CONTAINER CLOSURE AND A METHOD OF SECURING THE SAME TO A CONTAINER

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ABSTRACT OF THE DISCLOSURE

Various modifications of container closure fittings, closure assemblies and container-closure packages are provided that are characterized by an enclosing metallic fitting to be secured, and secured, to a container that has a stiffened involute inwardly curved terminal skirt bead joined to the fitting skirt by a sharp bend, which bead upon being permanently constricted by pressure applied inwardly and circumferentially simultaneously becomes the sole substantial securing restraint in affixation of the closure to a container or causes the skirt material immediately adjoining the bead to move inwardly to form a closure securing rib so maintained by the restraint imposed by the constricted fitting bead. A method of affixation of the closure fittings and closure assemblies is also provided.

Background of the invention

Closure members or fittings are known which are to be secured to a container having an outwardly projecting circumferential shoulder or bead formation adjacent the entrance mouth of the container by permanent deformation and constriction of a circumferential bead forming the bottom of the closure fitting skirt to a closure restraining and securing location relative to the closure retaining bead of the container. A circumferential closure fitting bead formation is likewise known in which the bead is hollow and inwardly curved more than a complete turn of the fitting material to prevent uncurling during bead deformation. There has been recognition that it is advantageous to stiffen an approximately half arcuate bead of inwardly turned structure by sharp bend at the junction of a flat bead shoulder and a flared fitting skirt.

An assembly of a frangible closure fitting and an inner cup-shaped plastic liner and reclosure to be secured by deformation of a fitting skirt bead is known, together with securing to a container being affected by simultaneous circumferential pressure applied to the bead, as by a sleeve member with an inwardly tapered throat.

The foregoing background may be found in United States Letters Patent Nos. 2,961,109 and 3,104,773. In addition various lever devices attached to closure members in association with weakened portions for tearing removal of the weakened portions by digital use of the lever devices are now too numerous to require identification by recital of specific patents.

Specification

This invention in its various respects, as will be described later, concerns closure fittings made from permanently deformable sheet material, preferably thin aluminum or aluminum alloy sheet, characterized first by an improved circumferential hollow inwardly curved bead at the bottom of the fitting skirt and the nature of the junction of bead and skirt for securing to a container by permanent constricting of the bead to effect securing relationship of the fitting with an outwardly projecting closure retaining shoulder adjacent the container opening. A closure fitting as used herein may have both a complete top and skirt or may have an interior top portion removed so that the fitting serves as a top flanged retaining band.

It is a primary object that the fitting bead and its junction with the fitting skirt be particularly adapted to provide secure affixation of closures to containers by restraint maintained by the bead when deformed and constricted in appropriate location on a container base to inwardly directed circumferential pressure applied simultaneously around the outer surface of the bead so that removal of the affixed closure requires rupture, destruction, elongation or severance beyond the elastic limit of the closure material.

It is a further object to accomplish the foregoing purpose by providing a closure fitting bead that is sufficiently stiffened by the extent of involute inwardly curling and sharpness of bend at the junction of the bead and the fitting skirt that constriction of the bead during affixation of the fitting will cause either the bead and adjoining skirt material to move inwardly to form a rib cooperating in securing relationship with the closure retaining shoulder of the container, or the bead itself to establish such securing relationship.

Additional objects concern the employment of the fitting bead structure and the nature of its joinder to the fitting skirt with additional elements of container closure structures to provide numerous new and improved closure fittings, closure assemblies and packages, as will be understood from the following description and references to the appended illustrations, in which:

FIG. 1 is a perspective view of a closure fitting with a pull tab affixed thereto;
FIG. 2 is a plan view illustrating a scored blank from which the closure fitting in FIG. 1 may be formed;
FIG. 3 is an enlarged, fragmentary, vertical view representative of a cross-section through the skirt of the closure fitting in FIG. 1;
FIG. 4 is a vertical view of the closure fitting in FIG. 1 and a cup-like liner for the closure fitting, showing both members in partial cross-section;
FIG. 5 is an enlarged, fragmentary, vertical, cross-sectional view of a mouth of a container suitable for use with the closure fitting of FIG. 1;
FIG. 6 is an enlarged, fragmentary, vertical cross-sectional view of the closure fitting and liner of FIG. 4 in position within a sealing head prior to effecting securement to the container;
FIG. 7 is an enlarged, fragmentary, vertical, cross-sectional view similar to FIG. 6 following securement of the closure fitting and liner on the container;
FIG. 8 is an enlarged, fragmentary, vertical cross-sectional view of a closure assembly with opening of the tear strip initiated;
FIG. 9 is a perspective view of the closure assembly on a container with the tear strip torn open;
FIG. 10 is an enlarged, fragmentary, vertical cross-sectional view showing the container assembly of FIG. 7 after removal of the closure fitting;
FIG. 11 is an enlarged, fragmentary, vertical cross-section of another embodiment of a closure;
FIG. 12 is an enlarged, fragmentary, vertical cross-section of the closure of FIG. 11 loosely supported upon and surrounding a container entrance mouth in position within a suitable sealing head prior to effecting securement;
FIG. 13 is an enlarged, fragmentary, vertical cross-sectional view similar to FIG. 12 following securement of the closure on the container of another embodiment of a closure;
FIG. 15 is an enlarged, fragmentary, vertical cross-sectional view of the mouth of a container suitable for assembly with the closure of FIG. 14;

FIG. 16 is an enlarged, fragmentary, vertical cross-sectional view of the closure of FIG. 14 loosely supported upon the overlying container of FIG. 15 in position within a suitable sealing head prior to effecting securement;

FIG. 17 is an enlarged, fragmentary, vertical cross-sectional view similar to FIG. 16 showing the closure securing affixation to the underlying container;

FIGS. 18 and 19 represent fragmentary views similar to FIGS. 6 and 7 with a modification thereof; and

FIG. 20 is an enlarged, fragmentary, vertical cross-sectional view of another embodiment of a closure fitment.

In the several illustrations appended hereto, a closure fitment has been selected in the form of a permanently deformable, drawn, metallic shell having a top portion for disposition over the entrance mouth of a container and a depending skirt terminating in a circumferential hollow bead, and in one embodiment with a tear strip divisive of the closure to facilitate its removal by manual use of a pull tab affixed to the tear strip. A sealing gasket or liner of conventional resilient plastic material is inserted transversely within the closure fitment and may be any one of several types, such as a "flowed-in" plastic layer; a suitable form cut from a sheet of natural or synthetic rubber; or a liner made in the form of a molded resilient skirted plastic reclosure element. The container has been illustrated as a rigid glass jar, bottle, or the like, but may be selected in any conventional equivalent form, such as a metallic drum having a side or end bung opening; or a resilient plastic throw-away type container in which later case metallic closure fitment could, if desired, be securely affixed against the resilient plastic entrance mouth configuration of the container without the necessity of a compressible gasket or liner interposed therebetween.

Referring now to the illustrations, FIG. 1 is representative of a closure fitment 10 formed from sheet metal or other permanently deformable material, and preferably from sheet aluminum, which is adapted to be secured over the entrance mouth of a container. Closure fitment 10 is comprised of an inwardly directed top portion 12 with a recessed central panel 14 therein and a raised rim 16 therearound, and with a depending skirt 18 terminating in an outwardly extending circumferentially inwardly curved hollow bead 20. The closure fitment 10 is weakened or scored along line 22 to form or define a tear strip 24 divisive of the fitment top from a starting location towards the periphery of the top relative to its center to a generally opposite location, and from there divisive of the closure fitment along one side of the tear strip 24 all the way to the edge of the sheet material of the closure, and along the other side of the tear strip 24 to a location short of the edge of the sheet material leaving a bridge or ligament of unscored metal between its end and the bottom of the skirt 18.

Pull tab 26 is affixed to the tear strip 24 in its starting end by rivet 28. Pull tab 26 is preferably of the reverse acting, double lever, ring type having a rigid tab body and a tongue 30, for affixation of the rivet 28, which is preferably bendable at its junction with the tab body. As best seen in FIG. 8, pull tab 26 is preferably formed from sheet material which has a curved edge to provide a rigid lever with tongue 30 extending therefrom within the ring. As affixed to the tear strip 24, pull tab 26 lies substantially flush with the surface of the recessed central panel 14. The recessed central panel thereby provides clearance or accommodation for the tab 26 so that its upper surface and its means of affixation are not higher than the top of the rim 16 of the closure. The easy opening structure is thereby protected from accidental opening or fracture of the score lines while on a container, and the closures are readily stackable.

Closure fitment 10 is also weakened or scored as by indentation outwardly of and adjacent to the starting location or end of the tear strip 24 by means of score line 32. Score line 32 is preferably located approximately opposite the skirt portion of the tear strip 24, and extends from adjacent the point of affixation of the tab 26 to the tear strip outwardly and into this closure strip but preferably ends short of the bottom edge of the skirt 18 to leave a bridge or ligament of unscored metal to serve as a hinge for spreading the closure sectors and removal of the closure from a container (FIG. 9).

FIG. 2 is representative of a scored rim 34 from which the closure fitment of FIG. 1 may be formed, and shows the bridge of metal at the end of score line 32 as well as the bridge of metal between the end of the short leg of score line 22 and the edge of the sheet material from which the closure fitment is formed. Preferably, score line 22 is bi-chordal in nature of the chord that defines the tear strip all the way to the edge of the sheet material is substantially parallel to a diametrical line through the center of starting end of the tear strip and the center of the blank. The chord of the score line 22 which terminates short of the edge of the sheet metal diverges from the tangent line and may be any one of several types of the tear strip towards the edge of the sheet material. The tear strip 24 defined by score line 22 is thereby angled towards the bridge of metal between the end of the short side of the score line and the edge of the sheet material so that there will be less likelihood of shearing of this bridge during removal of the closure from the container.

A new and improved feature of the closure fitment 10 is concerned with the lower terminal circumferential bead configuration 20 as shown in FIG. 3. Bead 20 of small outside dimension is formed, preferably by a known circumferentially simultaneous edge curving practice, from a stepped extension of the initially drawn skirt 18. As initially drawn, the skirt 18 extends vertically downwardly from the top portion 12 of the closure with an intermediate outwardly extending horizontal step therein. In this form, the vertical terminal bead 20 of the skirt 18 extends as shown by the dotted portion 36 in FIG. 3. This terminal end 36 is then curled or rolled to form bead 20. Bead 20 projects radially outwardly from the skirt portion adjacent to above it to provide preferably a generally flat annular rim 38 that is inwardly connected by a sharp or "tight" bend 40 to the skirt 18 extending inwardly involutely curled bead of curvilinear and transversely hollow form having a terminal outwardly directed end portion or sector 42. The end portion or sector 42 has sufficient length that the bead 20 is turned substantially more than 360° from the bend 40 and preferably underlies not only the generally flat annular rim 38, but also part of the downwardly curvilinear portion beyond such rim. Terminal bead sector 42 also preferably contacts substantially coextensively the undersurface of the bead that it underlies. The inner or enclosing curvilinear surface 44 of the bead 20 is preferably located tangential to an extended plane of the inner wall surface of the depending skirt 18. As to outside dimension, the bead 20 should be small. In minimum respect small means a hollow bead able to further curl within itself in response to circumferential pressure, rather than a solidly curled bead. In maximum respect small means an outside dimension of about seven to eight times the nominal gage of the fitment sheet material.

Reliable attainment of the made in place closure affixation through construction of the bead 20, as is later described, requires the stiffness obtained from the sharpness of bend 40 augmented by the double gage thickness described above and, where overall dimensions permit, by the preferable inclusion of the rim 38, however, narrow the latter may be. The radius of the sharp bend 40
as a practical matter should be such that the radius of the arc of the central portion of the bend does not change materially in the affixed closure. In general, the radius to be used is that of approximately the minimum bend radius for the gage of metal of the closure fitment which will not result in fracture of the skirt at bend 40 in making the bend. As will be readily understood, such a radius expressed numerically will depend upon the composition, thickness and temper of the material. In the instance of forming bend 40 of approximately 0.050 inch diameter in an aluminum sheet alloy known in the Aluminum Association (U.S.A.) nomenclature as 3105 alloy of a hard rolled temper known as H-19 and of nominal 0.009 inch gage, a sharp radius of about 0.012 inch has been used satisfactorily. In respect of the double gage thickness of bead 20, the bead preferably is turned to provide 11/4 to 1/2 times its transverse enclosing circumference.

