

March 11, 1969

E. C. FRAZE ET AL

3,432,068

EASY OPEN CAN END

Filed March 28, 1967

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Fig. 1

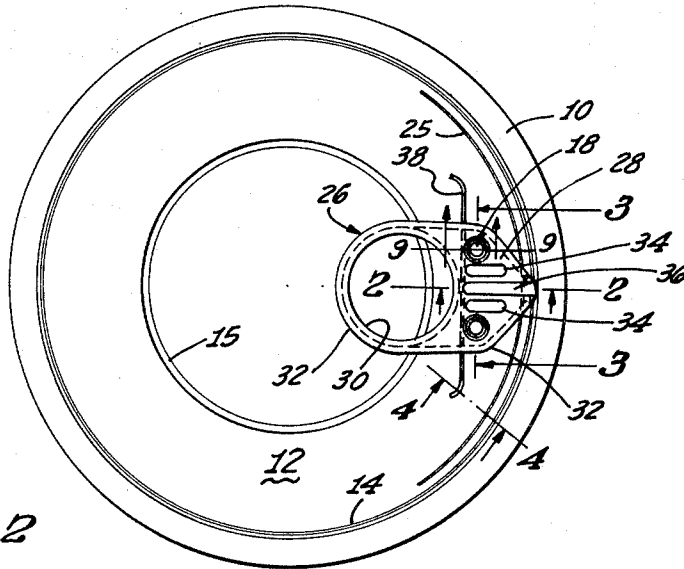


Fig. 2

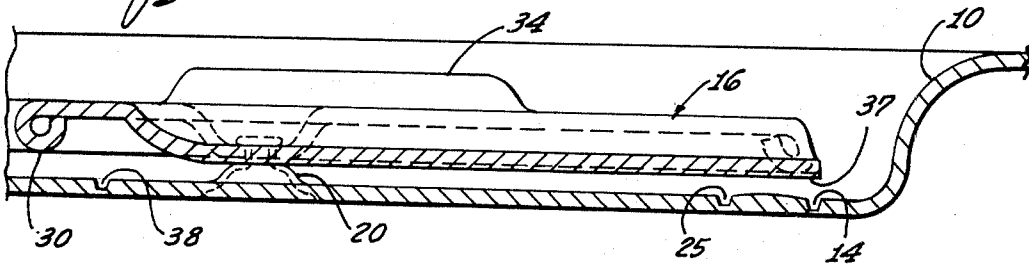


Fig. 3

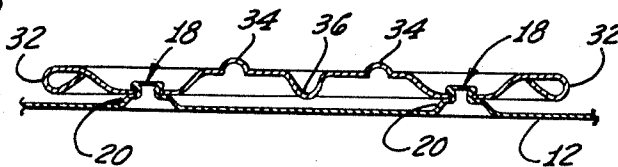


Fig. 4



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Fig. 5

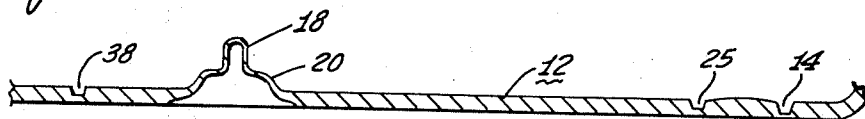


Fig. 6

