

Feb. 24, 1970

R. L. LA BARGE ET AL
CONTAINER CLOSURE AND A METHOD OF SECURING
THE SAME TO A CONTAINER

3,497,097

Filed Nov. 14, 1967

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FIG. 1.

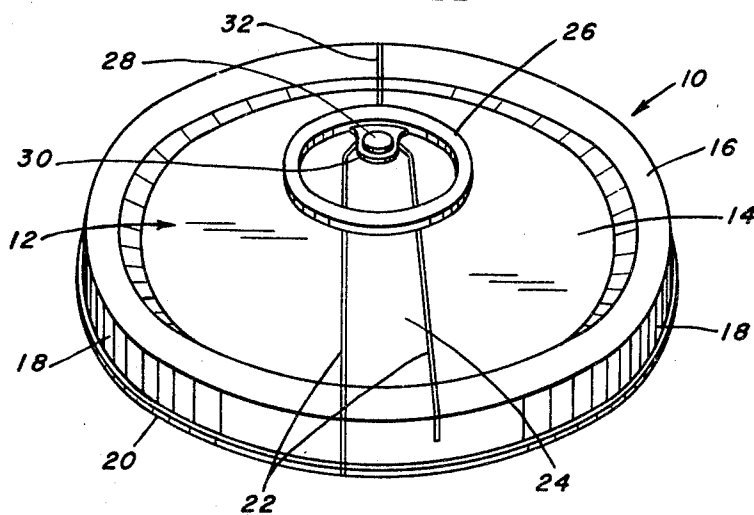
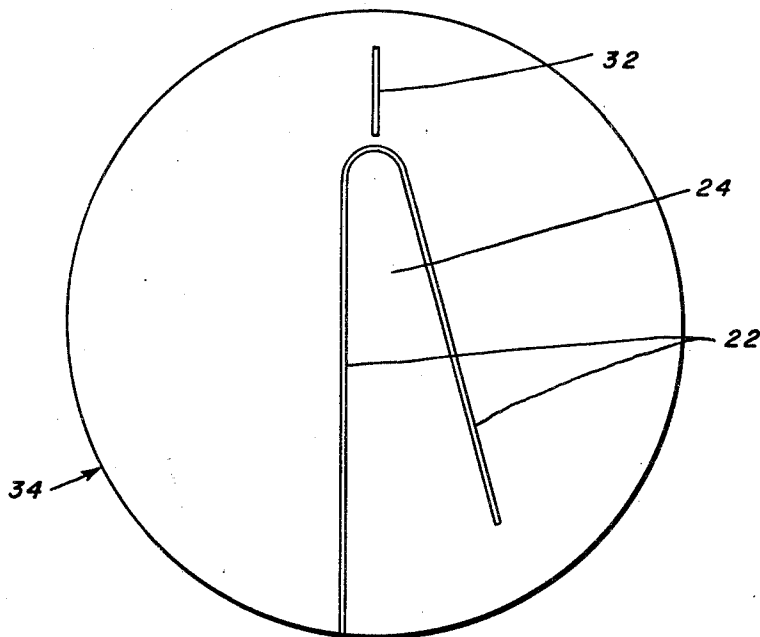


FIG. 2.



