

[54] **POP-IN CONTAINER CLOSURE**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 331,844, Feb. 12, 1973, abandoned.

[52] U.S. Cl. **220/268; 220/541**

[51] Int. Cl. **B65d 41/32**

[58] Field of Search 220/266, 267, 268, 276; 222/541

[56] **References Cited**

UNITED STATES PATENTS

2,210,225 8/1940 Walensky 220/266

3,227,304 1/1966 Asbury 220/268
3,794,206 2/1974 DeLine et al. 220/268

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[57] **ABSTRACT**

A container lid, by the steps of shear-coining over die surfaces to provide a fracture, and a swedging, comprises a peripherally dilated button portion which adequately resists internal fluid pressures, yet is disruptable by external finger pressure urging the button portion inwardly. The fracture terminates within a wall of the button portion, being sealed by surfaces preferably swedged into overlapping relation. The button may be provided with a non-disruptable or hinge portion, or formed to enable it to fall into the container, the button in either case not being separately disposable. No harmful closure edges are exposed.

16 Claims, 9 Drawing Figures

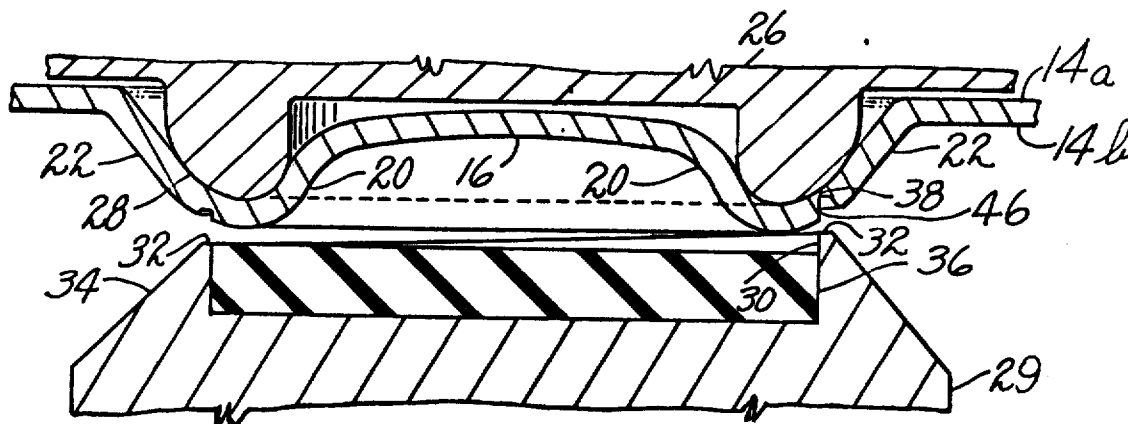


Fig. 1

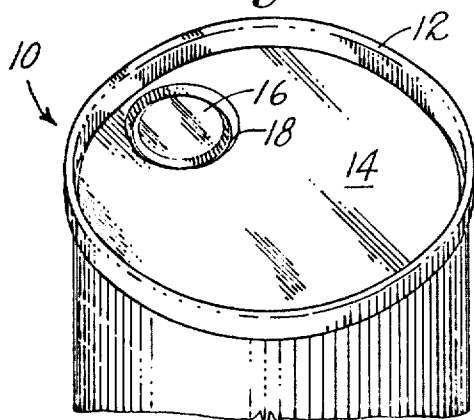


Fig. 2

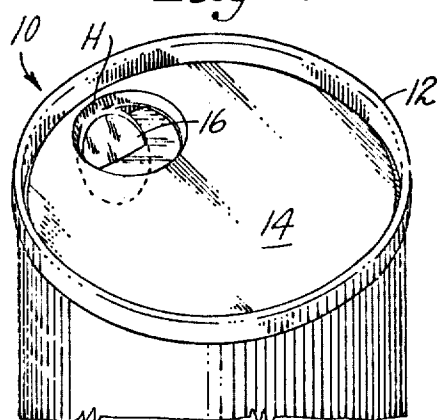


Fig. 3

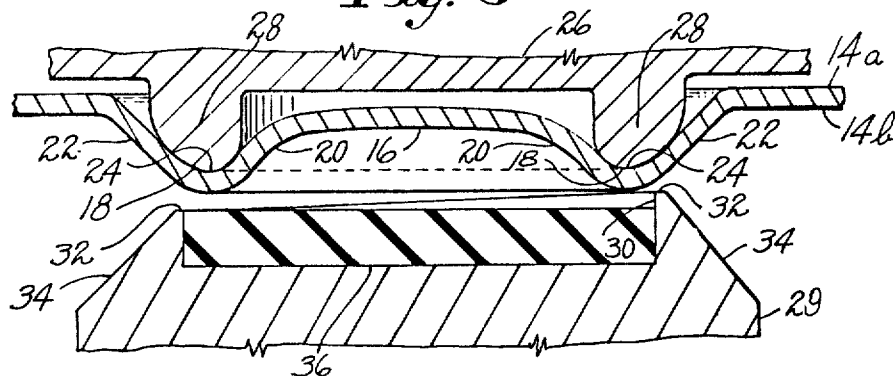


Fig. 4

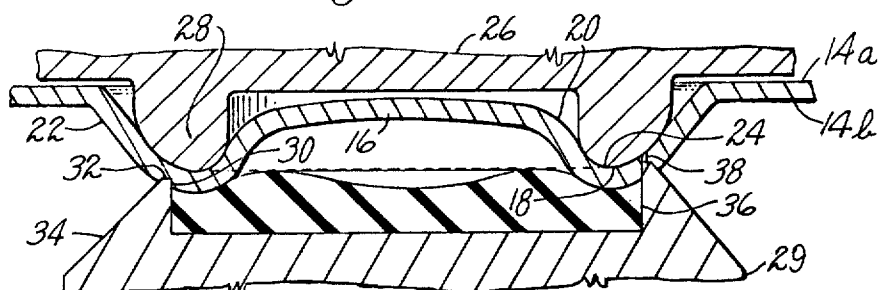


Fig. 5

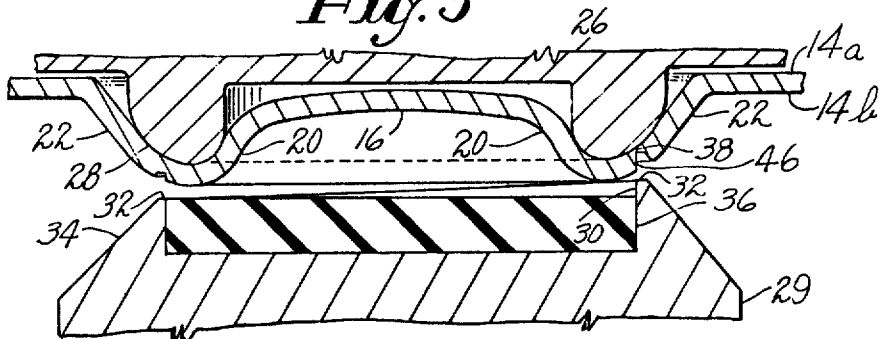


Fig. 6

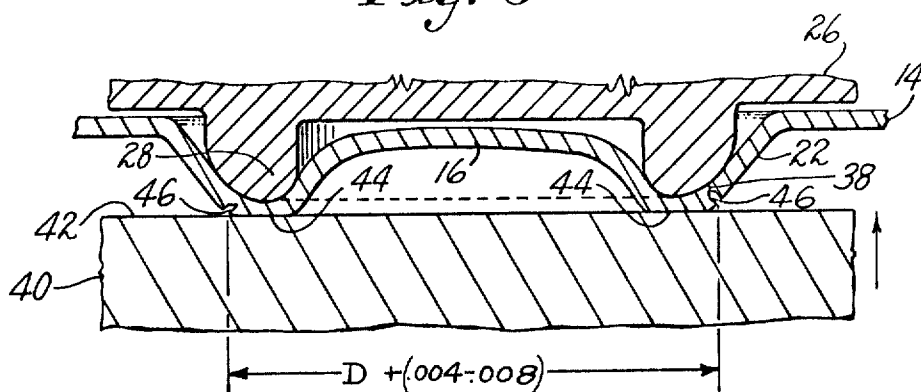


Fig. 9

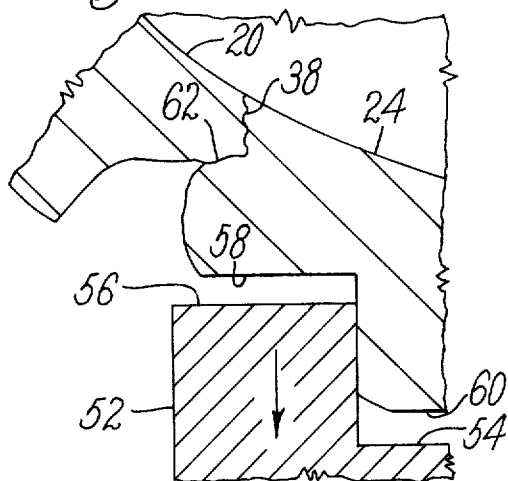


Fig. 7

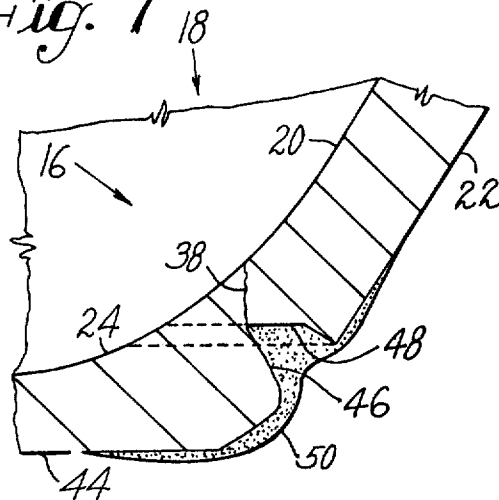
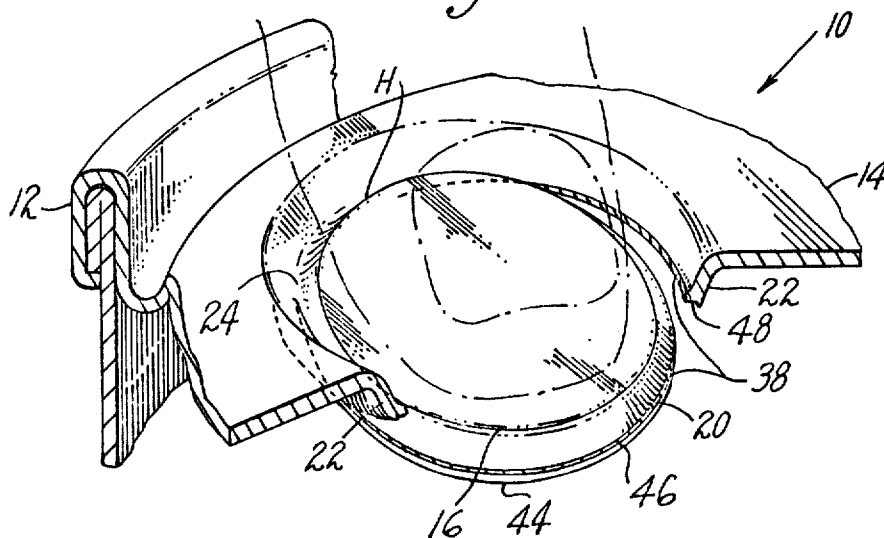


Fig. 8



POP-IN CONTAINER CLOSURE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 331,844, now abandoned, filed Feb. 12, 1973, in the names of Walter Lovell and Frederick G. J. Grise, and relating to "Environmental Pop-In Button Closure for a Can". Application Ser. No. 454,384 pertaining to the method aspects of this invention is also a continuation-in-part of application Ser. No. 331,844.

BACKGROUND OF THE INVENTION

This invention pertains to a tabless, push-in type closure for the sheet metal lid of a container adapted to retain fluid under pressure.

In the prior art, several different closures of the so-called "pop-in" type have been proposed. Some required a leverage tab or lifting projection and scoring in the lid, and others such as disclosed, for instance, in U.S. Pat. Nos. 3,227,304 to Asbury, or 3,334,775 to Klein et al., specify a score line in a flat region, or a score line in a wide angle notch, but in a fold such as to preclude reliable operation or uniformity in manufacture. When the latter types can be "pushed-in" they commonly have inadequate strength to resist internal pressure such as may be present in a carbonated beverage or a pasteurized fluid.

An easy-open lid construction providing no separately disposable parts is generally recognized as very desirable provided it can safely retain fluid pressures and yet be uniformly reproduced by a practical method.

SUMMARY OF THE INVENTION

In view of the foregoing, it is an object of this invention to provide a simple, economical, reliable push-in closure useful in sheet metal container lids.