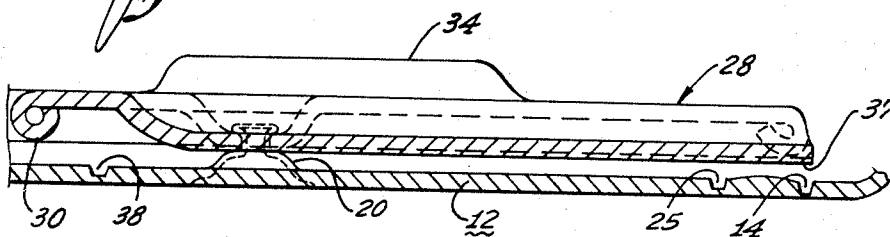


Fig. 7

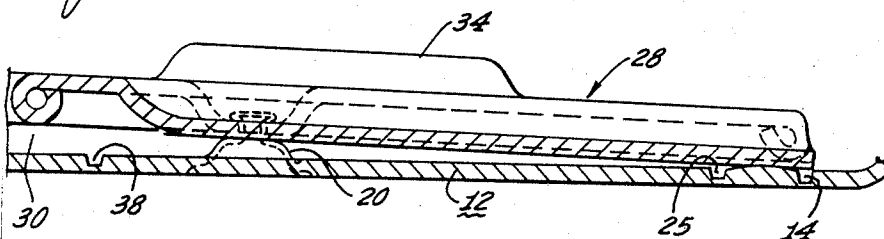
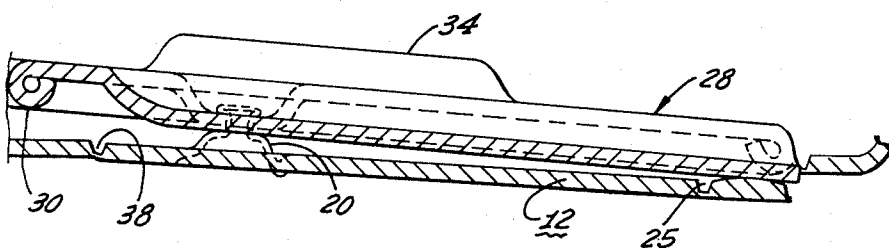


Fig. 8



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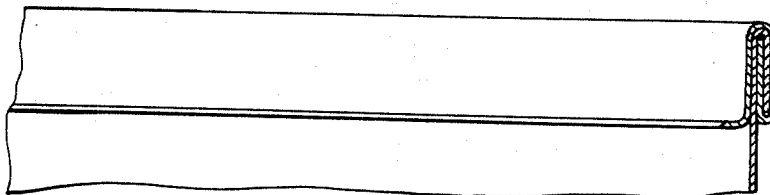
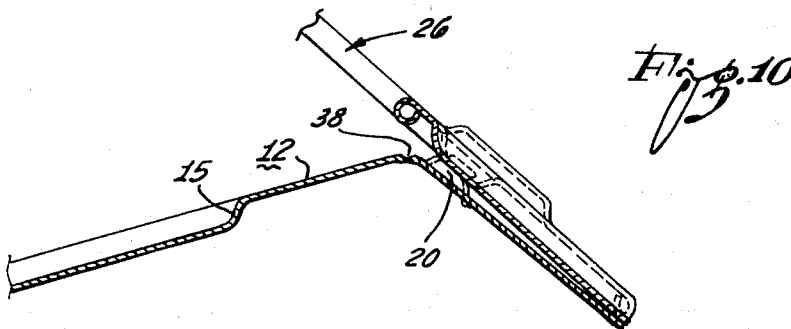
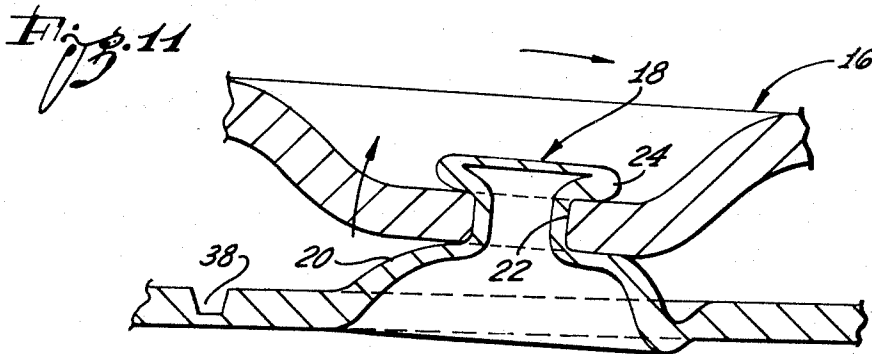
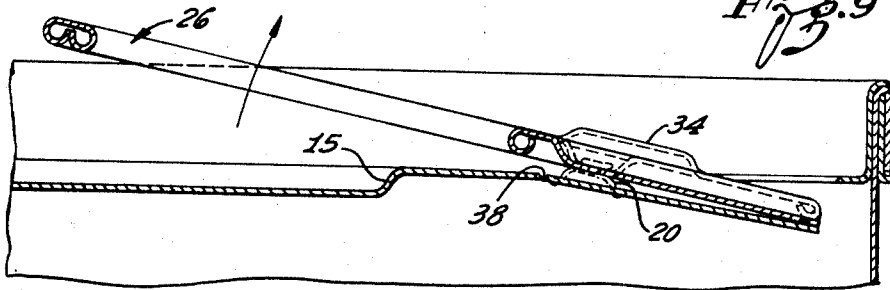
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Sheet 3 of 4