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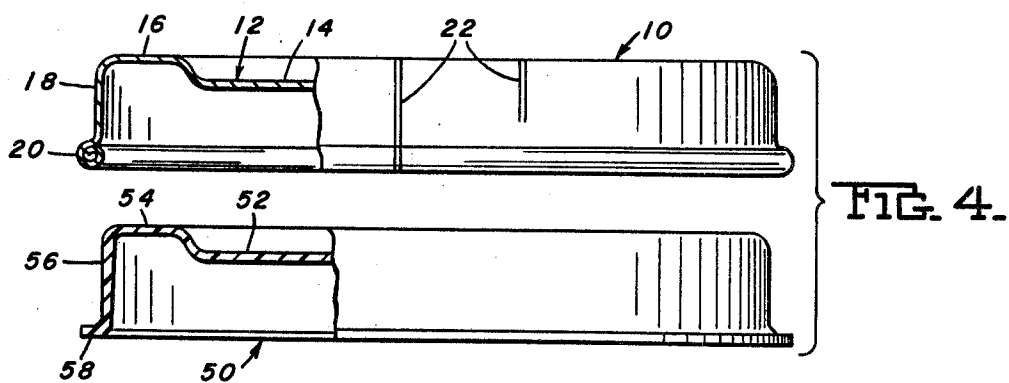
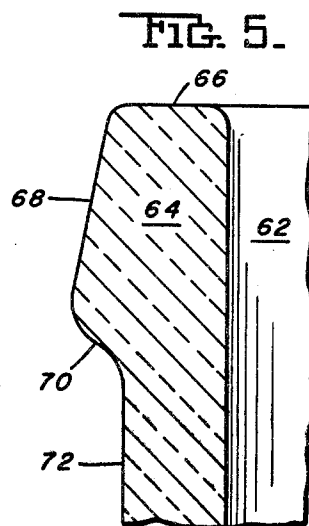
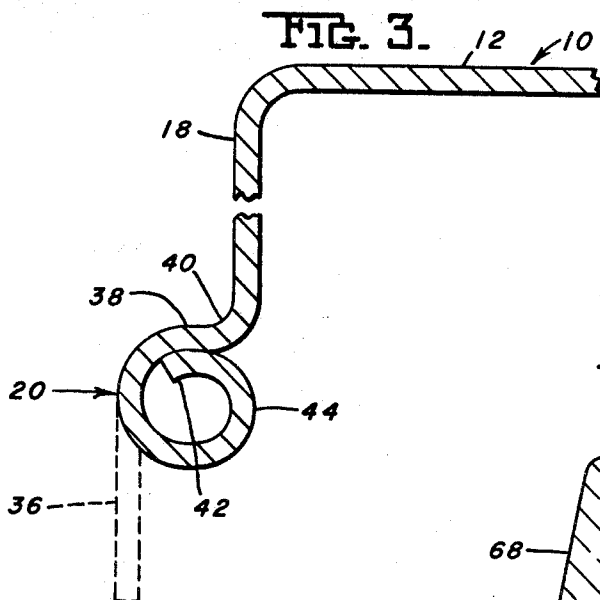