More specifically, another object of this invention is to provide improved container structure reinforcing the margins of push-in button portions of can lids whereby fluids can be safely contained yet manual access be readily available by rupture of the margins.

To these ends, and as herein illustrated, a metal lid is first formed with a recess providing a button having inner and outer bounding walls merging in a peripheral ridge on one side of the lid. Next a coin-shearing operation is performed, preferably in a convex portion of the outer button wall, to provide (as per one mode of the invention) a peripheral indentation having convergent angular faces meeting at a fracture extending through the metal of the wall. Then, while the thus indented wall is backed by a die having complemental (preferably convex) curvature, a swedging operation against the peripheral ridge dilates the metal of the outer wall to force one of the indentation faces into partly overlapping relation to the other face, by a few thousandths of an inch over its length, and enables the metal in the locality of fracture to spring substantially closed. A lacquer coating may thereafter be applied for sealing, if desired, to the button internal surface, but is often unnecessary.

While the "single indent" form of the lid button closure just described is generally satisfactory, this invention also comprehends a closure of similar construction but which may be referred to, for reasons hereinafter becoming apparent, as the "double indent" type. The latter involves a modified swedging for providing a me-

chanical locking of the metal at the fracture, a localized peripheral portion of the wall metal being forced to flow into the shear-coined indentation to prevent fluid penetration of the fracture and overlap the bottom face of the indentation. This advantageously dilated button construction, as herein disclosed, need not involve extra tooling or operating time.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features of the invention will now be more particularly described in connection with an illustrative embodiment and a variant form and with reference to the accompanying drawings thereof, in which:

FIG. 1 is a perspective view of one illustrative embodiment of the invention, a can top having a circular closed closure button hinged to the lid;

FIG. 2 is a view similar to FIG. 1 and showing the button pushed inwardly;

FIG. 3 is an enlarged diametral section showing a padded coin-shearing die and a back-up die about to commence operation on a lid, the button portion of which has previously been struck up from the inside, or the surrounding material has been depressed relative to the lid by a drawing die;

FIG. 4 is a section similar to FIG. 3 showing the button and parts at bottom of peripheral fracture opening stage;

FIG. 5 is a section similar to FIG. 4 showing the parts at a subsequent released or partial fracture reclosing stage;

FIG. 6 is a section similar to FIGS. 3-5 but indicating the final stage wherein a swedging die, of flat as opposed to axially stepped form shown in FIG. 9, dilates a wall of the shear-coined indentation and tensions the fracture web over a convex back-up surface;

FIG. 7 is a further enlarged detail view, predicated on a typical photomicrograph showing in transverse section the released button wall having a sprung together fracture and a dilated indentation face at least partly overhanging the wall fracture, and lacquer coating applied thereto;

FIG. 8 is a perspective view corresponding in part to a portion of FIG. 2 and showing the closure of FIGS. 1-7 inclusive being opened; and

FIG. 9 is a view similar to FIG. 7, but omitting the lacquer and showing an important variant, a double-indent button closure wall as magnified to reveal the fracture reclosed upon retraction of an axially stepped swedge.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following disclosure it will be appreciated that certain critical physical distinctions resulting from method and structure obtaining in this case over prior art may be dimensionally small and possibly to the point of being invisible to the naked eye. It will nevertheless be understood, as hereinafter pointed out, that despite possibly small dimensional changes involved, the significance of the novel structure to be described is real and of considerable importance from both the standpoint of manufacturing advantage and improved closure performance.

FIGS. 1-8 inclusive pertain to a so-called single indent closure, and an important variant is subsequently described with reference to FIG. 9.

FIG. 1 shows a conventional can 10 having a rim 12, usually the chime of an otherwise planar sheet metal lid 14 (FIGS. 1-8). A pop-in closure 16 for instance of circular shape like a button, to be manually pressed inwardly for opening the container lid is preferably positioned adjacent to the chime. It will be understood that neither the lid or its button portion 16 need be circular. The lid 14 is first formed as by a die (not shown) to provide its button portion 16 with a surrounding continuous depression 18 bounded by inner and outer walls 20, 22 respectively. Preferably the flat of the integral button portion 16 remains only slightly depressed with respect to the general plane of the lid 14 so as to readily indicate the locality to be opened inwardly.