In FIG. 4 the closure fitment 10 and a liner 50 for use with the closure fitment 10 are seen in partial cross section. Liner 50 may be formed from any of a variety of materials that will provide the desirable gasketing qualities and resilience with reasonable stiffness, of which rubber, paper, cardboard, and the synthetic plastics such as polyethylene, polypropylene and polyvinyl chloride are non-limiting examples. The liner 50 has a top, with a recessed central panel 52 therein and a raised channel 54, 56 similar to closure fitment 10 and is designed to fit or nest in fitment 10. Preferably, on meeting within the closure fitment, the liner 50 is retained or secured within the fitment by an interference fit therewith so that the assembly will not accidentally separate during routine handling prior to affixation of the assembly to a container. The skirt 56 of the liner 50 is dimensioned so that it will extend below bead 20 on the fitment skirt 18 and preferably terminates in an outwardly extending flange 58 that aids in grasping the liner 50 for removal from a container. The liner skirt 56 preferably has a slight bevel on its inner surface corresponding to an opposed negative draft on the outer sealing surface of the container top to which it is to be secured to improve the side seal therebetween.

The container mouth entrance illustrated in FIG. 5 is representative of structure suitable for affixation of the closure fitment 10 and liner 50 and its equivalent. It will be observed that its structure provides an entrance mouth 62 defined by an outwardly projecting closure securing bead 64 having an upwardly facing sealing surface 66, a laterally facing side sealing surface 68, and a shoulder having an undersurface 70 blending into the container wall 72 therebelow.

FIG. 6 illustrates an assembly of the closure fitment 10 and liner 50 of FIG. 4 loosely supported upon the container mouth entrance of FIG. 5 in position within the cavity of a sealing head 74. It is noted, that the bead 20 on the closure fitment skirt 18 is located at approximately the same vertical plane as the undersurface 70 on the container entrance mouth 62. The sealing head 74 comprises a central pressure-applying block 76, engageable against at least the upwardly facing surface of the rim 16 of the closure fitment 10, and a surrounding relatively movable sleeve element 78 provided with a lower minimal upwardly converging throat 80.

With the sealing head 74, as illustrated in FIG. 6, relative movement of the central pressure block 76 towards the upwardly facing top of the closure fitment 10 compressibly and/or resiliently reduces somewhat the thickness of the liner 50 into sealing contact against the upwardly facing sealing surface 66 of the underlying container, and effects lateral side sealing against the outer sealing surface 68. It is noted that the horizontal component of the force produced by the draft on the container's outer sealing surface 68 and the inner surface of the liner skirt 56 enhances this side sealing.

Relative movement of the surrounding sleeve 78, with the upwardly converging throat 80 thereof in circumferential contact against the outer surface of the inwardly curved bead 20 reacts to apply pressure circumferentially simultaneously around the bead 20 to inwardly deform and constrict it and concomitantly to move inwardly and impress the sharp bend 40 so that it becomes the most inwardly impressed portion of circumferential rib 46 in the fitment skirt.

In explanation of the transformation of the circumferential bead 20 from that of FIG. 6 to that of FIG. 7, coupled with the development of the inwardly impressed rib 46, the simultaneously applied inwardly directed pressure around the outer circumference of the bead 20 by the tapered throat 80 reacts to compressively constrict and permanently transform the bead 20 by further curling and resulting tightening of the same. To this end, the sharpness of the bend 40 augmented by the double gauge thickness of the material of the bead structure 20 and, where overall dimensions permit, by the preferable inclusion of the rim 38, provide requisite stiffness immediately adjacent and below the sharp bend 40 in the skirt of the closure fitment in opposition to the resistance of the container surface opposite to the lip of the fitment skirt to prevent mere collapse of the bead 20 and to cause the formation of rib 46. The reformed bead 20, as shown in FIG. 7, is slightly and permanently transformed into a generally elliptical transverse cross-sectional configuration with its major axis generally parallel to the axis of the container from its original cross-section as shown in FIG. 6. This occurs without substantial change in the maximum outside dimensions of bead 20, and without substantial change in the location at which the end portion 42 of bead 20 begins to tightly underlie the inner wall surface of such bead, that location being near the junction of the inner wall surface of the bead and the skirt portion above it. It will be observed also from FIG. 7 that the displacement inwardly of the bend 40 is accompanied by inward bending of a short length of the skirt immediately above it to form the entire rib 46.

In a container sealed with a closure fitment and liner as shown in FIGS. 7 and 8, the permanently deformed, reformed and constricted fitment bead 20 is the primary or substantially sole closure affixing element by reason of having been displaced to remove restraining location beneath the container shoulder 70 with the liner skirt 56 tightly and sealingly compressed and locked between the inner surface of the container shoulder. In such embodiment, as distinguished from embodiments later described, the rib 46 serves little, if any, purpose to affix the closure fitment to the container, but does serve to improve the seal between the affixed closure assembly and the container surface 68.

In the embodiment of a closure and container shown in FIGS. 7 and 8, the permanently deformed, reformed and constricted fitment bead 20 is the primary or substantially sole closure affixing element by reason of having been displaced to remove restraining location beneath the container shoulder 70 with the liner skirt 56 tightly and sealingly compressed and locked between the inner surface of the container shoulder. In such embodiment, as distinguished from embodiments later described, the rib 46 serves little, if any, purpose to affix the closure fitment to the container, but does serve to improve the seal between the affixed closure assembly and the container surface 68.

FIG. 9 shows the container 90 and closure 92 as illustrated in FIG. 7 having the edge seal 94 secured to the rim 16 of the closure 92. The edge seal 94 may be preferably of the silicon rubber type and is bonded or otherwise secured to the rim 16 of the closure 92. In general, the edge seal 94 may be bonded to the rim 16 of the closure 92 by a suitable adhesive. The above described embodiment of the container closure and container is preferably used to seal containers of the type described in U.S. Pat. No. 3,278,205, the specification and drawings of which are hereby incorporated herein by reference. In the above described embodiment of the container closure and container, the edge seal material is bonded to the rim 16 of the closure 92. In the above described embodiment of the container closure and container, the edge seal material is bonded to the rim 16 of the closure 92. In the above described embodiment of the container closure and container, the edge seal material is bonded to the rim 16 of the closure 92.
tion, namely, resistance of the liner top to the downward shearing to be initiated and damage to the liner top in initiation of such shearing.

After the initial rupture of the end of the score line as shown in FIG. 8, continued pulling of the tab 26 ruptures score line 32 along both sides of the tab and into the closure skirt (FIG. 9). The tearing stops at the end of the short leg of scoring along one side of the tear strip 24 but continues along the length of the other leg of scoring which extends all the way to the edge of the skirt to convert the closure into a unitary, partly split member with the tear strip attached to the skirt of the closure by a ligament or bridge of metal between the end of the short leg of scoring and the bottom of the skirt. This results in confronting ends of the severed sectors of the closure. Spreading such confronting ends will rupture the single score line 32 adjacent the starting end of the tear strip and cause hinge-like opening of the closure sectors as shown in FIG. 9 without dismemberment of the closure. By making the skirt hinge bridge suitably weak and the tear strip bridge suitably strong, the spreading may be done by further pulling of the tab to move the closure sector to which it remains attached far enough away from the opposite closure sector to permit easy removal of the severed closure.

Upon removal of the closure fitting, the underlying liner 50 remains secured over the container mouth entrance 62, as shown in FIG. 10, by the inwardly projecting rib 82. Rib 82 is formed by the permanent deformation of the liner 50 upon construction of the closure bead 20 in compression of the liner skirt 56 against the container bead 64. Liners made of plastics such as polyethylene and polypropylene are exemplary of materials that will deform by cold plastic deformation in the manner described to form a suitable rib for any given closure purposes. The inherent flexibility or resilience of the liner 50 makes it a simple matter to pull or pry off the liner manually. Reclamping the container is effected by merely snapping the liner 50 and its rib 82 over the container mouth.

FIG. 11 illustrates a modification of the invention wherein a compressible or resilient gasket 88 is located within the raised channel 96 of the fitting 90. Closure fitting 90 similarly to closure fitting 10 essentially comprises a generally cup-shaped drawn metallic shell having a top with a recessed central panel 94 and a depending skirt section forming in an outwardly extending, circumferential, inwardly curled, hollow bead 100. Bead 100 projects radially outwardly from the skirt portion adjacent above it to provide preferably a generally flat annular rim 102 that is inwardly connected by a sharp or tight bend 104 to the skirt 98, and has a terminal outwardly directed end portion 106 underlying the generally flat annular rim 102. In this respect, the bead 100 is the same as the previously described bead 20 (FIG. 3) in that it is reinforced and stiffened by its sharp bend, substantially flat rim, and underlying terminal portion 106. As with closure fitting 10, the inner or enclosing curvilinear surface 108 of bead 100 is preferably located tangentially to an extended plane of the inner wall surface of the depending skirt 98.

FIG. 12 illustrates an assembly of the closure 90 with gasket 88 therein loosely supported upon a container mouth entrance 100 which is similar to the mouth entrance shown in FIG. 5 in that it has an outwardly projecting closure securing bead 112 with an upwardly facing sealing surface 114, a laterally facing side surface 116, and a shoulder having an under surface 118 blending into the container wall 120 therebelow.

The fitting head 124 comprises a central pressure applying block 126, engageable at least against the upwardly facing surface of the annular rim or flange 96 of the closure fitting 90, and a surrounding relatively movable sleeve element 128 provided with a lower terminal upwardly converging throat 130.
tion 160. The bead 160 is the same as the previously described beads 20 (FIG. 3) and 100 (FIG. 11) in that it is reinforced and stiffened beneath its outwardly projecting upper substantially flat radially projecting rim 158 by an outwardly directed underlying terminal sector 162 of the inwardly curled bead forming material of the depending skirt 154.

The annular entrace mouth configuration illustrated in FIG. 15 receives the closure of FIG. 14 and provides an outwardly projecting circumferential closure securing bead 164 adjacent and defining the mouth entrance 166 to the container. The bead 164, as in the case of the container configuration illustrated in FIG. 5, provides an upwardly facing sealing surface 168, a lateral or side sealing surface 170 and an inwardly directed under surface 172. In addition, and distinguishing from the lateral sealing surface 68 of the container entrance mouth finish or configuration of FIG. 5, an inwardly depressed circumferential groove 174 is provided in the lateral or side sealing surface 170 of the container finish of FIG. 15 for accommodating the inwardly directed rib 148 on the inner surface of the depending skirt 146 of the aforementioned resilient reclosure liner 138.

Reference to FIGS. 16 and 17 illustrate, respectively, initial placement and final affixation and securing of the outer afixation of the outer closure assembly to the container of FIG. 15 by means of the sealing bead 176 in the same manner as previously described in FIGS. 12 and 13.

It will be observed on reference to FIG. 16 (loose placement of the closure fitment in frictional assembly with its reclosure liner on its underlying container) that the inner plastic liner 138 has its inwardly projecting rib 148 disposed within the circumferential groove 174 of the container mouth entrance 166. This is possible because of the resilient nature of the plastic material from which the liner 138 is molded and because of registration of the inwardly projecting rib 148 within the lateral container groove 174 also obtains in the intended use of liner 138 as a reclosure.

In carrying out the closure securing method illustrated in FIG. 17, top pressure applied by the centrally located pressure block 136 against the linearly disposed, upwardly directed, fitment rim portion 152 compresses the underlying liner 138 into sealing engagement against the upwardly directed sealing surface 168 of the container mouth entrance 166. With the top pressure maintained, the outer surrounding sleeve 190 is moved downwardly in response to the linearly extended plane of the diverging circumferential throat surface 182 around the outer exposed surface of the closure bead 160 to apply inwardly directed pressure circumferentially simultaneously around the bead 160 to further inwardly curl the transverse cross-sectional configuration of the bead into a constricted substantially elliptical transverse cross-sectional configuration with attendant inward displacement of a straight wall area of the skirt 154 and bend 156 to form the circumferential rib formation 184 into closure securing affixation of the container closure package of FIG. 17. It will be understood from a comparison of FIGS. 17 and 13 that the completed unitized closure packages are the same in respect to the final closure restraining configuration of the beads 100 and 160 and the permanently inwardly formed ribs 156 and 184.