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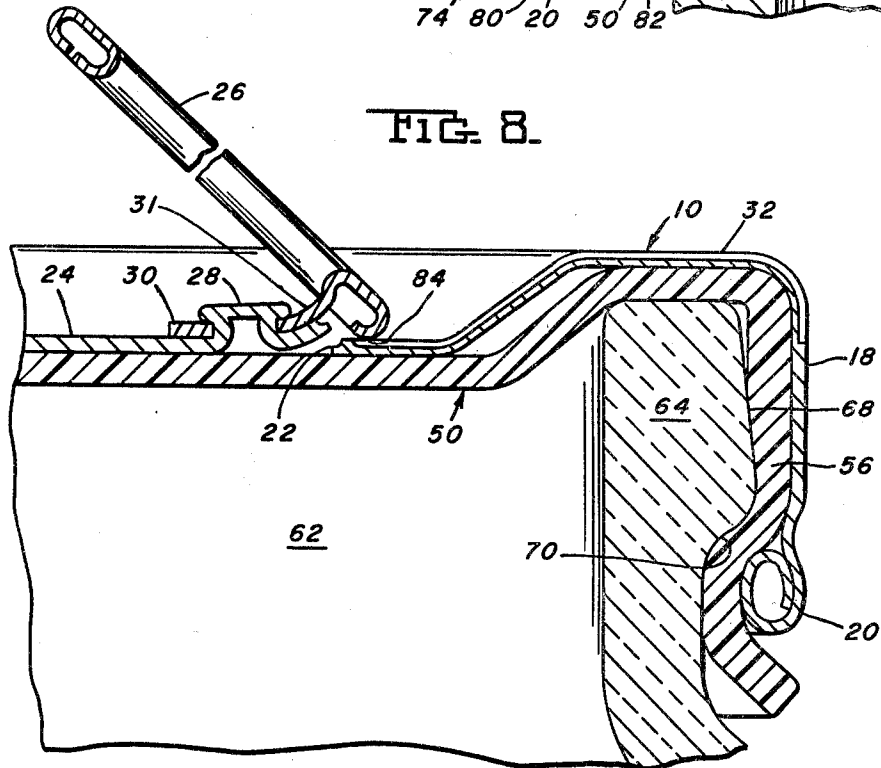
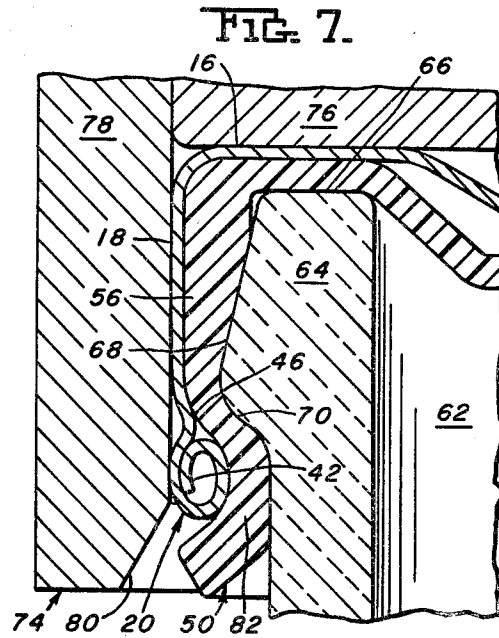
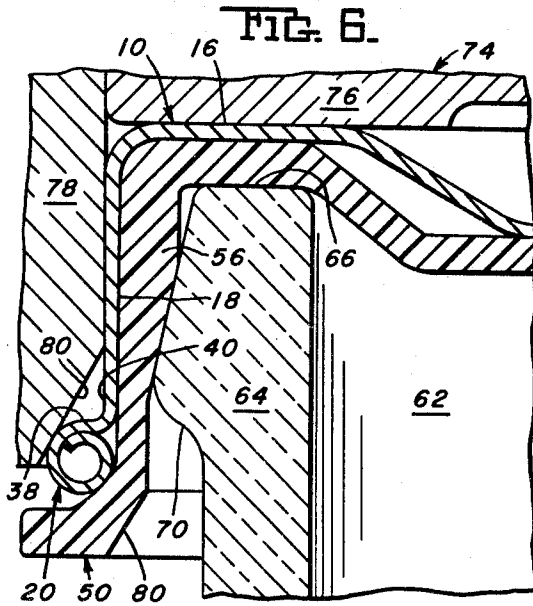
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FIG. 9.

