces have a vertical component which immediately upon the snapping of the frangible bridges, propels the separable ring downwardly at high velocity.

The neck portion of the container is made so that it is of substantially smaller diameter than the inside diameter of the separable ring. Due to the angled position of the detents on the container finish, and the small diameter container neck, the ring immediately terminates contact with the container and falls freely through the air and it strikes an intercepting container portion considerably below the container finish with substantial impact, to audibly report the breaking of the container seal.

Once the container has been opened, the tamper-proof ring is clearly visibly separated and will rattle about on the container neck when the container is handled so as to audibly report the breaking of the seal to a prospective purchaser.

The broad object of the invention is to provide a package substantially as immediately above described.

More detailed and specific objects will become apparent upon studying the drawings and detailed description of the preferred embodiments to follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a sectional elevation view of a closure cap constructed in accordance with the principles of the invention as it appears prior to its application to a container finish;

FIGURE 2 is a fragmentary portion of a container having a finish adapted to accommodate the cap of FIGURE 1;

FIGURE 3 is a fragmentary enlarged cross-sectional view of the finish of FIGURE 2 with the cap of FIGURE 1 being applied by a capping head, shown fragmentarily, before the curl at the bottom of the skirt of the cap is pressed into engagement with a circumferential bead on the finish;

FIGURE 4 is a view similar to FIGURE 3 with the cap in the fully seated position with the curl being in engagement with a circumferential bead on the finish;

FIGURE 5 is a fragmentary perspective view of a container and cap construction as shown in FIGURES 1-4, illustrating the position of the separable ring resting on the shoulder portion of the container after the container has been opened;

FIGURE 6 is a view similar to FIGURE 4, showing a slightly modified cap construction in which the lower end of the cap skirt is not provided with a curl but is turned under the circumferential bead;

FIGURE 7 is an elevational view, partly broken away, of a modified form of cap shell prior to the application to a container finish;

FIGURE 8 is a fragmentary elevational view of a container having a finish adapted to receive the cap shell of FIGURE 7 thereon;

FIGURE 9 is a fragmentary enlarged cross-sectional view of the container finish of FIGURE 8 with the cap shell of FIGURE 7 being applied thereon and just prior to the formation of embossed thread formations in the side-wall of the cap skirt;

FIGURE 10 is a view similar to FIGURE 9, with the thread formations in the side-wall of the cap skirt having been completed so that the cap is firmly engaged with the container finish and with the curl at the lower end of the cap skirt being in engagement with detents on the container finish; and,

FIGURE 11 is a view similar to FIGURE 10, but showing the separable ring of the cap dropping away from the upper cap portion in a free-fall and just before making audible contact with an enlarged shoulder portion of the container.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGURE 1, the closure cap 10 includes a top panel portion 11 having a shoulder portion 12 forming one margin of a gasket groove 13 while the outer margin is defined by the depending skirt portion 14. The inner circumferential surface 15 of the skirt 14, as well as the gasket groove 13 at the juncture of the skirt and top panel portion, is filled with a layer of flowable plastic-like gasket material 16 for sealing to a container finish and formation of means to facilitate rotational removal of the closure cap. The gasket material may be of the type described in U.S. Patents 2,874,863, issued to Harold W. Unger et al., on Feb. 24, 1959 and 2,841,304, issued to Donald H. Zipper on July 1, 1966, or the equivalent.

The lower edge of skirt 14 is in the form of a separable tamper-proof ring 18 which is connected to the upper skirt portion through a series of frangible bridging portions 19 at spaced intervals. The lower margin of the tamper-proof ring 18 may be curved as at 20.

A fragmentary portion of a container is illustrated at 22 in FIGURE 2, having a necked-in portion 23 defining a neck of the container located directly below the container sealing finish portion 24. The sealing finish portion 24 is provided with a plurality of inclined multi-start threads or camming surfaces 25 which may be constructed in accordance with the teachings of the U.S. patent to C. N. Foster et al., No. 3,270,904, issued Sept. 6, 1966. The lower edge of the sealing finish portion is in the form of a circumferential bead 26 having circumferentially spaced apart detents 27 in the form of hollows in the rounded undersurface of the bead 26.

In FIGURE 3 is illustrated an enlarged half-sectional view of the closure cap of FIGURE 1 being applied to the container finish of FIGURE 2. Capping head 32 presses the closure cap 10 onto the rim 28 of the container finish causing the gasket compound 16 to flow around the multi-start threads 25 creating inclined hollow thread formations or camming surfaces 29 in the gasket compound 16. The details of this feature are fully described in the above-mentioned Foster et al. patent.