FIGS. 18 and 19 are illustrative of the practice of the invention similar to that shown in FIGS. 1 through 10 wherein a long skirted liner is frictionally assembled within a metallic closure fitment except that an inwardly projecting circumferential rib in the closure fitment skirt is used as the closure securing structure. A molded resilient plastic liner 186 similar to the liner of FIG. 4 is employed having relatively movably surrounding sleeve 192 which extends downwardly at least to the plane of entrance to the closure fitment 190 overlying the liner 186 frictionally restrained therein. In other respects, the metallic closure fitment 190 is initially configured at the terminal edge of its substantially straight wall depending skirt to provide a sharp bend connection at 194 with an outwardly projecting inwardly curved circumferential hollow bead 196, in the same manner and structure as described above and illustrated in FIGS. 3, 6, 11, 14 and 16.

Comparison of FIGS. 18 and 19 will clearly reveal the reactions developed by the pressing block 198, and relatively movable surrounding sleeve 200 of FIG. 18 with an inner stopping bead 202, to effect compressive sealing of the plastic liner 186 across at least the upwardly facing sealing surface of the container mount entrance 204 underlying the same, effecting inward constricting and permanent transformation of the circumferential bead 196 of the closure fitment 190 as a result of progressive inward movement thereof against the upwardly converging tapered throat 266 of the sleeve 200. As in the case of the embodiments of FIGS. 13 and 17, permanent inward deformation of the circumferential bead 196 develops the permanently inwardly directed closure securing rib 206 thereabove, and the bead 196 provides the same substantial restraint against removal of the closure as in such embodiments.

In this embodiment, as in the embodiment of FIGS. 7, 8 and 10, the interposed depending liner skirt 192 of the liner 186 is also circumferentially permanently inwardly transformed below and in circumferential bearing contact against the under surface 212 of the container bead 210.

FIG. 20 is illustrative of a lower edge of the depending skirt of a closure shell or fitment substitutable for the previously described closure fitments and container closure assemblies, as well as responding to the forming edge of the previously described method of applying closures in accordance with the invention.

In this embodiment of the invention, the closure fitment 214 is initially provided with an outwardly projecting circumferential bead configuration 216 which is of generally involute transverse cross-sectional, as in the case of the previously described bead configurations. The bead 216, however, is curvilinearly contiguous with the sharp bend connection 218 to the substantially straight wall of depending skirt 220 of the fitment 214, and as such, eliminates the substantially fiat configuration of the crescentoid bead configurations 20, 100, 160 and 196. Otherwise, the end portion 222 of the inwardly curled bend 216 underlies and preferably contacts substantially the inner arcuate surface of the bead 216 to provide stiffness to the bead. Moreover, the inner surface 224 of the bead is preferably located at an extended plane of the outer wall surface of the depending fitment skirt 220.

It should be observed that the sleeve element shown herein for deforming and constricting the fitment skirt bead has a circumferentially continuous thread surface, so that the skirt bead in its deformed and constricted condition will have a preferred substantially uniform and continuous cross-sectional shape. It will be understood, however, that the device for applying inward circumferential pressure against the skirt bead need not press against such bead in a wholly continuous circumferential manner in that the bead in restraint shape and location has a sufficiently uniform and continuous cross-sectional shape.

It will be apparent to those versed in the art to which the invention is addressed that the particular embodiments have been selected for purposes of specific illustration and description, and that further will be understood that numerous variations of the structural details of the selected embodiments herein described may be made within the intended scope of the invention without departing from the appended claims. Exemplary of such variations are permanently deformable outer closure shells or fitments thereof, resilient and/or compressible liner or gasket structures effecting top sealing, with or without side sealing against the container sealing surface. The outer affixed closure fitments
may also be manually removable by a variety of conventional closure removing tools which distort the outer closure fitment out of securement on its underlying container; and circularly appropriately weakened tear strip patterns may be incorporated in the outer closure shell fitments having various digitally manipulable gripping tabs associated therewith for removal of the closure fitment of the invention from its underlying container.

What is claimed is:

1. A closure fitment for affixation on a container having an outwardly projecting, closure fitment retaining bead adjacent the entrance mouth of said container, said closure fitment comprising:
   (a) a top portion for disposition over the entrance mouth configuration of the container and a depending skirt having an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end connected inwardly to a substantially straight wall portion of the depending skirt thereabove by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material, and further having the end portion of the inwardly curled bead tightly underlying a substantial length of the inner wall surface of said hollow bead;
   (b) said closure fitment, on disposition over the entrance mouth of said container, being responsive to pressure applied circumferentially simultaneously against said fitment bead, to effect further inward thereof with permanent inward deformation and circumferential constriction thereof into substantial restraint respecting fitment removal from the container.

2. A closure fitment in accordance with claim 1 in which the restraint respecting fitment removal from the container is effected by the transformed fitment bead as the primary fitment securing element in underlying closure fitment securing disposition beneath the container-closure retaining bead.

3. A closure fitment in accordance with claim 1 in which the deformation and constriction of said fitment bead concomitantly effects permanent inward displacement of said sharp bend to form a rib in underlying closure fitment securing disposition beneath the container-closure retaining bead.

4. A closure fitment in accordance with claim 1 having a compressible sealing liner therewith adapted to sealingly bear against a sealable surface of a container entrance mouth underlying the same.

5. A closure fitment in accordance with claim 1 having a compressible sealing liner therewith adapted to sealingly bear against at least an upwardly facing sealable surface of a container entrance mouth underlying the same.

6. A closure fitment for affixation on a container having an outwardly projecting, closure fitment retaining, bead adjacent the entrance mouth of said container, said closure fitment comprising:
   (a) a top portion for disposition over the entrance mouth of the container;
   (b) a depending skirt having an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end;
   (c) said fitment bead having an outwardly extending substantially flat rim inwardly connected to a substantially straight wall portion of the skirt thereabove by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material, and further having the end portion of the inwardly curled bead tightly underlying at least part of said rim; and
   (d) said closure fitment, on disposition over the entrance mouth of said container, being responsive to pressure applied circumferentially simultaneously against said fitment bead to effect further inward curling thereof with permanent inward deformation and circumferential constriction thereof into substantially restraint respecting removal from the container.

7. A closure fitment in accordance with claim 6 in which the restraint respecting fitment removal from the container is effected by the transformed fitment bead as the primary fitment securing element in underlying closure fitment securing disposition beneath the container-closure retaining bead.

8. A closure fitment in accordance with claim 6 in which the deformation and constriction of said fitment bead concomitantly effects permanent inward displacement of said sharp bend to form a rib in underlying closure fitment securing disposition beneath the container-closure retaining bead.

9. A closure fitment in accordance with claim 6 having a compressible sealing liner therewith adapted to sealingly bear against a sealable surface of a container entrance mouth underlying the same.

10. A closure assembly for affixation on a container having an outwardly projecting closure retaining bead adjacent the entrance mouth of the container comprising:
   (a) a closure fitment of sheet material having a top portion and a depending skirt with an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end connected inwardly to a substantially straight wall portion of the depending skirt thereabove by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material, and further having the end portion of the inwardly curled bead tightly underlying a substantial length of the inner wall surface of said hollow bead;
   (b) an inner liner nested in said closure fitment, said liner being made of compressible material and having a top portion and a depending skirt extending at least to the bottom edge of said fitment skirt; and
   (c) said closure assembly on disposition over the entrance mouth of said container being responsive to pressure applied circumferentially simultaneously against said fitment bead to effect further inward curling thereof with permanent inward deformation and circumferential constriction thereof into underlying assembly securing disposition beneath the container-closure retaining bead with the liner compressed therebetween.

11. A closure assembly in accordance with claim 10 in which the fitment bead has an outwardly extending substantially flat rim inwardly connected to the sharp bend.

12. A closure assembly for affixation on a container having an outwardly projecting closure retaining bead adjacent the entrance mouth of the container comprising:
   (a) a closure fitment of sheet material having a top portion and a depending skirt, and having further
      (i) an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end connected inwardly to a substantially straight wall portion of the depending skirt thereby by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material, and further having the end portion of the inwardly curled bead underlying a substantial length of the inner wall surface of said hollow bead,
      (ii) a tear strip defined by weakening in line material adjacent and divisible of the fitment top from a starting location towards the periphery of said top relative to its center to a generally opposite top location and therefrom divisible of the fitment along one side of said tear strip all the way to the edge of the sheet material of the fitment and along the other side of said tear
strip to a location short of the edge of said sheet material, and
(iv) a tab attached to the tear strip near said starting location, for manual manipulation to
rupture the sheet material along the tear strip for nearly complete severance of the tear strip
thereby to convert the fitment into a one-piece partially split member with confronting ends
that may be easily spread apart for release of the partially split member from the container
with the partially severed tear strip attached to one of the two confronting ends of the partially
split member;
(b) an inner liner nested in said closure fitment, said liner being made of compressible material and
having a top portion and a depending skirt extending at least to the bottom edge of said fitment skirt; and
(c) said closure assembly on disposition over the entrance mouth of said container being responsive to
pressure applied circumferentially simultaneously against said fitment bead to effect further inward
curling thereof with permanent inward deformation and circumferential constraint thereof into under-
lying assembly securing disposition beneath the container-closure retaining bead with the liner com-
pressed theretwixt.
13. A closure assembly in accordance with claim 12 in which the closure fitment has a further line of weak-
ening extending peripherally from a location near the starting location of the tear strip to further facilitate
the spreading of the closure fitment in removal.
14. A closure assembly in accordance with claim 12 in which said tab is a lever connected near said starting
location in a tongue integral with the tab and inwardly directed from a tab fulcrum that is located outside said
tear strip starting location.
15. A closure assembly in accordance with claim 12 in which the major portion of said tear strip in the fit-
ment top is divisible along chordal line configurations and in which said tab is a lever connected near said starting
location in a tongue integral with the tab and inwardly directed from a tab fulcrum that is located outside said tear strip starting location.
16. A closure assembly in accordance with claim 12 in which the major portion of said tear strip in the fit-
ment top is divisible along chordal line configurations and in which said tab is a lever connected to said tear strip by a hollow rivet formed in the tear strip near said starting location in a tongue integral with the tab and inwardly directed from a tab fulcrum that is located outside said tear strip starting location.
17. A closure assembly in accordance with claim 12 in which the liner skirt is deformably compressible by
constriction of said fitment bead to form an inwardly disposed rib on the liner skirt to facilitate use of the
liner as a reslosure.
18. A unitary sealed package comprising:
(a) a container having an entrance mouth defined by
an outwardly projecting closure fitment retaining bead adjacent thereto; and
(b) a closure fitment secured to said container and having a top portion and a depending skirt that is secured in overlying relationship to said container bead, the depending skirt being characterized by having at its lower end a circumferential permanently deformed and inwardly displaced hollow bead of generally vertical elliptical cross-section that is inwardly curled with the end portion thereof tightly underlying a substantial length of the inner wall surface of said container, the portion of said container that is located outside所述 tear strip starting location.
19. A unitary sealed package in accordance with claim
18 in which a compressible sealing liner is interposed between at least the container mouth entrance and the closure fitment and the restraint respecting fitment removal from the container is effected by the inwardly displaced fitment bead as the primary fitment securing element in underlying closure fitment securing disposition beneath the container-closure retaining bead.
20. A unitary sealed package comprising:
(a) a container having an entrance mouth defined by
an outwardly projecting closure fitment retaining bead adjacent thereto;
(b) a closure fitment and an enclosed sealing liner secured to said container, said fitment having a top portion and a depending skirt secured in overlying relationship to said container bead; and
(c) the depending skirt of said closure fitment being characterized by having a permanently deformed, circumferential, inwardly directed, securing rib below the closure fitment retaining bead and having below said rib a circumferential, permanently de-
formed, inwardly displaced, inwardly curled, hollow bead with the end portion thereof tightly under-
lying a substantial length of the inner wall surface of said hollow bead, said bead restrainedly maintaining securement and affixation by said se-
curing rib of said closure fitment onto said container.
21. A unitary sealed package comprising:
(a) a container having an entrance mouth defined by
an outwardly projecting closure fitment retaining bead adjacent thereto;
(b) a closure fitment secured to said container, said fitment having a top portion and a depending skirt secured in overlying relationship to said container bead, said closure fitment being characterized by having
(i) a circumferential, permanently deformed, inwardly displaced, inwardly curled, hollow bead with the end portion thereof tightly underlying a substantial length of the inner wall surface of said hollow bead to effect substantial restraint respecting fitment removal from said con-
tainer.
(ii) a tear strip defined by weakening in line config-
uration and divisible of the fitment top from a starting location towards the periphery of said top relative to its center to a generally opposite top location and therefrom divisible of the fitment along one side of said tear strip all the way to the edge of the sheet material of the fitment and along the other side of said tear strip to a location short of the edge of said sheet material, and
(iii) a tab attached to the tear strip near said starting location, for manual manipulation to
rupture the sheet material along the tear strip for nearly complete severance of the tear strip
thereby to convert the fitment into a one-piece partially split member with confronting ends that may be easily spread apart for release of the partially split member from the container with the partially severed tear strip attached to one of the two confronting ends of the parti-
ally split members; and
(c) a compressible sealing liner interposed between the container mouth entrance and the closure fit-
ment and having a top portion and a depending skirt extending at least to the bottom edge of said
fitment skirt.
22. A unitary sealed package in accordance with claim
21 in which said tab is a lever connected to said tear strip near said starting location in a tongue integral with the tab and inwardly directed from a tab fulcrum that is located outside said tear strip starting location.
23. In a method of securingly affixing a closure fitment on a container, the steps comprising:
(a) providing a container having an outwardly pro-
jecting, closure fitment retaining bead adjacent an entrance mouth;
(b) providing a closure fitment enclosing a sealing liner and having a top portion and a depending skirt with an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end connected inwardly to a substantially straight wall portion of the depending skirt thereabove by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material, and further having the end portion of the inwardly curled bead tightly underlying a substantial length of the inner wall surface of said hollow bead;
(c) locating the closure fitment with the top portion thereof overlying the container entrance mouth and with the depending skirt overlying the closure retaining bead of the container; and
(d) applying pressure circumferentially simultaneously against said fitment bead to effect further inward curling thereof and permanent inward deformation and circumferential constriction thereof into substantial restraint respecting fitment removal from the container.