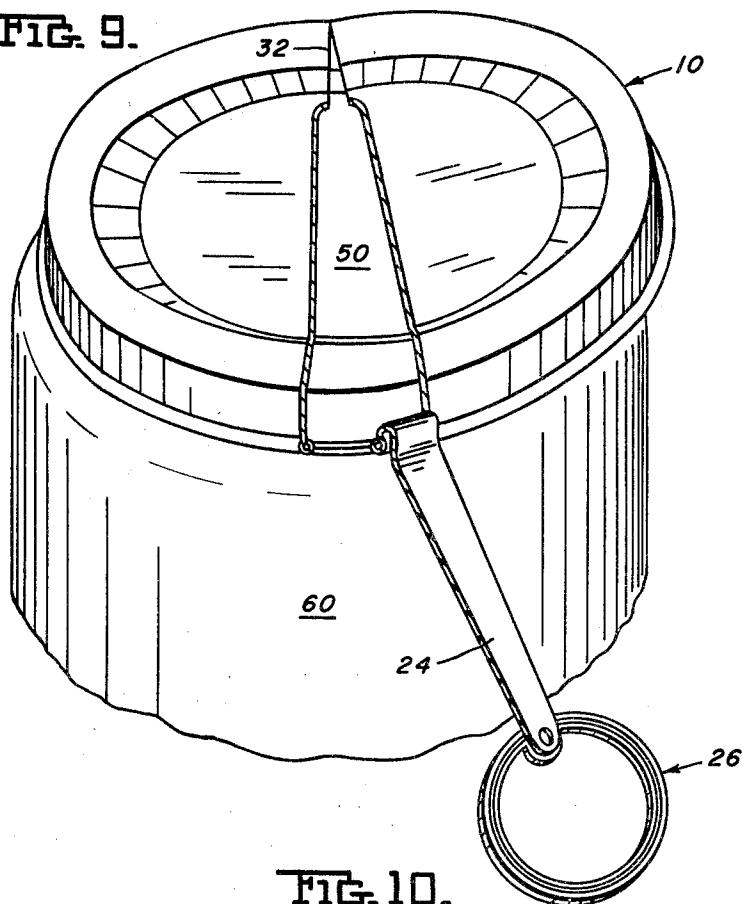


FIG. 10.

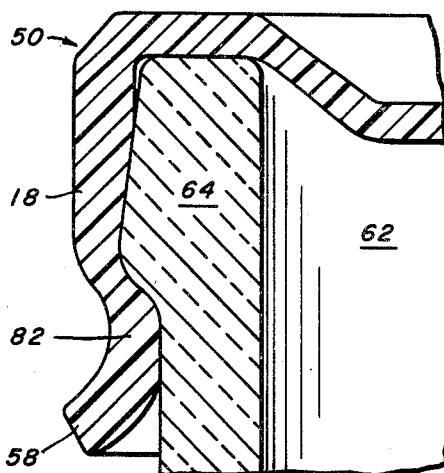
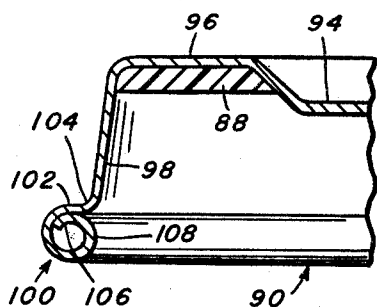


FIG. 11.