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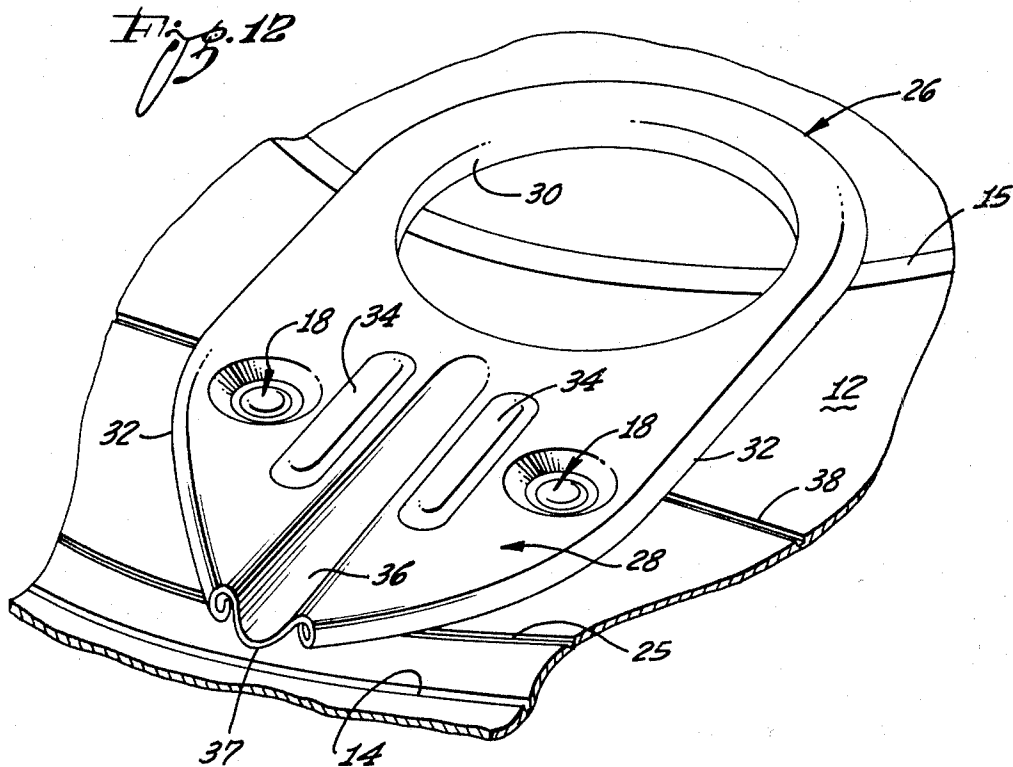
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EASY OPEN CAN END

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U.S. Cl. 220-54

Int. Cl. B65d 17/20

21 Claims

ABSTRACT OF THE DISCLOSURE

A tab for manual severance of a full-sized tear panel in a can end is attached to a pair of bosses on the panel to incline the tab to concentrate the severance pressure at the working end of the tab. In addition, to facilitate initial severance along an adequate extent of the perimeter of the panel, the panel is weakened along a bend line to define a segment of the panel with the bend line rearward of the two bosses so that the initially depressed segment of the panel includes the pair of bosses and the pivotal action for initial severance occurs at the bend line of the panel.

Background of the invention

In the prevailing type of easy open can, a tab that is attached to the tear panel is first employed as a lever to rupture the metal along an initial portion of the perimeter of the panel and then the tab is employed as a handle to complete the severance by pulling on the panel. If the tear panel is a full sized panel, i.e. a panel nearly as large as the can end, and if the can is of relatively small diameter, say a diameter no greater than 2½", it is not difficult to free a sufficient arc of sheet metal by the initial lever action to make it easy to complete the severance by pulling force. In fact, the initial lever action of a conventional tab on a small diameter can lid may sever to much sheet metal with the consequence that the lever action abruptly bends a relatively large segment of the tear panel into the contents of the can.