24. In a method in accordance with claim 23 in which said fitment bead has an outwardly extending substantially flat rim portion inwardly connected to said sharp bend, and the fitment bead is transformed into the primary securing element in underlying closure fitment securing disposition beneath the container-closure retaining bead.

25. In a method in accordance with claim 23 in which said fitment bead has an outwardly extending substantially flat rim portion inwardly connected to said sharp bend, and applying said pressure against the fitment bead also effects concomitant inward displacement of said sharp bend to form a rib in underlying closure fitment securing disposition beneath the container-closure retaining bead.

26. In a method of securely affixing on a container a closure fitment having a scaling liner therewithin, the steps comprising:
(a) providing a container having an outwardly projecting closure fitment retaining bead adjacent an entrance mouth;
(b) providing a closure fitment having a top portion and depending skirt with said skirt having an outwardly extending, circumferential, inwardly curled, hollow bead of small outside dimension at its lower end, said bead having an outwardly extending, substantially flat rim inwardly connected to a substantially straight wall portion of the depending skirt by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material and further having the end portion of the inwardly curled bead tightly underlying a substantial length of the inner wall surface of said hollow bead;
(c) providing a liner made of resilient material having a top and a depending skirt extending at least to the bottom of said fitment skirt;
(d) locating the closure fitment with the top portion overlying the container entrance mouth and liner therewithin with the depending skirt of the fitment overlying the closure fitment retaining bead of the container; and
(e) applying pressure simultaneously against the fitment bead to effect further inward curling thereof with permanent inward deformation and in circumferential constriction thereof into underlying closure securing disposition beneath the container-closure retaining bead with the liner compressed therebetween.

27. In a method in accordance with claim 26, applying pressure against the top portion of the closure fitment to effect sealing of the liner therewithin against at least the top entrance wall of the container entrance mouth prior to applying pressure around the fitment bead.

References Cited

UNITED STATES PATENTS

2,961,109 11/1960 Podesta 215—39
3,104,773 9/1963 Podesta et al. 215—38

FOREIGN PATENTS

652,564 2/1963 Italy.

GEORGE T. HALL, Primary Examiner

U.S. Cl. X.R.
This invention relates to an improved can end construction for carbonated beverage cans having a score line defined opening panel therein for beverage dispensing and, more particularly, to an improved construction for a resealing cap assembly for such type can ends.

13 Claims, 3 Drawing Sheets
RESEALABLE CAP HINGE STRUCTURE

BACKGROUND OF THE INVENTION

Recent years have witnessed ever increasing quantities of carbonated beverages, such as beer and carbonated soft drinks, being packaged in amounts up to 12 ounces in metal cans and particularly in metal cans with ends that include a score line defined opening panel therein to provide implement free access to the contents. Such opening panel containing can ends are generally called “easy open ends” and include variant basic constructions of a first type wherein the score line completely circumscribes the panel to render the panel completely separable from the can end and of a second type wherein the score line only partially circumscribes the panel to render the latter only partially separable from the can end and to thus remain in attached relation within the can end after the pouring opening has been formed. As mentioned above, such opening panels are conventionally perimetrically delineated by score lines of decreased metal thickness.

In order to extend the use of such easy open can end constructions to larger volume containers, the art has suggested the utilization of a cap assembly to close and reseal the opening defined by such score line defined panel. Among the objects of such cap utilization are a re-closure of the container to prevent loss of liquid content and a resealing of the container to limit further loss of the dissociable gases, i.e., the “carbonation”, of the remaining liquid contents. U.S. Pat. No. 4,580,692 discloses one construction for such a resealable closure cap assembly in association with a selectively contoured can end construction to cooperatively accommodate such resealable closure and to retain the advantages characteristic of the “easy open end” construction.

The provision of commercially acceptable resealable easy open can end constructions for larger capacity beverage containers requires, in addition to the functional feature of present easy open can ends, sealable retention of the can contents, the securement of the sealing cap assembly to the can end, the accommodation by the resealable cap of the inherent pressure buildup therein and the minimization of hazard to the user in the event of destructive pressure release. Also required is a can end configuration to accommodate the disposition of the resealing cap thereon without appreciable diminution of the convenience and cost effective nature of the basic easy open end constructions during manufacture, filling, shipping, selling, and consumer usage. As such, the provision of a commercially acceptable resealable easy open end construction requires accommodation of problems not heretofore met in the basic easy open end constructions conventionally employed in the smaller capacity beverage can.

Experience to date with the resealable cap and can end construction disclosed in U.S. Pat. Nos. 4,580,692 and 4,648,528, the disclosure contents of which are herein generally incorporated by reference, has indicated a need to assure retention of the resealing cap assembly in secured relation to the can end under conditions where excessive pressure buildup within the can results in a separation of the resealable cap from sealing relation with the previously opened dispensing aperture.

SUMMARY OF THE INVENTION

This invention may be briefly described as an improved resealing cap construction for easy open end can closures that includes, in its broader aspects, the interposition of a hinge means of markedly decreased bending stiffness intermediate a readily displacable sealing portion thereof and locus of securement of the cap assembly to the can end closure. In its narrower aspects, the subject invention includes the provision of a monolithic sealing cap assembly having bifurcated hinge means of markedly reduced bending stiffness disposed adjacent to the sites of riveted securement of the cap assembly to the can end closure.

Among the advantages of the subject invention is an enhanced security of attachment of a sealing cap assembly to a can end closure element and an attendant minimization of hazard in the event of blow off of the cap from sealing engagement with the container opening as may be occasioned by undue pressure buildup therein.

The primary object of this invention is the provision of an improved resealing cap assembly for easy open end can closures.

A further object of the invention is the provision of an improved cap assembly for resealable easy open can ends and particularly for a resealable easy open can end construction of the type disclosed in U.S. Pat. Nos. 4,580,692 and 4,648,528.

Other objects and advantages of the invention will become apparent from the following portions of this specification and from the appended drawings which illustrate, in accord with the mandate of the patent statutes, a presently preferred embodiment of a can end construction and resealable cap assembly that incorporates the principles of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a resealing cap construction incorporating the principles of this invention as included in a resealable easy open end can end construction of the general type disclosed in U.S. Pat. No. 4,580,692.

FIG. 2 is an enlarged plan view of the resealing cap shown in FIG. 1.

FIG. 3 is a further enlarged sectional view of a portion of the resealing cap as taken on the line 3-3 on FIG. 2.

FIG. 4 is a side elevation of a portion of the cap shown in FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

As pointed out above, the invention will be described in association with a resealable easy open end construction of the general type disclosed in U.S. Pat. No. 4,648,528, the disclosure of which is herein incorporated by reference. However, it should be understood that the invention may be used in other easy open end can constructions.

Where the words “upwardly”, “inward”, “outwardly”, “under” and the like are used hereinafter, their meaning is to be taken with reference to a can in an upright position having a can end closure incorporating this invention attached to the top end thereof.

Referring to the drawings and initially to FIG. 1, a resealable cap assembly incorporating the principles of this invention is disclosed in association with a can end closure of the general type disclosed in said U.S. Pat.
No. 4,580,692. Such can end closure 12 includes a substantially flat or planar end wall portion 16, a counter- sinking defining inner sidewall 17 and an outer sidewall 14 terminating in an upwardly and outwardly projecting annular flange 18 forming a chime for conventional attachment of the can end closure to a can body by double seaming.

As best shown in FIG. 1, the can end closure 12 further includes an upwardly projecting dispensing spout 20 preferably formed as an integral portion thereof. Such spout 20 includes an elevated and inclined top wall 24 having a score line 26 interrupted by a hinge 28 partially circumscribing and defining an opening panel 27 depressible inwardly of the can by fracture of the score line. Associated with the dispensing spout 20 is a resealing cap assembly generally designated 10, preferably molded in one piece using a plastic material having a low modulus of elasticity, such as, for example, low density polyethylene.

As best shown in FIGS. 1-3, the resealing cap assembly 10 includes a sealing cap portion 32 adapted to be placed in sealing relation over the spout 20 and the score line defined opening panel 27 therein, an extending arm portion 34 connected at one end to the sealing cap portion 32 and a tab 38 projecting outwardly from the sealing cap portion 32 for convenience in manipulation of the cap assembly. The cap assembly 10 is pivotally attached to the end wall 16 by a rivet 36 extending through an opening in a boss 70 disposed at the second and remote end of the arm portion 34. The outboard edge of the flange portion of the rivet 36 is formed downwardly and inwardly to provide an opening for the rivet when the rivet is staked to attach the cap assembly 10 to the can end in such manner as to insure that there is secure engagement between the rivet 36 and lip 78 of the boss 70, yet still permit the sealing cap portion 32 to be rotated by hand about the rivet 36 with relative ease. Preferably, the rivet 36 is an integrally formed portion of the end wall 16 of the can closure 12.

Experience to date has indicated that the resealable cap construction disclosed in the aforesaid U.S. Pat. No. 4,580,692 may be subject to separation from the can end closure at the locus of rivet attachment when blow off of the sealing cap portion 32 from the spout 20 occurs as a result of excessive pressure buildup within a resealed container.

Referring now to FIGS. 2-4, in order to insure against separation of the resealable cap assembly 10 from the can end closure 12 and to thereby reduce potential hazard to a user, the extending arm portion 34 disposed intermediate the sealing cap 32 and the situs of riveted attachment to the can end closure is selectively contoured to markedly decrease the bending stiffness of arm 34 at the latter location. The main body 58 of the arm 34, as best shown in FIG. 4, is suitably of a first and uniform predetermined thickness sufficient to insure rotative displacement of the cap assembly as an entity when desired and to minimize, if not prevent, curling thereof in the direction perpendicular to the end closure. The end of the arm 34 adjacent rivet 36 is of bifurcated character defining a pair of spaced apart ends 60 and 62 separated by a crescent shaped opening 64.

Disposed intermediate the ends 60 and 62 is a circular boss 70 having a pair of extending wings 72, 74 disposed in aligned spaced relation with the bifurcated ends 60 and 62 of the main body portion 58 of the extending arm 34. The boss 70 and extending wings 72, 74 are of a second predetermined thickness of a magnitude substantially greater than that of the main body portion 58 of the extending arm 34 to markedly increase the bending stiffness thereof. As best shown in FIG. 3, the boss 70 contains an upper bore 76 sized to accommodate a flattened rivet head therewithin and a lower bore 78 sized to accommodate a rivet shank in such manner as to permit rotative displacement of the resealing cap assembly 10 relative to the container end closure 12. As illustrated in FIG. 2, the left edges 71 of the extending wings 72, 74 that are adjacent the hinge zone 82 are disposed in coaxial alignment with the diameter 80 of the boss 70.