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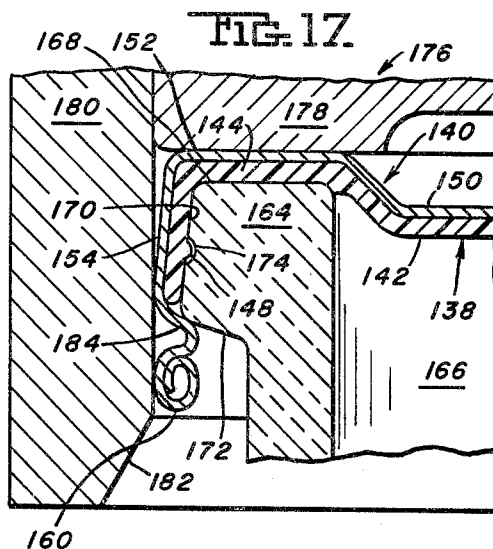
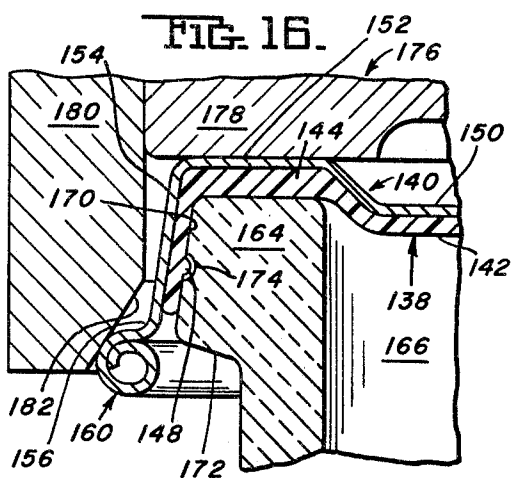
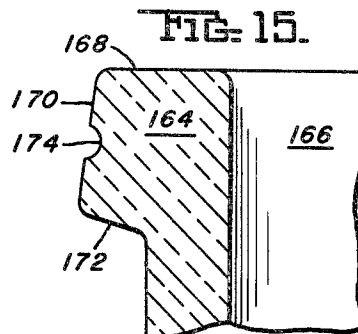
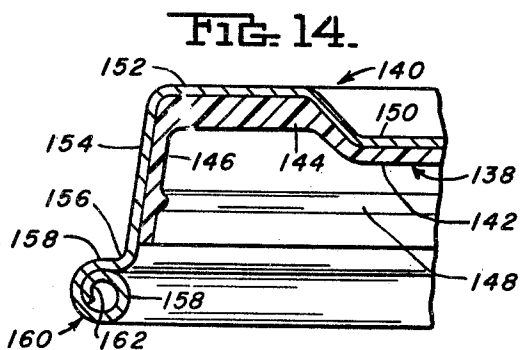
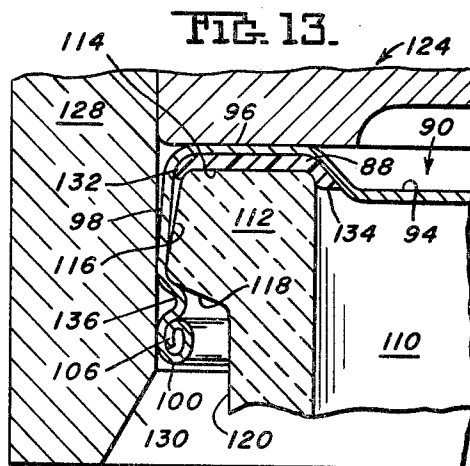
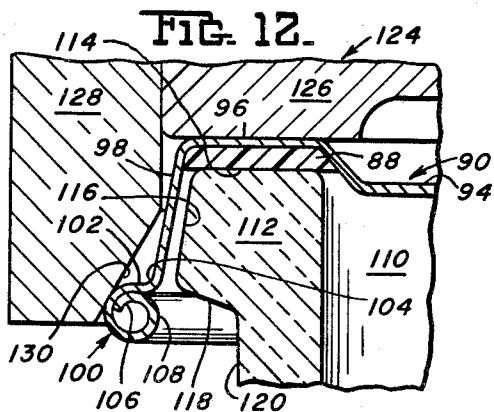
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FIG. 18.

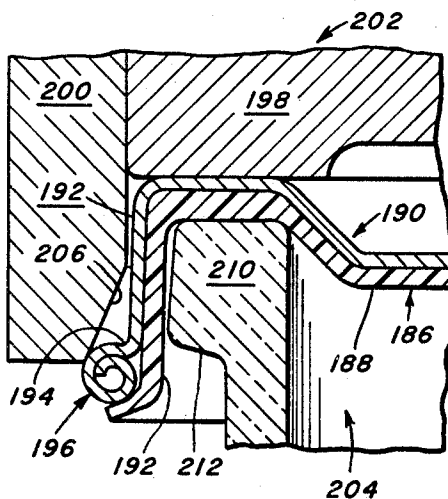


FIG. 19.