It will be noted (FIGS. 3-5) that the button walls 20, 22 to be processed as by steps hereinafter explained are desirably partly convex in section and merge in a rounded trough 24. Walls 20, 22 simply inclined to the plane of the lid without being convex may in some cases be satisfactorily employed but are not usually preferred. Regardless of the care with which the sheet metal is originally made, there is no real control over its grain structure. Accordingly, scoring a closure as thin as that found, for instance, in beer cans requires an extra degree of penetration and sizing control nicely afforded by the mentioned wall convexity in order to prevent leakage on the one hand and yet, on the other hand, insure manual accessibility to the container contents without requiring extra finger strength. While it has been found that the invention may be practiced on the inner wall 20, and whether it be transversely arcuate or straight and inclined to the lid, it is generally preferable to operate on the convex portion of the outer wall 22, and usually at least about a third of its length, as will hereinafter be explained.

Assuming the lid button 16 to be substantially in the configuration shown in FIG. 3, the outer wall 22 is next shear-coined lengthwise in its convex periphery. For this purpose an upper back-up die 26 (FIGS. 3-6) has an annularly projecting rounded ridge 28 formed to fit in and engage the trough 24. A lower shear-coining die 29 (FIGS. 3-5) is arranged to cooperate coaxially with the back-up die 26, and has a vertically disposed cutting edge 30, an angularly related narrow coining face 32, and a longer inclined coining face 34 extending outwardly from the face 32. The coining face 32 commonly will have a uniform width on the order of from about one-fifth to one-third of the thickness of the lid, depending on the particular sheet metal and the extent of fracture desired. In this connection it may be noted that actual through-wall fracture as a result of the shear-coining step is generally desired.

To clampingly hold the button 16 against bodily shifting laterally on the die ridge 28 when the convex portion of the outer wall 22 is peripherally shear-coined as shown in FIG. 4 during relative approach of the dies 26, 29, the latter die preferably has a yieldingly compressible rubber pad 36 of uniform thickness nested within the cutting edge 30.

As shown in FIG. 3, the coining face 32 axially tapers from a maximum projection above the pad 36 on the right side of the die periphery to a minimum on the left side substantially flush with the pad 36. In this manner the periphery of the outer wall 32 is variably shear-coined, providing a controlled indentation extending substantially all around the button 16 but of tapering lesser depth in the left-hand portion than in the right-

hand portion as shown in FIG. 4. The depth of the shear-coining is usually selected to insure that the coining indentation concomitantly causes a fracture 38 (FIGS. 4-7) all the way through the metal and extending for roughly from about 120° to 180° around its periphery. This fracture serves as an easily started locality of rupture in the complete button. The locality of no indentation, generally opposite to the locality of greatest indentation and/or fracture, will serve as a hinge H (FIGS. 2 and 8) when the button is pushed into the can 10.

It is to be noted that shear-coining the button wall 22 over a transversely convex back-up die surface, i.e. outwardly of the center of the annular die ridge 28, provides both a refined control of the desired indentation and degree of the resultant fracture 38, and an improved service life for the shear-coining die 29. The latter is probably largely due to the freedom of the metal in the wall 22 to flow as necessary during tensioning outwardly over the curved surface of the die 26. It will be understood, nevertheless, that this invention whether in the single or double indent form may be utilized in either of the walls 20 or 22 and whether they be convex, concave or straight but inclined to the lid.

When the dies 26, 29 are relatively separated heightwise as shown in FIG. 5 after shear-coining, resilience of the pad 36, which had been distorted as indicated in FIG. 4, frees the lid for the last step about to be described. No wall material has been removed. It will be understood that the nearly 90° angle at the bottom of the peripheral indentation or groove initially imparted by the convergent cutting edge 30 and the adjacent coining face 32 as shown in FIG. 4 is partly reduced as indicated in FIG. 5 when relative die retraction permits residual tension in the wall material to be dispelled. Accordingly, mating irregular metal at the fracture 38 springs substantially closed without appreciable misalignment of confronting edges. No complete separation is permanently incurred at the bottom of the wall indentation.

The final and perhaps most important step in this single-indent button forming will next be described with reference to FIGS. 6 & 7. With the backing die 26 still in its work-engaging position, swedging die 40 (FIG. 6) having a flat face 42 compressively bears on the walls 20, 22 at the annular locality of their convergence. This imposes a flat 44 on the periphery of the button 16 opposite to the depression 18 and causes metal of the indented wall 22 to flow outwardly. More significantly, and as better shown in FIG. 7, as a consequence of the swedging an indentation face 46 of the wall 22 is dilated and hence at least partly overlaps a convergent indentation face 48 imparted by the coin-face 32. This overlap which may be on the order of about two to four thousandths of an inch on opposite sides of the button respectively, is disposed outwardly of the fracture 38. The swedging therefore stiffens the button wall in the vicinity of the fracture, and generally appears to close the fracture; along its length. A lacquer coating 50 (FIG. 7) may be applied at least to seal the fracture and the indentation on the inside of the completed lid.