Disposed intermediate the bifurcated ends 60 and 62 of the arm 34 and the left edges 71 of the wings 74 and 72 of the boss 70 is a hinge zone, generally designated 82, of markedly decreased bending stiffness. Such hinge zone is preferably constituted by a pair of integral links 84, 86 interconnecting the bifurcated ends 60 and 62 with the left edges 71 of wings 74 and 72 respectively, said hinge zone being of a third predetermined thickness of a magnitude less than said first predetermined thickness of the arm 34.

While the actual thickness of the main body portion 58, the wings 74 and 72 and the links 84 and 86 are determined by the nature and character of the material employed and methods of manufacturing the resealing cap assembly, a general indication of suitable dimensions and relative thicknesses for a presently preferred construction would be to have the main body portion 58 about 0.030 inch thick, the wings 72 and 74 about 0.075 inch thick and the links 84 and 86 about 0.015 inch thick.

Such reduced thickness links 84, 86 in association with the greater thickness of the extending arm 34 and boss wings 74, 72, 74 function to selectively markedly decrease the bending stiffness of the resealable cap assembly at such hinge zone location and provide, in effect, a readily bendable hinge intermediate the end of arm 34 remote from the sealing cap portion 32 and the situs of securement of the cap assembly 10 to the container end closure 12. Such hinge zone 82 of reduced bending stiffness operates to minimize, if not effectively eliminate, the magnifying of the blow-off forces by leverage action and the concentration of the magnified forces to a small portion of the locus of rivet securement that characterize utilization of an arm 34 of uniform thickness, including the hinge zone, such as that incorporated in the structure disclosed in U.S. Pat. No. 4,580,692. In addition, the preferred bifurcation of the end of arm 34 and disposition of the left edges 71 of the wings 72 and 74 in alignment with a diametral extension of the boss 70 serves to divide the unmagnified separating forces created by cap blow off and to transmit half of these unmagnified forces to each of two points located at opposite ends of the same diameter. Cooperatively associated therewith, the increased thickness of the boss 70 serves to provide an increase in bending stiffness at such location and in a consequent generally uniform distribution of any force or load tending to separate the cap assembly from the rivet around the entire perimeter of engagement between the rivet and cap. Such described construction has not only effectively eliminated cap assembly separation from the container end closure in the event of sealing cap blow off but has further reduced the possibilities of accidental loss of the sealing cap prior to and during use thereof.

Having thus described my invention, I claim:

1. A cap assembly for substantially gas tight sealing engagement with a container closure having an opening
5 therein circumscribed by a sealing surface thereon, the cap assembly comprising
a seal portion releasably engageable in surrounding gas tight sealing relation with said sealing surface on said container closure circumscribing the opening therein,
an extending arm portion connected at one end to said seal portion and having bifurcated second end disposed remote therefrom, a boss adjacent to the second end of said arm having an opening therethrough to accommodate a rivet for securing of the cap assembly to said container closure, and hinge means interconnecting said bifurcated second end of said extending arm to said boss to permit flexure of said seal portion and said arm portion relative to said boss and to minimize risk of separation of said boss from said rivet.

2. A cap assembly as set forth in claim 1 wherein said hinge means has a bending stiffness less than that of said arm portion and said boss.

3. A cap assembly as set forth in claim 1 wherein said seal portion, extending arm portion, hinge means, and boss are integrally interconnected to form a monolithic structure.

4. A cap assembly as set forth in claim 1 wherein one end of said hinge means is disposed on a diametric centerline extension of the opening in said boss, said diametric centerline being perpendicular to a centerline through the centers of said boss and said seal portion.

5. A cap assembly as set forth in claim 1 wherein said opening in said boss includes
an upper bore sized to rotatably accommodate a flattened head of said rivet, and
a lower bore of reduced diameter sized to rotatably accommodate a shank portion of said rivet.

6. A cap assembly for substantially gas tight sealing engagement with a container closure having an opening therein circumscribed by a sealing surface thereon, the cap assembly comprising
a seal portion releasably engageable in surrounding gas tight sealing relation with said sealing surface on said container closure circumscribing the opening therein,
an extending arm portion of a first predetermined thickness connected at one end to said seal portion and having a bifurcated second end disposed remote therefrom, a boss of a second predetermined thickness of a magnitude greater than said first predetermined thickness disposed adjacent to the second end of said arm having an opening therethrough to accommodate a rivet for securing of the cap assembly to said container closure, and hinge means interconnecting said bifurcated second end of said extending arm to said boss to permit rapid flexure of said seal portion and said arm portion relative to said boss and to prevent separation of said boss from said rivet.

7. A cap assembly as set forth in claim 6 wherein said hinge means is of decreased bending stiffness and of a third predetermined thickness of a magnitude less than that of said boss.

8. A cap assembly as set forth in claim 6 wherein said hinge means is of decreased bending stiffness and is of a third predetermined thickness of a magnitude less than said first predetermined thickness.

9. A cap assembly as set forth in claim 8 wherein one end of said hinge means is disposed on a diametric centerline extension of the opening in said boss, said diametric centerline being perpendicular to a centerline through the center of said boss and said seal portion.

10. A cap assembly as set forth in claim 6 wherein said seal portion, extending arm portion, and hinge means are integrally interconnected to form a monolithic structure.

11. A cap assembly for substantially gas tight sealing engagement with a container closure having an opening therein circumscribed by a portion of said container closure having a sealing surface thereon, the cap assembly comprising
a seal portion releasably engageable in surrounding gas tight sealing relation with said portion of said container closure circumscribing the opening therein,
a support arm of a first predetermined thickness integrally connected at one end to said seal portion and having a bifurcated second end disposed remote therefrom defining a pair of spaced apart terminal ends,
a boss of a second predetermined thickness of a magnitude greater than that of said first predetermined thickness disposed intermediate the spaced apart terminal ends of said second end of said support arm and having an opening therethrough to accommodate a rivet for securing thereof to said container closure, and readily bendable hinge means of a decreased bending stiffness relative to said support arm and boss interconnecting the terminal ends of said bifurcated second end of said support arm to said boss to permit rapid flexure of said seal portion and said arm portion relative to said boss and to prevent separation of said boss from said rivet.

12. A cap assembly as set forth in claim 11 wherein said opening in said boss includes
an upper bore sized to rotatably accommodate a flattened head of said rivet, and
a lower bore of reduced diameter sized to rotatably accommodate a rivet shank portion of said rivet.

13. A cap assembly as set forth in claim 11 wherein said seal portion, support arm and hinge means are integrally interconnected for form a monolithic structure.

* * * * *
ABSTRACT OF THE DISCLOSURE

A method is provided for securing a closure to a container by inward deformation of a circumferential bead of a metallic closure shell skirt through pressure applied simultaneously around the bead to move inwardly a substantially circumferential portion of the skirt of the closure located above the bead into secure closure affixation on the container so that such closure affixation is thereafter maintained by the inwardly deformed and constricted closure bead. A closure fitment or closure is also provided that is adapted to be securely affixed to the container by a partially preformed inwardly directed skirt portion in securement relation to a suitable container bead and to be maintained in secure closure affixation on the container by a deformed and constricted lower skirt bead of the closure.

This is a divisional application of my co-pending application, Ser. No. 682,898, filed Nov. 14, 1967.

The invention relates generally to a method of securing closures to containers, to a closure fitment and to resulting closure-container assemblies. The closure fitment as used herein and in the appended claims, may have both a complete top and depending skirt, or may have an interior portion of the top removed so that the fitment serves as a top flanged retaining band. More specifically, the invention relates to a method of securing closures which are deformed into secure closure affixation on containers so that removal requires either rupture or elongation beyond the elastic limit of the material of the closures.

It is known to secure a closure to a container having an externally beaded mouth configuration in which a depending skirt of the closure is deformed beneath a container bead in response to inwardly directed and applied pressure against the closure skirt in substantially the area or areas of deformation thereof adjacent and below the container bead against the resistance of the container bead.

The present closure method contemplates the inward deformation of a circumferentially outwardly projecting configuration of a closure or bead of a closure or closure fitment skirt by means of force applied simultaneously around the configuration or bead to cause substantial inward movement of a circumferentially preformed portion or band area of the skirt of the closure or fitment disposed above the circumferentially projecting configuration or bead thereof into secure closure affixation on the container. The outwardly projecting circumferential closure bead or configuration is re-formed beyond its elastic limit and serves to restrain the overlying inwardly disposed portion of the closure skirt in secure closure affixation on the container. The restraint thus provided by the permanently deformed annular bead or outwardly projecting configuration of the closure eliminates the need for placing complete reliance upon the bending strength of the skirt material in the deformed portion thereof above the bead. With this method, effective closure affixation and restraint thereof obtained without positively engaging the circumferential bead of the skirt of the closure with a retaining configuration of the container.

It is an object of this invention to provide a method of effecting secure closure affixation on a container by inward permanent deformation of an outwardly projecting circumferential bead, or equivalent configuration, of a closure skirt to cause substantial radial inward movement of a circumferentially preformed portion of the closure skirt disposed thereabove and located below a closure securing bead on the container.

It is another object of this invention to provide a method of permanently inwardly deforming a substantially circumferentially disposed portion of a closure skirt beyond its elastic limit by force applied simultaneously about the circumference of an outwardly projecting bead configuration contiguous therewith located below the inwardly deformed portion of the closure skirt to provide effective restraint of the closure on an underlying container.

It is a further object of this invention to provide both a sealed container-closure assembly, or package, and a closure (or fitment) in which the closure is provided with a continuous annular bead at the lower extremity of its closure skirt restraining an inwardly directed skirt portion disposed above the annular bead in secure closure affixation on the container.

These and other objects will be more fully understood and appreciated from the following description, and reference to the illustrations appended hereto, in which:

FIG. 1 is an enlarged fragmentary sectional elevation of a type of closure suitable for use in the practice of the invention;

FIG. 2 is an enlarged fragmentary sectional elevation of a type of container finish adaptable for use with the invention;

FIG. 3 represents the loosely assembled closure and container of FIGS. 1 and 2 within a closure-applying head prior to initiation of a closure-affixing operation;

FIG. 4 represents the closure-container assembly of FIG. 3 in some intermediate assembly thereof;

FIG. 5 represents the closure-container assembly of FIG. 4 with closure-affixation completely effected;

FIG. 6 represents an enlarged fragmentary partial sectional elevation of another embodiment of a unitary closure assembly prior to affixation on an underlying container; and

FIG. 7 represents the closure assembly of FIG. 6 with closure-affixation on its underlying container completely effected in unitary package form.

Referring now to the drawings, in greater detail, FIGS. 1 and 2 illustrate a basic embodiment of a closure and container finish contemplated by this invention. The closure 1 has a top portion 2 and a depending skirt 3. The particular form of closure illustrated has a compressible gasket 4 disposed in the gasket receiving channel 5, which is defined within the upper portion 2 of the closure shell. The closure skirt terminates in a continuous circumferentially outwardly projecting shoulder configuration, which in this instance is shown as a hollow bead 6 which is of substantially uniform cross-sectional diameter throughout its circumference. An inwardly directed preformed annular rib or groove 7, which is preferably, but not necessarily, continuous, is disposed above the hollow bead 6.

UNITED STATES PATENT OFFICE

3,506,151
CRIMPED CAP
Robert L. La Barge, Pittsburgh, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Nov. 14, 1967
Patented Apr. 14, 1970

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Rib 7 and the hollow bead 6 may be made by various practices. A convenient manufacturing procedure is that of forming an outwardly stepped shell for fitment with a bend of relatively small radius at the junction of the skirt 3 and the outwardly stepped portion that is to be formed into the bead 6, next forming the bead 6 by known simultaneously circumferential cufing practice, and then forming the rib 7 by axial compression of the shell to set inwardly the aforementioned rib 7. The container, which may be of conventional plastic, glass or other suitable material, preferably has mouth 8 defining an orifice 9, the outwardly exposed configuration of which provides a circumferential bead or lip 10. The bead or lip 10 provides an upper entrance mouth sealing surface 11, a lateral or outer sealing surface 12, and a lower underlying shoulder surface 13.