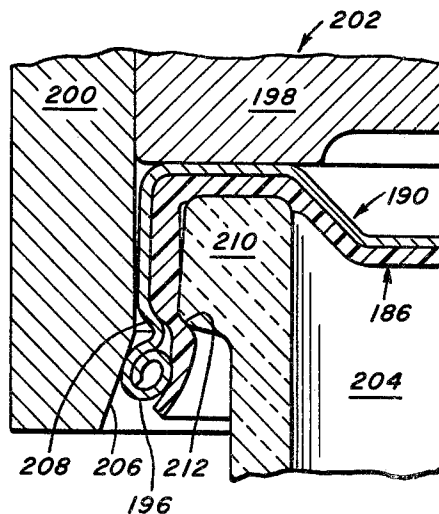
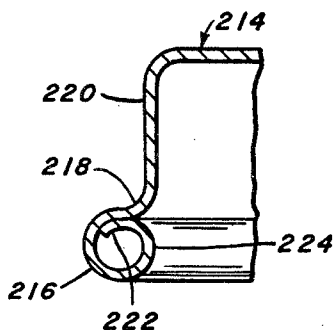


FIG. 20.



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27 Claims

ABSTRACT OF THE DISCLOSURE

Various modifications of container closure fitments, closure assemblies and container-closure packages are provided that are characterized by an enclosing metallic fitment to be secured, and secured, to a container that has a stiffened involutely inwardly curled terminal skirt bead joined to the fitment skirt by a sharp bend, which bead upon being permanently constricted by pressure applied inwardly and circumferentially simultaneously becomes either 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 fitment bead. A method of affixation of the closure fitments and closure assemblies is also provided.

Background of the invention

Closure shells or fitments 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 fitment skirt to a closure restraining and securing location relative to the closure retaining bead of the container. A circumferential closure fitment bead formation is likewise known in which the bead is hollow and inwardly curled more than a complete turn of the fitment 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 a sharp bend at the junction of a flat bead shoulder and a flared fitment skirt.

An assembly of a frangible closure fitment and an inner cup-shaped plastic liner and reclosure to be secured by deformation of a fitment skirt bead is known, together with securement 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 fitments made from permanently deformable sheet material, preferably thin aluminum or aluminum alloy sheet, characterized first by both an improved circumferential hollow inwardly curled bead at the bottom of the fitment skirt and the nature of the junction of bead and skirt for securement to a container by permanent constricting deformation of the bead to effect securing relationship of the fitment with an outwardly projecting closure retaining shoulder adjacent the

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container opening. A closure fitment as used herein may have both a complete top and skirt or may have an interior top portion removed so that the fitment serves as a top flanged retaining band.

It is a primary object that the fitment bead and its junction with the fitment 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 in response 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 fitment bead that is sufficiently stiffened by the extent of involute inwardly curling and sharpness of bend at the junction of the bead and the fitment skirt that constriction of the bead during affixation of the fitment 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 fitment bead structure and the nature of its joinder to the fitment skirt with additional elements of container closure structures to provide numerous new and improved closure fitments, 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 fitment with a pull tab affixed thereto;

FIG. 2 is a plan view illustrating a scored blank from which the closure fitment 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 fitment in FIG. 1;

FIG. 4 is a vertical view of the closure fitment in FIG. 1 and a cup-like liner for the closure fitment, 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 fitment of FIG. 1;

FIG. 6 is an enlarged, fragmentary, vertical cross-sectional view of the closure fitment 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 fitment 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 fitment;

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 overlying 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;

FIG. 14 is an enlarged, fragmentary, vertical cross-sectional view 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 provided 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 circumferential inwardly curled 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 curled 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 the closure skirt 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 blank 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, and the chord that defines the tear strip all the way to the edge of the sheet material is substantially parallel to a diametric 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 such diametric line from the starting end 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 curling 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 end of the stepped 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 adjacently 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 and is otherwise an 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

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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 bead 20 of approximately .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 $1\frac{1}{4}$ to $1\frac{1}{2}$ 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, and a depending skirt 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 draft 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 undersealing surface 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 terminal 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