In the case of a full sized tear panel on a relatively large can, however, a conventional tab may not be capable of severing a sufficient arc of the sheet metal by the initial lever action. The problem is to free the perimeter of the larger tear panel along an arc extensive enough to make it easy to complete the severance by pulling operation. This problem may be understood by considering the forces that are involved in the second stage pulling operation.

When the lever action severs the sheet metal along a given initial arc and thereafter the pulling force is exerted at a given upward angle along a diameter that bisects the arc, the shearing effectiveness of the pulling force when the pulling force is first applied varies with the extent of the arc. To give an extreme example, if the initial arc of metal that is freed by the lever action is 180°, the tangents to the two ends of the arc will be parallel to the diametrical pulling force and the pulling force will have maximum initial shearing effect to make it extremely easy to pull the tear panel free. If the initial arc extends for 90° instead of 180°, the two tangents at the two ends of the arc are at an angle of 45° relative to the diametrical pulling force and consequently the pulling force is less efficient. Decreasing the initial arc decreases the effective shearing component at an accelerated rate and in practice it is desirable to have a minimum initial arc of severance of approximately 30-40° to facilitate subsequent completion of the severance by pulling force.

Since the work required to pull a small diameter tear panel free is much less than the work required to pull

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a large diameter panel free and since the shearing component rises more rapidly as the severance of a small diameter panel progresses, the initial severance arc may be substantially less than 30-40° in a can lid of a diameter under 2½" and a conventional tab can easily produce initial severance along an adequate arc. The problem is to provide a tab that will initially sever an adequate arc in a can end of relatively large diameter, for example, a can end of approximately 4" in diameter where the diameter of the full panel may be approximately 3½". The prevailing type of pull tab severs such a short initial arc along the larger circle as to make the subsequent completion of the severance unduly difficult.

The present invention solves this problem of providing adequate initial severance of a full sized tear panel of relatively large diameter and does so with a pull tab that is of small size relative to the larger diameter.

Summary of the invention

The invention provides certain features which work together to facilitate easy severance of a tear panel of relatively large diameter. It will be apparent that each of these features has utility separate and apart from the other features.

One of the features of the invention is the elevation of the tab above the plane of the tear panel in the region where the tab is attached to the tear panel. Preferably the tab is attached to the panel at two points on opposite sides of the longitudinal axis of the tab and two bosses are formed in the tear panel at the two points of attachment. In the construction disclosed herein, the peaks of the two bosses are formed into two corresponding hollow rivets that anchor the tab and the sheet material of the two bosses is reduced in thickness to make the bosses readily yieldable by deformation. Initially the bosses hold the tab flat with the lever arm of the tab extending forward from the two rivets in spaced relation to the tear panel and with a ring-shaped handle of the tab extending rearwardly from the two rivets.

Initial elevation of the handle end of the tab rocks the forward lever arm downward against the perimeter of the tear panel with deformation of the two bosses to accommodate the rocking movement. The resulting preliminary inclination of the tab relative to the plane of the tear panel provides positive assurance that the pressure against the tear panel will be concentrated at the extreme forward end of the lever arm.

Another feature is that the forward end of the lever arm is in the form of a narrow nose that is of only a fraction of the width of the tab and this nose protrudes downwardly relative to the rest of the tab. Thus the force output of the lever arm is not only initially applied at the extreme end of the lever arm but is also initially restricted to a small portion of the width of the end of the lever arm, the consequence being a high concentration of stress to facilitate initial rupture of the sheet material of the can end.

A third feature is that in the fabrication of the can end, the sheet material of the tear panel is weakened to form a bend line under the tab extending transversely of the tab in a region rearwardly of the two bosses on which the tab is mounted. This transverse bend line bounds a segment of the tear panel that is bent inward by the initial lever action of the tab and the tab is directly attached to the segment to act directly on the segment.