In effecting a closure-container assembly, the closure 1 is placed on the container with the hollow bead 6 adjacent the container bead 10. The relative diameters of the closure and container may be such that, in initial disposition of the closure on the container, either or both of the inwardly directed rib 7 and bead 6 of the depending closure skirt 3 is or are flexed outwardly by contact against the outer or lateral sealing surface 12 of the container, or alternatively, the relative diameters of the closure and container may be such that the inner diameters of the inwardly directed rib 7 and bead 6 are somewhat greater than the diameter of any portion of the container to be admitted into the closure, and in such case the oversize is preferably slight. In any event, it is not intended that the relative diameters be such that the closure is a "snap-on" closure in the sense that the initial relative diametric dimensions serve to retain the closure in effective sealing relationship to the container.

Practice of the method of the invention is described in reference to FIGS. 3 through 5. In general, equipment in the form of a closure-affixing head 15 is illustrated as having a centrally disposed top pressure block 16 and a surrounding radially movable pressure-applying sleeve 17.

In the practice of the method of the invention, a closure preferably supported over the mouth of a container, is presented in vertically aligned disposition within the sealing head 15 of FIG. 3. Top pressure is applied against the upwardly facing outer surface of the closure 1, by the pressure block 16 in abutting engagement thereagainst, to compress the gasket 4 and lower or advance the closure skirt 3, and its terminal bead 7, from the positions thereof illustrated in FIG. 3. With the pressure exerted by the pressure block 16 maintained, relative downward axial travel of the surrounding sleeve 17 of sealing head 15, and circumferential engagement of an upwardly converging throat surface 18 of the sealing head sleeve 17 in progressive tangential bearing circumferential contact against the outer periphery of bead 6 of closure 1, results in radial inward permanent deformation and reduction in the circumference of the closure bead 6, with attendant inward movement of the inner surface of the closure skirt 3 resisted by the lower portion of container bead 10 adjacent the inwardly depressed rib 7 of closure skirt 3, and preferably immediately above the rib 7, to thereby cause further permanent deformation and radial inward deepening of the inwardly directed rib 7 in underlying relationship to the shoulder surface 13 of the container bead 10.

FIGS. 4 and 5 depict progressive inwardly directed permanent deformation and transformation of the circumferential closure bead 6 and inwardly directed rib 7 above the same in response to progressive axial movement of the closure bead 6 into the converging throat 18 of the sealing head 15, with an intermediate and final redefined backer relationship of the compressible gasket 4 illustrated in FIGS. 4 and 5, respectively. In this regard inner and outer peripheral side sealing between the compressed gasket 4 and the container will be observed at 20 and 21 (FIG. 5), respectively, as well as across the upper sealing surface 11 of the container.

It will be observed that the inwardly directed rib 7 located above the closure skirt bead 6 has been illustrated in the permanently affixed and secured unitary closure-container package of FIG. 5 as being of appreciably greater depth than in the initial and intermediate preformed depths thereof illustrated in FIGS. 3 and 4, respectively. This increased depth of the deepened circumferential area identifying the rib 7 in final permanently deformed condition, as well as the permanent inward deformed and constricted condition of the closure skirt bead 6 below the same (FIG. 5), has insured a permanently sealed and affixed unitary container-closure package requiring subsequent peripheral rupture or distortion of the closure, as performed by a closure-removing tool, to permit removal of the closure 1 from its complementary underlying container. Preferably, the final circumferential inward disposition of the closure skirt bead 6 remains out of contact with the container below its bead configuration 10 but in any event provides and maintains an inward circumferential contracting force and restraint of the inwardly depressed permanently deformed rib 7 in securing engagement against the underside closure engaging surface 13 of the container.

For purposes of illustration, the annular or circumferential restraint type 6, which provides the aforementioned restraint, has been shown as a single curl hollow bead. While it is by no means essential that the bead 6 be hollow, if this form is employed, it is preferred that it be curled inwardly, as illustrated, since it thereby reduces the likelihood of undermined bead uncuring during the sealing operation. Preventing inward uncuring may be further assured, as well as providing further stiffening of the bead 6, if that should be desired, by extending the curl of the hollow bead somewhat beyond the single curl that has been illustrated. It will be appreciated, however, that other forms of circumferential or annular projecting configuration may be substituted for the bead 6 so long as they serve as a means of tool engagement for applying pressure simultaneously around the outwardly extending configuration represented by the bead 6 to facilitate permanent inward deformation of the securing rib 7 in the practice of the invention. It is only essential that bead 6, or its equivalent configuration, serves to provide effective tool engagement with the sealing head sleeve beveled thrust 18 in order to downwardly and inwardly permanently deform the rib 7 thereaboe into locking affixation against the underside surface 13 of the container bead 10 in FIG. 5. The inwardly contracted condition of the bead 6, or its equivalent configuration, thereafter serves to maintain the permanent securement of the closure performed by the inwardly projected rib 7.

The rib 7, while preferably circumferentially continuous, as illustrated, may, if desired, be segmented or peripherally interrupted providing the interruptions are not too numerous and the depressed ribs therebetween exceed the circumferential length of the interruptions. Accordingly, the word "rib" is used hereinabove and in the claims in the sense of both a continuous structure and an interrupted circumferential outwardly projecting configuration being deepening in affixation of the closure as being of substantial depth, but in fact such rib, at least when continuous, may be quite shallow. It is requisite, however, that the inwardly directed rib 7 be located above the closure bead 6, and preferably adjoining the closure bead 6.

FIGS. 6 and 7 are representative of another embodiment of a closure assembly responding to the method of application described above in conjunction with FIGS. 1 through 5. A unitized closure assembly is illustrated in FIGS. 6 and 7 as comprising a metallic shroud 24 en-
Distinguishing from the first described embodiment of the invention (FIGS. 1–5), the lower peripheral flange 26 of the elastomeric nipple 25 is engaged by a lower prefabricated flange 28 of the shroud 24 and the depending skirt 30 thereof is circumferentially inwardly ribbed at 32 above an outwardly projecting configuration or circumferential terminal bead 34 of the shroud 24. Simultaneously, inwardly and downwardly applied circumferential pressure exerted against the outwardly directed bead 34 (FIG. 6) by the upwardly converging throat entrance 36 of the outer reciprocal sleeve 38 of a pressure applying head 40, following downwardly exerted pressure of the central pressure block 42 thereof, performs in the same manner described for FIGS. 4 and 5 to circumferentially contract the terminal bead 34, of the shroud 24, and direct the circumferential rib 32 above the same against the resistance of the outer face or side sealing surface of the container bead 44 into underlying restraining engagement of the shroud 24 and its encased nipple 25 in unitary assembly on its underlying container 45, with the nipple flange 26 in compressed sealing attitude against the upwardly directed sealing surface of the container bead 44.

Authorized exposure of the nipple 25 is accomplished by fracture of the shroud 24 peripherally above the nipple flange 26, as described in the aforementioned United States Letters Patent No. 3,335,890.

It will be appreciated that, unlike prior sealing systems which employed circumferential application, as by rolling or otherwise deforming the lower skirt portion of a closure or closure fitting under a container bead, the method of this invention facilitates rapid simultaneous application and sealing affixation of closures on containers, which is highly advantageous with respect to modern high speed unitary package production, since a single downward stroke of a sealing head effects a complete and secure unitary sealed container-closure package.

Wherever particular embodiments of the invention have been described for purposes of illustration, it will be apparent to those skilled in the art that numerous variations of the details may be made without departing from the appended claims. Exemplary of such variations are closure fittings and assemblies with containers that are provided with liner or gasket constructions affording side sealing with or without top sealing. Also the liner may have a top and skirt and be adapted to serve as a re-closure. In further exemplary manner, the closure fittings may be manually rupturable by means well known in the art such as an appropriately weakened tear strip having associated with it a grasping tab that may be integral with the fitting and tear strip or affixed to the tear strip. In the latter case, the tab may be of fewer type affixed as by a rivet all in the manner now well known in regard to can ends.

What is claimed is:

1. A closure fitting for securing affixation on a container having an outwardly projecting closure fitting retaining bead adjacent an entrance mouth to said container, said closure fitting comprising:
   (a) a top portion for overlying disposition to the entrance mouth of the container and a depending skirt having an inwardly directed circumferential rib disposed above an outwardly disposed circumferential configuration of said skirt, and
   (b) said closure fitting, on disposition over the entrance mouth to said container, being responsive to pressure applied against its top portion and pressure applied simultaneously around its outwardly disposed circumferential configuration to effect permanent inward deformation of the initially inwardly directed rib further inwardly below the outwardly projecting closure fitting retaining bead of the container for securing affixation of the closure fitting on said container.

2. The closure fitting of claim 1 in which the inwardly directed rib is circumferentially continuous.

3. The closure fitting of claim 1 in which the outwardly disposed configuration of said skirt is circumferentially continuous.

4. The closure fitting of claim 1 in which the outwardly disposed configuration of said skirt is an inwardly curved hollow bead.

5. A unitary closure fitting for securing affixation on a container having an outwardly projecting closure fitting retaining bead adjacent an entrance mouth to said container, said unitary closure fitting comprising:
   (a) a fitting having a top portion for overlying disposition to the entrance mouth of the container and a depending skirt having an inwardly directed circumferential rib disposed above an outwardly disposed circumferential configuration of said skirt,
   (b) a compressible sealing liner within said fitting and located above said inwardly directed rib of the fitting skirt, and
   (c) said fitting and compressible liner, on disposition over the entrance mouth to said container, being responsive to pressure applied against the top portion of the fitting and pressure applied simultaneously around the outwardly disposed circumferential configuration thereof to effect permanent inward deformation of the initially inwardly directed rib further inwardly below the outwardly projecting fitting retaining bead of the container for compressive sealing of the liner against the container and securing affixation of the liner and liner on said container.

6. A unitary sealed package comprising:
   (a) a container having a mouth entrance defined by an upwardly facing sealing surface and an outwardly projecting closure fitting retaining bead adjacent thereto,
   (b) a closure fitting secured to said container having a top portion and a depending skirt secured in overlying relationship to said upwardly facing sealing surface and outwardly projecting closure fitting retaining head,
   (c) a permanently deformed circumferential rib in said depending closure fitting skirt extending inwardly and below the container head in secure closure fitting affixation therewith, and
   (d) a circumferential permanently deformed and inwardly displaced closure fitting skirt configuration below said rib restrainingly maintaining securement and affixation by said rib of said closure fitting on said container.

7. The unitary sealed package of claim 6 having a resiliently compressed elastomeric gasket interposed at least between the container upwardly facing sealing surface and inwardly directed top portion of said closure fitting.

References Cited

UNITED STATES PATENTS
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GEORGE T. HALL, Primary Examiner
CONTAINER WALL WITH RUPTURABLE WEAKENING LINE

Assignee: Aluminum Company of America, Pittsburgh, Pa.

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ABSTRACT

A sheet metal container wall or end closure is provided which includes a weakening line in the sheet metal and a rib formed across the weakening line to facilitate rupture of the residual metal in the weakening line. Such container wall may also have a hollow button formed in it with the weakening line and rib formed in the button whereby flexing of the button stresses the rib and weakening line to initiate rupture of the residual metal in the weakening line.

24 Claims, 9 Drawing Figures
CONTAINER WALL WITH RUPTURABLE WEAKENING LINE

REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 517,324, filed Oct. 23, 1974, now abandoned which is a continuation-in-part of our application Ser. No. 287,525, filed Sept. 8, 1972 for “Container Wall with Rupturable Weakening Line” now abandoned.

BACKGROUND OF THE INVENTION

Can ends and end closures are known which include rupturable weakening lines or score lines defining panels which are at least partially removable from the ends and which further include embossments or buttons raised in the panels for depressing the panels to rupture the score lines without the need for auxiliary tools or pull tabs attached to the panels. Can ends of this type are disclosed in U.S. Pat. Nos. 3,227,304, 3,246,791 and 3,355,058, among others. It is also known to provide an auxiliary score which is positioned close enough to the primary score around a removable panel to lessen the force which is required to initiate rupture of the primary score as is disclosed in U.S. Pat. No. 3,422,983. A further disclosure of interest is contained in U.S. Pat. No. 1,098,444 which teaches the provision of V-shaped dents in a metal container wall along a weakening line to form buttresses against the sides of the weakening line to prevent tearing into the metal adjacent the weakening lines. U.S. Pat. No. 3,416,698 is of interest for its disclosure of a reinforcing bead across a score line to require a greater force to tear across the bead and provide protection against blowout of a tear strip defined by the score line.