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the upwardly converging throat 80 thereof in circumferential contact against the outer surface of the inwardly curled 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 gage 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 the lower portion of the fitment skirt to prevent mere collapse of the bead 20 and to cause the formation of rib 46. The reformed fitment bead 20, as shown in FIG. 7, is slightly and permanently transformed into a generally elliptical transverse cross-sectional configuration with its main 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 the embodiment of 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 removal restraining location beneath the container shoulder 70 with the liner skirt 56 tightly and sealingly compressed and locked between the fitment bead and 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 a container sealed with a closure fitment and liner as shown in FIG. 7, opening is effected by grasping the pull tab 26 which is attached to the tear strip 24 to be torn free at its starting end (FIG. 8). Upon lifting, the pull tab 26 will pivot about a sliding fulcrum point 84 that is and remains outwardly of score line 22, causing tongue 30 on the pull tab to bend or flex at its juncture with the body of the tab, creating two levers, one in the tab body and one in the tongue portion 31, and a resultant double lever action. Thus, when lifted the lever provided by the tab body exerts a downward force on the metal lying outwardly of the scoring around the starting end of the tear strip 24, and the lever action of the tongue 30 exerts an upward force on the rivet 28 and the tear strip 24. Consequently, this double lever action produces nearly perfect opposed shearing forces on opposite sides of the score line 22 at the starting end of the tear strip to effect initial rupture thereof with a minimum of effort. It should be noted that location of the fulcrum of the tab body lever outside the score line 22 avoids two problems attending a fulcrum located within the score line which would result in downward plunging of the tear strip at its starting loca-

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 22 along both sides of the tear strip across the top 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 still unitary, partially 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 fitment, 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 constriction 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 just described to form a suitable rib for snap on reclosure purposes. The inherent flexibility or resilience of the liner 50 makes it a simple matter to pull or pry off the liner manually. Reclosing 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 fitment 90. Closure fitment 90 similarly to closure fitment 10 essentially comprises a generally cup-shaped drawn metallic shell having a top with a recessed central panel 94 and a depending skirt 98 terminating in an outwardly extending, circumferential, inwardly curled, hollow bead 100. Bead 100 projects radially outwardly from the skirt portion adjacently 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 fitment 10, the inner or enclosing curvilinear surface 108 of bead 100 is preferably located tangential 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 sealing head 124 comprises a central pressure applying block 126, engageable against at least the upwardly facing surface of the annular rim or flange 96 of the closure fitment 90, and a surrounding relatively movable sleeve element 128 provided with a lower terminal upwardly converging throat 130.

As shown in FIG. 13, with the sealing head 124 in position over the closure fitment, relative movement of the central block 126 towards and against the rim 96 of the closure fitment 90 compressibly reduces the thickness of the gasket 88 into sealing contact against the upwardly facing sealing surface 114 of the underlying container and depending upon the characteristics of the gasket 88 lateral exterior and interior side sealing, at 132 and 134, respectively, may also be accomplished.

Relative movement of the surrounding sleeve 128 of the sealing head 124, with the upwardly converging throat 130 thereof in circumferential contact against the outer surface of the closure fitment bead 100 reacts to apply pressure simultaneously around the bead to inwardly deform and constrict it and concomitantly inwardly direct and permanently impress a circumferential rib 136, which in this case is in closure securing affixation below and in bearing contact against the undersurface 118 of the container bead 112.

In the transformation of the circumferential bead 100, the circumferentially simultaneously applied inwardly directed pressure around the outer circumference of the bead by the tapered throat 130 reacts to compressibly restrict and permanently transform the bead 100 by further inward tightening curling of the same. The sharpness of the bend 104 and the double gauge thickness of the material of the bead structure 100 and the preferable inclusion of the rim 102 provides requisite stiffness immediately adjacent and below the initial sharp bead 104 in the skirt 98 of the closure fitment so that the sharp bend 104 is moved inwardly and impressed to permanently form rib 136 against the resistance of the adjacent projecting container bead 112 and becomes the most inwardly impressed portion of rib 136. The bead 100 is permanently transformed from its initial cross-section to a generally elliptical transverse cross-sectional configuration with its major axis substantially vertical. In its permanently transformed circumferentially restraining condition (FIG. 13), the bead 100 has undergone further curling on itself thereby increasing its stiffness, and the initially located and disposed substantially flat rim area 102 is downwardly tilted at a slightly steeper angle in FIG. 13 to that in FIG. 12. This occurs without substantial change in the maximum outside dimension of the bead 100, and without substantial change in the location at which the end portion 106 of bead 100 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. In such condition the bead 100 serves as a substantial and intended restraint against removal of the closure fitment by assuring and maintaining proper engagement of rib 136 with the container shoulder 118.