Simultaneously with the completion of the press-on motion which applies closure cap 10, punch 33 engages the curl 20 to force it radially inward into contact with the circumferential bead 26 as shown in FIGURE 4. Punch 33 may be continuous or can engage the curl at spaced points around the closure cap depending upon the particular application. In either event, the deformation of the curl 20 radially inward to the position as shown in FIGURE 4 serves to assist in maintaining the closure cap 10 on the container finish 24.
When the curl 20 comes into contact with the circumferential bead 26, it deforms so that portions of the curl 20 fit into the detents 27 with the remaining portions contacting the rounded shoulder portion 35 of the container 22. Upon separating from the cap, the separable ring 18 falls freely through the air a considerable vertical distance before it audibly strikes the enlarged shoulder portion 35 so that it is easily observed by a prospective customer to be separated from the cap. Furthermore, the necked-in portion of the container 23 is considerably smaller than the inside diameter of the ring 18 so that when the container 22 is picked up by a prospective customer and moved about, the separable ring 18 will rattle on the container neck 23 to further indicate that the container is not sealed.

Referring to FIGURE 3, it will be observed that the detents 27 are provided in the undersurface of the circumferential bead 26 and are generally disposed at an angle L from the vertical axis of the container. By so disposing the detents 27, it will be observed in FIGURE 4 that the resultant reaction force F exerted by the surface of a detent 27 of the container against the surface of a detent 34 on the separable ring 18 is generally vertical. Since the reaction force F is nearly vertical, it will have a large vertical component tending to hold the closure cap 10 securely in place on the container 22 so as to maintain the rim 28 securely sealed in the gasket material 16. This is important in that immediately after the closure cap 10 has been pressed onto the sealing finish portion 24, the gasket material 16 is in a relatively soft or pliable condition and may not be effective to adequately hold the cap in place without the holding action of the curl 20 against the circumferential bead 26 and the hollow detents 27 therein.

As shown in FIGURE 4 the relationship of the cooperating detents 27 on the sealing finish and the detents 34 on the separable ring 18 permit the depending skirt portion of the cap 14 to be free of the usual protuberances found in the prior art tamper-proof constructions. The smooth skirt 14 lends modern styling to the closure cap 10 which provides a competitive edge in sales appeal.

In view of the fact that the closure cap 10 would be adequately maintained in place on the container 22, without the provision of the detents 27 on the circumferential bead 26, the main purpose of the detents 27 cooperating with the detents 34 on the separable ring 18 is to prevent the ring 18 from rotating when the closure cap 10 is being turned for removal. By thus preventing the separable ring 18 from turning, shearing stresses are set up in the frangible bridging portions 19 which connect the separable skirt portion of the cap 10 from the upper portion of the cap indicated at 36. The shearing stresses in the bridging portions 19 result in the fracture of the bridging portions 19 and the separation of the ring 18 from the upper cap portion 36.

Since the closure cap 10 is rotated in a counter-clockwise direction for removal, the resultant reaction force F of the closure cap 10 against the detents 34 will be of increased magnitude and will tilt in a clockwise direction so as to be about as illustrated in FIGURE 2 during removal of the upper cap portion. It will be noted that the force F has a horizontal component Fx and a vertical component Fy which are approximately equal in magnitude. The horizontal component Fx is responsible for preventing the rotation of the separable ring 18 on the sealing finish during the removal of the upper cap portion 36. On the other hand, the vertical component Fy causes the separable ring 18 to be propelled downwardly with considerable force at the instant the frangible bridging portions snap, resulting in the ring 18 striking the shoulder portion 35 with sufficient force to provide an audible report that the sealed container was not priorly opened.

It will be observed that the position and the design of the detents 27 and cooperating detents 34 permit the ring 18 to immediately fall free of engagement with the container finish upon the rupture or snapping of the bridging portions 19. In prior art designs, the tamper-proof ring merely slides down on the container finish rather than being forcefully propelled downwardly and away from the finish in accordance with the present invention.

In FIGURE 6 is depicted a modified version of the cap 10 which is indicated generally at 10' applied to the container 22. The cap 10' is similar in all respects to the cap 10 with the exception of the elimination of the curl 20 on the separable ring 18, and prime numerals have therefore been employed to indicate the portions of the cap 10' that have the same designation as respective similar numerals used in the description of the cap 10.

Instead of the curl 20' being provided with a curl such as the curl 20 of the cap 10, the skirt portion adjacent the marginal edge indicated at 37 at the bottom of the depending skirt portion 14' is merely turned inwardly under the circumferential bead 26 and pressed into the hollow detents 27 so as to form the detents 34' on the separable ring 18' which prevent the separable ring 18' from rotating upon turning of the upper cap portion 36' during removal thereof. The detents 34' are contiguous with the marginal edge 37.

It will be noted that the cap 10' has most of the important features provided by the cap 10. For instance, the depending skirt portion 14' is smooth and free of normally visible protuberances in keeping with the modern design concepts.