SUMMARY OF THE INVENTION

This invention provides a container wall or end closure which includes a weakening line and a rib formed across the weakening line to facilitate rupture of the weakening line. This invention further includes a button formed in the container wall, and the weakening line and rib are formed in the button to facilitate rupture of the weakening line when the button is flexed.

Accordingly, an object of the invention is to provide a container wall with a weakening line therein which can be easily ruptured.

Another object of the invention is to provide a container wall with a weakening line formed therein and a rib or bead formed across the weakening line.

A further object of the invention is to provide a container wall with a flexible button formed in it which will facilitate rupture of a weakening line in the wall when the button is flexed.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a top plan view of a closure of the invention,
FIG. 2 is a partial cross-section through the closure of FIG. 1 taken along lines II—II, showing the closure secured on a container,
FIG. 3 is a cross-section similar to FIG. 2 illustrating rupture of the score in the closure,
FIG. 4 is an enlarged cross-section showing forming of the rib in a closure of the invention,
FIG. 5 is a cross-section through an alternative rib which may be used in the invention,
FIG. 6 is a top plan view of an alternative embodiment of a closure of the invention,
FIG. 7 is a partial cross-section through the closure of FIG. 6 taken along line VII—VII showing the closure sealed on a container,
FIG. 8 is a top plan view of another alternative embodiment of a closure of this invention,
FIG. 9 is a partial cross-section through the closure of FIG. 8 taken along line XVI—XVI and showing the closure sealed on a container.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

According to this invention, a rib or ribs are formed in a container wall across a weakening line in the container wall to provide a stress riser in the weakening line which will facilitate initiation of rupture of the weakening line. Such a rib in a container wall acts as a beam section in the wall and the score across the beam section weakens the beam at the point of maximum tensile stress when the beam is loaded. Consequently, the beam can be easily broken as can a notched stick.

This invention may further include a button in a container wall in which the weakening line and rib are formed. This button can be flexed to bend the rib or beam section and thereby initiate rupture of the residual metal in the weakening line. Flexible buttons are known for some applications such as use in a baby food closure to indicate the existence of a vacuum in a bottle on which the closure is sealed, but have not been known for use in facilitating rupture of a weakening line in a container wall.

In order to facilitate understanding of the subject invention and in the interest of clarity, the terms “inwardly” and “outwardly” will be herein employed to delineate directions relative to the interior and exterior respectively of a container having a container wall or closure of the invention secured thereon.

Referring to FIGS. 1 and 2, a preferred embodiment of the invention is illustrated as comprising a closure 10 which is made of sheet metal, preferably aluminum or an alloy thereof, and which is at least an intermediate temper alloy, and preferably a hard temper alloy. The sheet metal from which the closure is formed may have a thickness in the range of 0.006 to 0.012 inch, with a 0.009 inch thickness being common. The closure 10 is adapted to be secured on a container 12 by threads or other conventional attachment means. It has a top end wall 14 and a depending peripheral skirt 16 which may have threads 18 formed therein for engaging threads 20 on container 12, and may have a pilferproof or locking band 22 on the bottom of the skirt. Pilferproof band 22 may be separated from the top portion of skirt 16 by a line of slits 24 and bridges 26, and is adapted to have a lower edge portion turned under a shoulder or bead 28 on container 12. Closure 10 may further have a ring or liner of gasket material 30 on the under surface of top end wall 14 around its outer edge for sealing against a top sealing surface on container 12.

In accordance with this invention, closure 10 further has a weakening line or score 32 in top end wall 14 and an embossed rib 34 formed across the score line. In the embodiment selected for illustration in FIGS. 1-3, rib 34 is formed downwardly in closure 10 and has a relatively small radius in its bottom so there will be a minimum of metal section at the bottom or apex of the rib.
The combination of a minimum metal section at the apex of rib 34 and the weakening provided by score 32 where it crosses the rib and makes it very easy to rupture the residual of metal in the score when the panel 14 is depressed as is illustrated in FIG. 3. Depressing panel 14 places a maximum load at the center of rib 34 which results in a maximum tensile stress across the score which ruptures the residual metal in the score where it crosses the rib.

The rib 34 is preferably substantially V-shaped with a relatively small radius at its corner, but may also be U-shaped or have a semi-circular cross sectional configuration. A sharp "V" will produce the highest stresses in the apex of the rib, but a "U" or semi-circular configuration will also function in accordance with this invention. The rib or beam need not be straight and need not be located in the center of the closure as in the closure which has been selected for purposes of illustration.

FIG. 4 shows tools which may be used to form a rib in a container wall in accordance with this invention. Preferably, the container wall will have been scored prior to the forming of a rib therein. Tools for forming a rib in a container wall 36 may comprise a lower die 40 with a V-shaped groove 42 in it and an upper die 44 which includes a blade 46 having a rounded nose 48 which can be moved downwardly against container wall 36 and into groove 42 to form a V-shaped rib 38 with a relatively small radius 50 at its apex. Moving blade 46 against container wall 36 into groove 42 draws metal from the container wall into the groove and may coin the container wall between the nose of the blade and the walls of the groove to extrude metal downwardly into the groove. Such extrusion makes it possible to form a relatively deep groove or rib which is desired for practice of this invention. It also thins the metal below the base of the rib which may facilitate rupture of the score line across the rib.

The rib 34 which is formed in the closure 10 should project from the panel 14 a distance of at least approximately five times the metal thickness, and preferably 7.5 to 8 or more times the metal thickness to minimize the force required to fracture the score line. A closure of the invention can desirably be opened with a force of approximately 12 to 18 pounds. Such force can be easily applied by most adults. The upper limit of the rib height is primarily a matter of ability to form such a rib, and not a matter of functioning of the rib. To form a rib having a height of over five or six times the metal thickness in a sheet metal aluminum closure usually requires both drawing and extruding the rib in the manner which is illustrated in FIG. 6. A sheet metal aluminum closure is subject to tearing or rupture of the metal during forming when a rib having a height of over 5-6 times the metal thickness is formed by a one step drawing operation without also extruding the metal.

The rib 34 should be at least 0.5 inch long and is preferably at least 0.6 to 0.8 inch long in a closure formed from 0.009 inch thick aluminum alloy. A rib at 0.6 inch long is desired to provide leverage for stressing the residual metal in the score line across the rib. If the rib is too short, it is more difficult to rupture the score line in the closure, much as it is more difficult to break a short stick than a long stick.

The rib may have a width which is approximately one to three times the height of the rib. The width of the rib is not believed to be critical to the functioning of the invention.

The score line 32 is preferably long enough that its terminal ends extend beyond the width of the base of the rib 34. The ends of the score line also are preferably tapered gradually such as at approximately a 3° angle on both ends of the score line from full score depth in the middle portion of the score line to zero score depth at its terminal ends. This taper on the ends of the score line is believed to help prevent accidental rupture of the score during forming of the rib.

In a preferred embodiment of this invention, the score line is relatively shallow, such as approximately one-third to one-quarter of the thickness of the sheet material from which the closure is formed. For example, the score line in a closure made from 0.009 inch sheet stock may be approximately 0.0025 inch deep. A deeper score is within the scope of this invention, and in fact would be easier to fracture with digitally applied pressure, but it would also be more likely to be accidentally ruptured as during forming of the rib in the closure. Further, with a relatively high rib, the stresses produced in the score by digitally applied pressure against the rib is great enough that even a relatively shallow score can be easily ruptured to produce an opening in the closure wall.

The opening force is also less affected by score residual in a closure having a relatively high rib than it would in a closure having a lower rib. Required opening force is also less affected by metal alloy, temper, thickness, and other variables in the closure having a relatively high rib.

FIG. 5 illustrates a cross section through an alternative rib configuration which can be formed in a container wall of the invention. This rib has such a relatively wide base and also has a relatively sharp radius on its apex to facilitate initiation of rupture of a score across the rib. It will be apparent to those skilled in the art that other rib cross-section may also be used. Preferably, any such rib will provide a minimum metal section in its side or edge which will be in tension when the rib is loaded or flexed to rupture the score, and a maximum metal section in the side or edge of the rib which will be in compression when the rib is so flexed.

FIGS. 6 and 7 show another embodiment of a closure and container-closure assembly of this invention in which the closure 60 has an integral outwardly projecting concave-convex dome or button 62 formed in the central panel 64 of the closure with V-shaped rib 66 formed across the center of the button. The closure 60 has a circular score line 68 therein in the center of the panel 64 and crossing the rib 66 at two locations. The score line could also be straight, but the circular score line 68 is preferred because it avoids any necessity of aligning the rib and score line so long as both are centered in the closure. The score line 68 is preferably formed in the undersurface of the closure 60 to avoid accidental rupture of the score when the button 62 is formed.

The button 62 preferably has a diameter of approximately 0.700 to 0.950 inch and a height of approximately 0.030 to 0.045 inch. The button is preferably recessed in the center portion of the closure to shield the button from being accidentally depressed which would result in premature rupture of the score line. An annular wall portion 72 which extends outwardly from the recessed center portion is believed to facilitate depressing the button 62 by providing a hinge or toggle effect which permits the base of the button to expand radially outward. In the absence of such annular wall portion 72, the base of the button would be substantially
rigidly contained by the surrounding metal which would make it more difficult to depress the button. The annular wall portion 72 may be formed by a combination of drawing and extrusion of metal which thins the metal in the wall portion. Thinning the metal in the wall portion 72 during forming weakens such wall portion and facilitates outward expansion of the base of the button 62 by the hinging or toggle effect produced by such wall portion.

The closure 60 of FIGS. 6 and 7 is opened in the same manner as the closure illustrated in FIGS. 1-5, i.e., by applying digital pressure against the closure in the area of the rib 62 to stress the rib, and especially the residual metal in the score line 68 where it crosses the rib. The score line may rupture at either one or both locations where it crosses the rib. With the rib formed inwardly in the opposite direction from which the opening force is applied, the residual metal in the score line 68 is stressed in tension which ruptures the metal with a minimum of digital pressure.

Instead of threads or other retaining means, the closure 60 may have a friction or slight interference fit with the container, so it will frictionally engage the container after venting and after the pilferproof band has been separated from the top portion of the closure. The friction fit may be provided by circumferentially spaced projections or lugs, not shown, on either the outer surface 76 of the container or on the closure skirt 78, which will permit the closure to resiliently deform between such projections to fit over the container mouth.

FIGS. 8 and 9 illustrate another alternative embodiment of the invention which is particularly adapted to automatically open or vent when the pressure in a container on which the closure is sealed becomes excessive and could otherwise burst the container. Closure 130 may be substantially the same as closure 10 illustrated in FIGS. 1 and 2 except that rib 132 in closure 130 is formed upwardly. A score 134 is preferably cut in the upper or exterior surface of the closure, but may also be cut in the interior surface of the closure. When pressure becomes excessive in container 136 on which closure 130 is sealed, the end wall of the closure will dome upwardly, which will stress rib 132 and rupture score 134 to permit venting of the container. The rib 132 and score 134 can be designed so that the score will rupture at a particular pressure. The pressure at which the score will rupture is dependent upon several parameters including the depth and shape of the rib, the residual metal thickness in the score, the material of which the closure is made and the diameter of the central panel in the closure among other parameters which can be controlled to provide desired venting characteristics for such closure.

Although the attached drawings and above description relate to three preferred embodiments of the invention, it will be apparent to those skilled in the art that various modifications could be made in the embodiments without departing from the invention. For example, an end closure of the invention could be made of a variety of sheet materials such as plastic, paper, metal or a laminate of such materials. Further, the flexible portions or buttons in end closures of the invention could be given a variety of shapes and forms for stressing a rib or ribs across the score line in such end closures, and the ribs in such end closures can be given a variety of configurations and depths. For example, the invention may comprise a circular rib with a dome in the middle and one or more scores across the rib to be ruptured while the dome is depressed to flex the rib. The invention can also be employed in either can ends, end closure or other container walls, and can be used to form a pouring or drinking opening, a vent to release either pressure or a vacuum from a container upon opening, a vent to admit air into a container during drinking or pouring, or as a safety release which will automatically break open when excessive pressure is built up in a container. Can ends and end closures embodying the invention can also be affixed or sealed on containers by a variety of means such as a double seam, roll-on threads, screw-on threads, lugs, or a crimped or constricted bead or edge portion on the closure.

What is claimed is:

1. A container wall having a score line therein for forming an opening in the wall and an integral hollow rib in the container wall across the score line projecting from the plane of the container at least five times the material thickness opposite the direction from which opening pressure is to be applied to stress the material in the score across the rib in tension and fracture such material.