FIGS. 14, 15, 16 and 17 represent a further embodiment of the invention in which a molded resilient plastic reclosure liner 138 is provided and frictionally secured within an exterior metallic enclosing closure fitment 140 substantially identical to that previously described and illustrated. Reclosure liner 138 is preferably provided in a form similar to liner 50 shown in FIG. 4, and has a recessed central panel 142 with a raised channel or rim 144 for overlying registry with an upwardly facing sealing surface of a complementary container to be described and a depending skirt 146 provided with an inwardly directed container engaging rib 148, circumferentially continuous or intermittently formed therein.

The closure fitment 140 in frictional assembly with liner 138 is preferably but not necessarily provided with an overlying recessed central panel 150, a raised channel or rim 152 therearound and a depending skirt 154 extending below the reclosure skirt 146, where it is outwardly directed by sharp or tight angular bend 156 to provide a substantially flat annular rim or flange 158 overlying a substantially circular transverse cross-sectional inwardly curled circumferential hollow bead configura-

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 fragmentary entrance 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 securement of the closure combination of FIG. 14 on the underlying container of FIG. 15 by means of the sealing head 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 178 against at least the underlying, 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 180 is moved downwardly in respect to the pressure block 178 to engage the converging 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 container 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 136 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 with 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 a recessed top panel 188 and a depending skirt 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 me-

talic 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 curled 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 pressure block 198, and relatively movable surrounding sleeve 200 of the sealing head 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 constriction 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 206 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 208 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 in every respect to 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-section, 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 flat rim of the aforesaid bead configurations 20, 100, 160 and 196. Otherwise, the end portion 222 of the inwardly curled bead 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 tangential to an extended plane of the inner 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 throat 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 order 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 it will be further 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, and combinations thereof, resilient and/or compressible liner or gasket structures affording 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; or additional appropriately weakened tear strip patterns may be incorporated in the outer closure shell fitments having various digitally manipulatable grasping 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 therewithin 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 therewithin 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 having an end portion 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 thereof by a sharp bend of a radius approximating but safely less than the radius of fracture of the fitment material,

(ii) the end portion of the inwardly curled bead underlying a substantial length of the inner wall surface of said hollow bead,

(iii) a tear strip defined by weakening in line configuration and divisive 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 divisive 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

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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 constriction thereof into underlying assembly securing disposition beneath the container-closure retaining bead with the liner compressed therebetween.

13. A closure assembly in accordance with claim 12 in which the closure fitment has a further line of weakening 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 fitment top is divisive 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 fitment top is divisive 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 reclosure.

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 such bead from a location on an upper and outwardly extending portion of such surface near the junction of such surface and the skirt portion thereabove to effect substantial restraint respecting fitment removal from said container.

19. A unitary sealed package in accordance with claim

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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 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, said bead restrainedly maintaining securement and affixation by said securing rib of said closure fitment on 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 container.

- (ii) a tear strip defined by weakening in line configuration and divisive 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 divisive 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 partially split members; and

- (c) a compressible sealing liner interposed between the container mouth entrance and the closure fitment 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 securely affixing a closure fitment on a container, the steps comprising:

- (a) providing a container having an outwardly pro-

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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 sealing 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 out-

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wardly 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.

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