Although in the cap 10 the detents 27 and 34 are completely hidden from view only the smoothly rounded curl 20 being visible to the customer, the detents 34' are substantially hidden from view as the cap 10' on a container 22 would normally be viewed on a retailer's shelf. Similarly, the marginal edge 34', although not completely hidden from view from all angles of observation, is substantially hidden from view as the cap 10' is normally viewed on the retailer's shelf.

In FIGURE 7 is depicted a modified form of closure shell made in accordance with the invention and indicated at 38. The closure shell 38 is adapted to be applied to the sealing finish 40 of a container 41 partially depicted in FIGURE 8.

The closure shell 38 has a top panel portion 42 and a depending skirt portion 43 at the marginal edge of the top panel. A separable tamper-proof ring 44 is provided around the circumference of the lower end of the depending skirt portion and is connected by means of a plurality of frangible bridging portions 45 to the upper cap portion 46. At the lower extremity of the tamper-proof ring 44 is provided a circumferential curl indicated at 47. A suitable gasket 48 is provided in contiguous relationship with the interior of the top panel portion 42 for sealing on the upper rim 51 of the sealing finish 40 of the container 41.

Container 41 is provided with a continuous inclined thread formation 52 on the sealing finish 40. The lower end of the finish 40 of the circumferential bead 53 having disposed on an undersurface thereof a plurality of detents in the form of raised protuberances or beads indicated at 54. Protuberances or beads 54 blend into the container neck 55. Container neck 55 is of reduced diameter and extends downwardly at reduced diameter until it blends into the shoulder 56.

It will be observed that the closure shell 38 illustrated in FIGURE 7 does not have thread formations in the depending skirt portion 43 before it is applied to the container 41. As seen in FIGURE 9, the shell 38 is merely
placed over the sealing finish 40 in the initial stage of application. Once the shell 38 has been placed as in FIGURE 9, the depending skirt portion 43 is rolled about the periphery thereof so as to form an embossed thread formation 57 therein over the thread formation 52 on the container finish as seen in FIGURE 10.

At the same time the thread formation 57 is being rolled into the skirt 43 in a manner well known in the art, the circumferential curl 47 of the separable ring 44 is similarly rolled inwards until portions thereof engage the beads 54. Curl 47 deforms where it comes into contact with the beads 54 to form detents therein indicated at 58 that fit around the beads 54 to provide engaging surfaces that cooperate to retain the tamper-proof ring 44 against rotating.

With reference to FIGURE 11, it will be seen that when the upper cap portion 46 is turned counter-clockwise to open the container 41, the bead detents 54 cooperate with the formed detents 58 in the separable ring 44, hold the separable ring against rotation, permitting shearing forces to be set up in the frangible bridging portions 45, causing the frangible bridging portions to snap with the result that the separable ring is propelled vertically downward in a free fall, as previously explained, until it audibly strikes the enlarged shoulder portion 56 to signal the person opening the container that the container was not priorly opened.

As will be observed in FIGURE 9, the detents or beads 54 are disposed along the undersurface of the bead 53 and at an angle L' from the vertical axis of the container. With this disposition of beads 54, the reaction forces Fy of one of which is shown in FIGURE 10, of the beads against the detents 58, will have a vertical component of a large magnitude since the forces Fy will be substantially vertically disposed. The force Fy thus aids in holding the closure 38 tightly seated on the container finish.

As viewed in FIGURE 8, the counter-clockwise turning of the closure during removal causes the reaction of force Fy of the individual bead 54 against the individual detent 58 to increase in magnitude and to be tilted in a clockwise direction so as to have a horizontal component F'x as well as a vertical component F'y. As previously explained, the horizontal component F'x resists the tendency of the tamper-proof ring 44 to turn which results in shearing forces being set up in the frangible bridging portions 45, causing the bridging portions 45 to snap, releasing the tamper-proof ring 44. The vertical component of the reaction force Fy, namely, F'y, exerts a downward force on the ring 44 which causes the ring 44 to be rapidly propelled downward immediately upon the snapping of the bridging portions 45.

As in the previously described embodiments, the separable ring 44 immediately drops free of the container finish 40 and free-falls a considerable distance through the air before striking the enlarged shoulder portion 56. Due to the ring being propelled downward at relatively high velocity as a result of the vertical force F'y, the ring will strike the shoulder 56 with considerable impact resulting in an easily heard signal being produced to indicate to the person opening the container that it was not previously opened.

Assuming the container 41 is on the shelf of the retailer and was previously opened, the separable ring 44 will be positioned on the shelf of the container a considerable distance below the upper cap portion 46 where it is readily observed as being separated by prospective purchasers. Furthermore, the neck 55 being of reduced diameter as compared to the inside diameter of the tamper-proof ring 44, will permit rattling and free-swinging of the ring on the neck 55 when a prospective purchaser handles the container 41 so as to additionally audibly and visually indicate that the container was priorly opened.