2. A container wall as set forth in claim 1 in which the rib projects from the plane of the container wall a distance of at least seven times the material thickness.

3. A container wall as set forth in claim 1 in which said rib is substantially V-shaped.

4. A container wall as set forth in claim 1 in which said rib projects inwardly into a container for rupture of said score line by digital pressure against the exterior surface of the container wall.

5. A container wall as set forth in claim 1 in which said rib projects outwardly from the container wall for rupture of said score line when loaded and stresses by excessive pressure in a container on which the container wall is sealed.

6. A container wall as set forth in claim 1 in which said rib has a relatively sharp corner at its apex.

7. A container wall as set forth in claim 1 in which said rib has a maximum metal section therein along its length on the side thereof which will be in compression when the rib is loaded to rupture said weakening line.

8. A container wall as set forth in claim 1 in which said rib has a relatively wide base.

9. A container wall as set forth in claim 1 in which said rib crosses said weakening line substantially perpendicular to the weakening line.

10. A container wall as set forth in claim 1 which is made of hard temper aluminum alloy sheet material.

11. A container wall as set forth in claim 1 in which the material in the base of the rib is thinner than the adjacent material in the container wall.

12. A container wall as set forth in claim 11 in which said rib is formed by drawing a groove in a metal closure and coining the metal in the base of the groove to form a rib of requisite height.

13. A sheet metal container closure comprising an end wall for closing a container and having a score line therein and an integral substantially V-shaped hollow rib in the wall across the score line projecting from the plane of the wall toward the interior of the container a distance of at least seven times the material thickness, said score line being adapted to be ruptured in response to digital force applied against said rib to form a vent opening in said end wall.

14. A container wall having a score line therein for forming an opening in the wall and an integral hollow rib in the container wall across the score line, said hol-
low rib having a projection measured perpendicular to the general plane of the container wall of at least five times the material thickness opposite the direction from which opening pressure is to be applied to stress the material in the score line across the rib in tension and fracture such material.

15. A container wall as set forth in claim 14 in which said rib has a relatively small radius at its apex.

16. A container wall as set forth in claim 14 in which said rib has a projection of at least seven times the material thickness.

17. A container wall as set forth in claim 16 which includes an annular wall portion around the base of said button.

18. A container wall as set forth in claim 14 which includes a concavo-convex button with said rib formed across the center thereof.

19. A container wall having a score line therein and an integral hollow rib in the wall across the score line projecting into the container at least five times the material thickness for locally stressing the material in the score line across the rib in tension to fracture such material when pressure is applied against the exterior surface of the wall.

20. An end wall for a container including a concavo-convex button projecting outwardly from the wall, a hollow rib projecting inwardly of the container across the center of the button and a score line across the rib which will be ruptured by pressure applied against the exterior surface of the wall.

21. An end wall as set forth in claim 20 in which said rib projects toward the inside of the container a distance of at least five times the thickness of the material in the wall.

22. An end wall as set forth in claim 20 which includes an annular wall portion around the base of said button.

23. A metal container wall having a score line therein for forming an opening in the wall and an integral hollow rib in the wall across the score line projecting into the container multiple times the metal thickness for locally stressing the metal in the score line across the rib in tension to fracture such metal when force is applied against the exterior surface of the wall at the score line.

24. A container wall as set forth in claim 23 in which said rib is at least 0.5 inch long and said score line crosses said rib near its middle.
CONTAINER OPENING DEVICE

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12 Claims. (Cl. 220—48)

This invention relates to sealed containers and more particularly to opening devices therefor.

Numerous attempts have been made to provide an effectively sealed container which may be safely and easily opened without the need for independent tools. Many of these provide visual means of determining whether the container has been tampered with or previously opened. In many conventional bottle or jar type closures, if the closure was sufficiently loose to permit easy opening, problems of gas transmission, reduced impact resilience and product contamination were frequently encountered. Sealing the container in a more substantial manner produced difficulty in opening the container as well as causing damage to the closure liner by the container mouth. As a result, much effort has been directed toward the development of suitable closure liner lubricants. These, by and large, have not been completely successful. Even where test samples of a given lubricant have yielded reasonably effective results, the quantity of lubricant required for each closure is so small that a lack of uniformity of quantity and thickness of coating and resultant required opening force have developed. With the mass production of large quantities of relatively low priced closures, increased inspection of individual closures is not economically feasible.

In addition, foreign particles frequently collected adjacent the closure and were drawn into the container contents when the container was opened. This problem was particularly acute with respect to vacuum packages wherein the initial inwardly directed rush of air created upon breaking the seal would frequently carry impurities into the container.

It is an object of this invention to provide a container which will consistently provide effective sterile sealing to protect the contents, while being capable of easy opening without the need for separate implements.

Another purpose of this invention is to provide a container opening device which may be readily grasped and operated, safely and without difficulty.

Another object of this invention is to provide a container assembly which may be sealed as tightly as desired without being concerned about possible detrimental effect upon opening qualities.

Yet another object of this invention is to provide a container which will provide a visual indication of any tampering or previous opening of the container.

Other objects and advantages of the invention will be understood from the following description of the invention and reference to the illustrations appended hereto, in which:

FIGURE 1 is a perspective view of the sealed container having a type of opening device of the invention;
FIGURE 2 is an enlarged sectional view of the container illustrating the opening device;
FIGURE 3 is an enlarged sectional view of a wall member which is adapted to form a portion of the opening device;
FIGURE 4 is an opening member adapted to cooperate with the wall member of FIGURE 3 to form the opening device;
FIGURE 5 is a plan view of an opening device employed with this invention; and
FIGURE 6 is a view through 6—6 of the opening device illustrated in FIGURE 2.

For purposes of clarity and simplicity, in making exemplary reference to specific embodiments of the invention, use in a closure for bottles, jars or vials will be discussed. It will be appreciated that the invention is equally applicable to cans and other containers having a substantially rigid wall portion adapted to receive the opening device of this invention.

Referring now to the drawings, a container 1 has a container wall 2 within which is disposed a removable portion 3 defined by at least one weakened or second line 4. Within the removable portion 3 is a raised boss 5 or rivet 5. In the form illustrated in FIGURE 5, the shank 8 of the boss 5 has a cross-sectional configuration which is substantially oval shaped. The opening member is a disc 9 having an orifice 7 of substantially oval shape. In assembling the opening device, boss 5 is passed through the orifice 7 of the opening member. The boss is then downwardly collapsed to secure the opening member to the container wall, as shown in FIGURE 2.

In order to effect opening of the container, the disc 9 is rotated about the vertical central axis of the boss or rivet 5. As both the shank 8 of the boss 5 and the orifice 7 of the disc 9 are oval in shape, after rotation is begun the smaller diameter d' of the disc 9 will compressively engage a portion of the boss 5 of larger diameter. The applied torque is thus converted to an inwardly directed compressive stress. Continued rotation of the disc relative to the boss increases the interference fit and results in increased compressive stresses on the shank 8 of the boss 5. As the compressive stresses are increased, the tensile stresses across the container wall 2 are increased, with the weakened portion along the scored line 4 providing a line of least resistance to the tensile stresses. As the rivet illustrated is hollow, it is adapted to be deformed inwardly as the resistance of the score line residual is overcome and the scored line 4 is fractured by the tension stresses resulting from the applied torque. Portion 3 may then be readily removed to permit access to the container contents.

FIGURES 1 through 6 illustrate an opening device having a mechanical advantage which is equal to the outside diameter D of the disc 9 divided by the difference between the large diameter D of the boss or rivet 5 and the small diameter of the orifice d'. The opening device, therefore, not only is adapted for ease of opening by a simple applied torque, without the need for independent implements, but also affords the added benefit of providing a mechanical advantage which produces stresses to effectively reduce the amount of torque which must be applied.

The height of the rivet 5 is by no means critical, so long as it is of sufficient size to permit deformation thereof to secure the opening member 9 against substantial translational movement with respect to the container wall. There is no critical cross-sectional configuration for the shank 8 of the rivet 5 or the orifice 7, so long as the shank 8 is adapted to cooperate with the shape of the orifice 7 to establish a compressive interference fit when the latter is subjected to a rotational movement relative to the former. It is obvious, however, that such an effect cannot be produced when either the shank 8 or the orifice 7 is circular. Therefore, the geometric configuration of both members should be non-circular.

In the embodiment employing a disc 9 as an opening member, it will be appreciated that the overlying position of the disc with respect to the container wall will substantially reduce the amount of foreign particles which can accumulate in the score line and on adjacent wall portions. This acts to reduce the possibility of contamination of the contents upon opening of the container. Also, it will be appreciated that the disc 9 is readily accessible and may be grasped easily. If desired, a flange 10, which
may be disposed upwardly, downwardly or angularly, may be provided. In the preferred form, it is knurled for improved ease of gripping.

While a disc-like opening member is preferred, it is not necessary that the opening member be of this configuration. All that is required is that a suitable orifice and an adequate gripping portion are provided in order that torque may conveniently be applied to the boss 5.

In some uses, such as vial type containers for medicinal purposes, it may be desirable to provide a frangible member 12 underlying the container wall so that the contents will remain sterile even after the removable portion is severed. In such a use, after severance of the removable portion, a hypodermic needle would pierce the frangible member to gain access to the contents. Alternatively, an underlying rubber or plastic plug could be employed to provide additional protection for the container contents after opening has been effected and it could also function as a convenient reclosure where the contents are not entirely exhausted at the time of initial opening.

It will be appreciated that any tampering will be apparent, as once the score line is severed, the pieces remain separated. Permanent distortion of rivet 5 upon opening also provides evidence of opening. These irreversible physical changes will provide a ready indication to the consumer that the integrity of the package has been impaired.

The closure is highly resistant to accidental opening as an accidental application of a torsional moment required to open the container is most unlikely. Also, the design is such that it is unlikely that opening would be effected by the application of other types of forces which might be accidentally applied.

Whereas particular embodiments of the invention have been described above for purposes of illustration, it will be apparent to those skilled in the art that numerous variations of the details may be made without departing from the appended claims.

What is claimed is:

1. A container opening device comprising
   (a) a container wall;
   (b) a removable portion of said wall defined by at least one weakened line;
   (c) a rotatable opening member adjacent said wall and having a non-circular orifice therein;
   (d) fastening means passing through said orifice of said opening member and securing said opening member to said wall;
   (e) a portion of said fastening means having a non-circular cross-sectional configuration adapted for rotational interference fit with said opening member; and
   (f) means for transmitting tension stresses, resulting from torque applied to said fastening means, to said weakened line, whereby rotation of said opening member creates a compressive interference fit between said member and said fastening means, thereby creating tension stresses which sever said weakened line and permit removal of said removable portion of said wall.

2. The container opening device of claim 1 wherein said fastening means is a rivet formed from the material of said wall.

3. The container opening device of claim 2 wherein said opening member is a disc having a flanged periphery.

4. The container opening device of claim 3 wherein said orifice in said disc is substantially centrally disposed and said flange is knurled.

5. The container opening device of claim 2 wherein said opening member has a torque-applying gripping portion longitudinally displaced from said orifice.

6. The container opening device of claim 2 wherein the cross-sectional configuration of the shank of said rivet is substantially identical with the configuration of said orifice of said opening member.

7. The container opening device of claim 2 wherein said orifice and the shank of said rivet are both of substantially oval configuration.

8. The container opening device of claim 3 wherein said orifice and the shank of said rivet are both of substantially the same configuration.

9. A container opening device comprising
   (a) a closure having a panel portion and a skirt portion;
   (b) a removable portion of said panel portion defined by at least one scored line;
   (c) a rotatable substantially circular flanged disc adjacent said panel portion and having a non-circular orifice substantially centrally disposed therein;
   (d) a rivet fastening means formed from the material of said panel passing through said orifice of said disc and securing said disc to said panel portion;
   (e) a portion of said fastening means having a non-circular cross-sectional configuration adapted for rotational interference engagement with said disc; and
   (f) means for transferring tension stresses, resulting from torque applied to said fastening means, to said scored line, whereby severance of said line is effected.

10. The container opening device of claim 9 wherein said device has sealing means underlying said panel portion.

11. The container opening device of claim 10 wherein said sealing means is a frangible sheet.

12. The container opening device of claim 10 wherein said sealing means is a resilient stopper.

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