A variant and important form of our novel closure, sometimes termed the W configuration or double-indent form, is illustrated in FIG. 9 along with a portion of an axially stepped swedge 52 used in its manufacture. As shown, the double indent form of peripheral wall may be considered one having a W-shaped inden-

tation in section. Instead of having a single flat working surface 42 as is the case with the swedge 40 of FIG. 6, the reciprocable swedge 52 has axially stepped inner and outer working faces 54,56 and an interconnecting wall disposed substantially at right angles thereto. The diameter (or transverse dimension) of the swedge face 54 is less than the dimension between opposite coin-induced fracture portions 38 and hence less than the dimension between opposite coining faces 32. Axial offset of the faces 54,56 desirably is selected to enable the face 54 to engage the die-backed ridge material and form a flat 60 (FIG. 9) forcing a portion of the metal to flow outwardly into fracture closing relation, and to enable the face 56 to apply a localized peripheral axial indenting pressure on the thus outwardly displaced metal of the bounding wall as at 58 (i.e. on the median strip of the W-shape) whereby the confronting closely associated and mating portions of the fracture, while held under tension by the face 54, are tightly locked together. Whether such sequential swedging occurs or not, almost simultaneously with this very effective closing of the fracture 38 the narrower swedge face 56 bearing on the double-indent face 58 of the median strip also causes a portion of the strip metal (within the single thickness of the button wall) to be extruded annularly and dilated outwardly into overlapping relation with the bottom of the first indentation caused earlier by the coining illustrated in FIG. 4.

It is to be noted in FIG. 9 that the fracture 38 now terminates inwardly of the button surface and at the junction of the overlapped or dilated metal with the coined indentation bottom. Thus a better, i.e. a tighter sealing of the fracture 38 is attained at the same time that an increased ability to retain fluid under pressure is accomplished. Moreover, it will be observed that no additional tooling or extra time consuming function is involved in producing the double indent closure over the single indent type. Accordingly, closures for holding greater pressure are presently expected to be of the double indent form. The working width of the swedge face 56 may be on the order of about one-half of the lid thickness. Whether the single or double indent button closure is used, it will be understood that an internal lacquer coating is desirably added.

In contrast to prior art closures wherein the metal sheet is often folded back upon itself, and control of the degree of fracture is lost, the double indent type closure insures uniform, reliable pressure holding capability, yet yields an easily cleanable cover—one which readily sheds dirt or foreign matter during washing.

Referring now more particularly to FIGS. 2 & 8, when the hinge H of the button 16 is adjacent to the can chime, suitable indicia, for instance an arrow (not shown), may indicate the diametrically opposite locality of deepest shear-coining and fracture where external finger pressure on the button can most easily start rupture. Once rupture has been started along the fracture, continued tearing of the metal along the remainder of the wall indentation requires less pressure. It will be understood that if internal hinging of the button H is not desired, a complete 360° shear-coining and fracture as herein explained will enable the closure to be separated inwardly and thereby deposited within the can so as not to be separately disposable.

From the foregoing it will be clear that the swedging provides a circumferential "growth" or dilation of the button 16, expanding its initial transverse dimension or

diameter D (perhaps on the order of about six to eight thousandths of an inch total) outwardly of the fracture 38 to overlap a part of the adjacent indentation wall as indicated in FIG. 7 or FIG. 9. Accordingly internal fluid pressure in the can tends only to close the wall indentation and the fracture 38 but has no significant disrupting effect thereon.

The described closures are applicable to various shapes of buttons and containers, and are economically employed with a high degree of precision control and hence uniformly reliable results.