It is to be understood that the bead-type detents 54 may be substituted for the hollowed-out type detents 27 and 75 used in cooperation with the closure caps 10 and 10' of FIGURES 1-6. Similarly the hollowed-out detents 27 may be used in lieu of the bead type detents 54 in the embodiment of the invention illustrated in FIGURES 7-11.

Upon the consideration of the foregoing, it will become obvious to those skilled in the art that various other modifications may be made without departing from the invention embodied herein.

The invention that is claimed is:

1. A tamper-proof package comprising:
   a container having a circumferential sealing finish;
   inclined cammed surfaces on said circumferential sealing finish;
   a sealing rim at the upper end of said circumferential sealing finish;
   a plurality of detent means circumferentially spaced apart around the lower end of said circumferential sealing finish and extending generally downward therefrom;
   a reduced diameter neck portion connected to said sealing finish and being substantially smaller in diameter than any part of said circumferential sealing finish;
   a wider diameter container portion connected to said reduced diameter neck portion;
   a closure cap adapted to be received over said sealing finish;
   said closure cap comprising:
     an upper portion having
     a top panel of a size to cover said upper end of said sealing finish; and
     a depending skirt integrally connected to the marginal edge of said top panel;
   inclined camming surfaces on said skirt adapted to engage said sealing finish inclined camming surfaces whereby said surfaces urge said cap upwardly when said upper portion of said cap is rotated for removal;
   a tamper-proof ring forming the bottom margin of said skirt, and being somewhat larger in internal diameter than the outside diameter of said circumferential sealing finish and of said plurality of detent means spaced around the circumferential sealing finish;
   spaced bridging portions joining said tamper-proof ring to the upper cap portion of said skirt;
   a plurality of detent means in said separable tamper-proof ring bridging surfaces that normally engage surfaces of said detent means on said sealing finish so that forces having a vertical component may be developed when said cap is fully on said container and said surfaces are in opposition and said cap detent means is pressed against said sealing finish detent means with great force when said cap is turned whereby said separable ring is propelled downward in a free fall when said spaced bridging portions are broken and said separable ring impinges on said enlarged container portion to give an audible signal.

2. A tamper-proof package as set forth in claim 1 further characterized in that said tamper-proof ring includes a curl at the lower end with said detents in said tamper-proof ring being formed in an interiorly disposed portion of said curl where they are hidden from view.

3. A tamper-proof package as set forth in claim 1 further characterized in that said tamper-proof ring includes an inwardly turned in marginal edge at the lower end with said detents in said tamper-proof ring being contiguous with said turned in marginal edge so as to be substantially hidden from view.

4. A tamper-proof package as set forth in claim 2 further characterized in that said flowable plastic-like material is provided along the interior of said skirt and around the juncture between said skirt and top panel; said flowable material flowing about said inclined camming surfaces on said container finish when said cap is pressed in place to form said camming surfaces on said upper
cap portion and to provide a gasket on which said sealing rim seats.

5. A tamper-proof package as set forth in claim 3 further characterized in that a flowable plastic-like material is provided along the interior of said skirt and around the juncture between said skirt and top panel; said flowable material flowing about said inclined camming surfaces on said container finish when said cap is pressed in place to form said camming surfaces on said upper cap portion and to provide a gasket on which said sealing rim seats.

6. A tamper-proof package as set forth in claim 2 further characterized in that said camming surfaces on said closure cap are in the form of embossed deformations in said depending skirt.

7. A tamper-proof package as set forth in claim 2 further characterized in that said sealing finish includes a circumferential bead around the said lower end thereof with said detents being provided along an undersurface of said bead.

8. A tamper-proof package as set forth in claim 7 further characterized in that said detents on said sealing finish are in the form of hollows in said circumferential bead undersurface,

9. A tamper-proof package as set forth in claim 7 further characterized in that said detents on said sealing finish are protuberances in the form of beads projecting from said circumferential bead undersurface.

10. A tamper-proof package as set forth in claim 3 further characterized in that said sealing finish includes a circumferential bead around said lower end thereof with said detents being in the form of hollows in said circumferential bead undersurface.

11. A tamper-proof package as set forth in claim 10 further characterized in that a flowable plastic-like material is provided along the interior of said skirt and around the juncture between said skirt and top panel; said flowable material flowing about said inclined camming surfaces on said container finish when said cap is pressed in place to form said camming surfaces on said upper cap portion and to provide a gasket on which said sealing rim seats.

12. A tamper-proof package as set forth in claim 6 further characterized in that said sealing finish includes a circumferential bead around the said lower end thereof with said detents being provided along an undersurface of said bead.

13. A tamper-proof package as set forth in claim 12 further characterized in that said detents on said sealing finish are protuberances in the form of beads projecting from said circumferential bead undersurface.

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