Having thus described my invention, what I claim as new and desire to be secured by Letters Patent of the United States is:

1. A manually disruptable pop-in type of button closure for a planar metal container lid comprising an integral button having inner and outer merging bounding walls generally inclined to the plane of the lid, one of the walls having opposite sides and being longitudinally indented on one side to provide a fracture extending between the bottom of the indentation and the other side of the one wall, and a face of the indentation being dilated relative to the fracture to permit its disruption from outside the container yet effectively resist internal pressure therein.
2. The closure of claim 1 wherein it is the outer bounding wall which is longitudinally indented, and has a transverse convexity along a portion of its length, the depth of the indentation tapering to provide a locality for facilitating the start of the disruption.
3. The closure of claim 1 wherein the indentation depth tapers in diminishing degree peripherally to a locality of substantially no fracture and the indentation is discontinued at a locality whereat the button has a hinging connection to the lid.
4. A button closure manually disruptable in an integral lid for access to the contents of a container, the closure being defined at least in part by a bounding wall extending transversely out of the plane of the lid, the wall having an indentation extending lengthwise provided by angularly related faces and a through fracture terminating substantially at the junction of the faces, one of said faces being dilated outwardly of said junction whereby the opposite mating portions of the fracture are releasably locked in close association.
5. A button closure as in claim 4 and a coating of lacquer on at least the indentation faces to seal said junction.
6. A sheet metal container lid comprising an integral, disruptable pop-in type of button closure, the closure having an outer, sectionally convex boundary wall, a coined longitudinal indentation formed in one of the two opposite sides of the wall and having a bottom face of generally uniform width on the order of about one-fifth to one-third the thickness of the lid, and a fracture extending from the said bottom face substantially to the other of said two wall sides.
7. A lid as in claim 6 wherein swedged metal from a peripheral wall of the indentation overlaps the fracture at said bottom face for sealing it.
8. A sheet metal container lid comprising an integral, disruptable pop-in type of button closure, the closure being largely defined by a continuous depression in the lid, and a bounding wall which, in section, is generally angularly related to the lid, a longitudinal indentation in the bounding wall, a fracture terminating interiorly of the wall substantially at the bottom of said indenta-

tion, and at least a portion of the metal adjacent to a peripheral face of the indentation being dilated to partly overlap the bottom surface of the indentation substantially at the interior terminal portion of said fracture.

9. A lid as in claim 8 wherein, without removal of material, a second longitudinal indentation is formed in said metal adjacent to a peripheral face of the aforementioned indentation to hold confronting mating portions of the fracture in close association.

10. A sheet metal container lid comprising an integral, disruptable pop-in type closure, said closure being largely defined by a continuous depression in the lid providing a bounding wall having an upstanding ridge portion, the wall having a longitudinal indentation outwardly of the ridge portion and a fracture terminating in the wall interiorly at the bottom of said indentation, mating metal portions on opposite sides of the fracture being in tension and dilated into closed relation by a swedging of said ridge portion, and the metal immediately adjacent to one face of said indentation being extruded into partly overlapping relation to the bottom of said indentation to lock and seal the mating portions of said fracture.

11. In a sheet metal container lid, an integral disruptable pop-in type closure, said closure being defined by a bounding wall projecting out of the plane of the lid, the wall having a pair of adjacent peripheral indentations and a fracture terminating interiorly of the wall at the bottom of one of said indentations, a face of the other indentation being dilated to extrude metal which partly overlaps and seals the interior terminus of the fracture.

12. A lid as in claim 11 wherein the wall is transversely convex and includes a ridge portion, and said fracture extends from the bottom of that one of said pair of peripheral indentations more outwardly from said ridge portion.

13. A lid as in claim 11 wherein the depth of said one of the peripheral indentations tapers from a maximum toward a peripheral locality wherein there is no fracture thereby providing a hinging connection for the closure.

14. A lid as in claim 11 wherein the peripheral indentations extend in substantially parallel relation, are respectively generally angular in transverse section to provide an intermediate strip, and said strip is swedged to extrude metal for sealing the fracture by partly overlapping the bottom of the adjacent indentation.

15. In a sheet metal container lid, an integral, disruptable button closure, the closure having a peripheral ridge formed by a pair of merging walls inclined to and coincident with the lid, a longitudinal indentation extending in one of said walls and having a generally W-shaped or double indent configuration in cross-section, the bottom of the indentation nearly connecting with a fracture extending through said one wall, and a portion of the median strip of the W-shaped indentation being swedged to extrude the metal of one face of the strip into sealing relation with said fracture.

16. A lid as in claim 15 wherein the fracture diminishes as it peripherally approaches a non-indented portion of the periphery of the button closure and is discontinued at said portion of the periphery.

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