By virtue of the described construction, the forward lever arm of the tab is initially spaced above the perimeter of the tear panel and preliminary lifting of the rearward handle of the tab pivots the tab about its point of attachment at the deformable bosses until the lever arm touches the tear panel. Thereafter the lever arm depresses the panel to initiate severance along the score line. As

the initial severance progresses in opposite circumferential directions and the expanding segment of the panel flexes into the interior of the can, the pivot or fulcrum of the level shifts rearward from the two bosses to the transverse bend line of the panel. Obviously the extent of the perimeter of the tear panel that is severed by the initial lever action varies with the width or radial dimension of the segment of the panel that is depressed by the tab and providing the rearward located transverse bend line, in effect, increases the length of the forward lever arm to insure adequate width for the depressed segment.

The end of the forward lever arm of the tab presses against only a small portion of the perimeter of the tear panel but the rearward location of the transverse bend line and the consequent effective length of the lever arm of the tab causes the initial severance to spread over an adequate initial arc. A tab of only moderate width is capable of initially severing the sheet metal over an arc of at least 30° and in practice the arc may approach 90° to make it very easy to carry out the second step of pulling the partially severed panel from the can end.

The features and advantages of the invention will be apparent from the following detailed description and the accompanying drawings.

Brief description of the drawings

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 is a plan view of a can lid of relatively large diameter incorporating the presently preferred practice of the invention;

FIG. 2 is a greatly enlarged section taken along the line 2—2 of FIG. 1 and showing how the tab is initially spaced slightly outward from the tear panel;

FIG. 3 is a transverse section of the tab as seen along the line 3—3 of FIG. 1;

FIG. 4 is an enlarged portion of the tear panel shown in FIG. 2;

FIG. 5 is a sectional view showing a hollow boss formed in the tear panel with a hollow rivet at the peak of the boss;

FIG. 6 is a sectional view showing the normal inoperative position of the tab;

FIG. 7 illustrates the preliminary step of swinging the forward end of the tab downward into contact with the perimeter of the tear strip, each of the two tabs supporting bosses being slightly deformed to accommodate the preliminary movement of the tab;

FIG. 8 is a view similar to FIG. 8 showing the initial rupture of the sheet metal by the tab;

FIG. 9 is a sectional view on a smaller scale showing how the lever action of the tab shown in FIG. 9 is continued to sever an initial arc of the sheet metal of a desired length;

FIG. 10 is a view similar to FIG. 9 showing an early stage in the operation of completing the severance of the tear panel by pulling on the tab;

FIG. 11 is a greatly enlarged fragmentary section showing how the tab is secured by a hollow rivet on a boss of the tear panel; and

FIG. 12 is a greatly enlarged perspective view of the tab.

Description of the preferred embodiment

In the drawings which illustrate the presently preferred embodiment of the invention, the can end shown in FIG. 1 has the usual circumferential flange 10 for joining the can end to a cylindrical body and has a full-sized tear panel 12 that is defined by a concentric circular score 14 which lines close to the circumferential flange and which forms a thin web of residual metal to be ruptured for severance of the tear panel. Preferably the tear panel 12

is stiffened by a large central depression which forms a concentric offset or shoulder 15.

A tab, generally designated 16, to serve as means for manually severing the panel 12, is attached to the panel in a suitable manner at two points on opposite sides of the longitudinal axis of the tab and preferably the sheet metal of the panel is offset outwardly at the two points of attachment to elevate the points of attachment above the plane of the tear panel. In this instance the tab 16 is attached by two rivets 18 to two corresponding bosses 20 that are formed in the tear panel and the rivets 18 are hollow rivets that are integral with the bosses, the hollow rivets extending through corresponding apertures in the tab.

FIG. 5 shows one of the two bosses 20 with a hollow rivet 18 of a preliminary configuration formed by offsetting the boss. FIG. 11 shows one of the hollow rivets 18 extending through a corresponding aperture 22 of the tab 16 with the hollow rivet staked to form an overlapping bead 24 in engagement with the tab.

It is contemplated that the tab 16 will be capable of rocking motion relative to its anchorage to the two bosses 20 and for this purpose the two rivets may, if desired, be loose enough to permit a slight degree of pivotal motion. In this particular embodiment of the invention, however, the two rivets 18 tightly engage the tab 16 and the sheet metal of the two bosses is reduced in thickness as shown in FIGS. 5 and 11 to make the two bosses capable of deformation to accommodate the desired slight range of pivotal movement of the tab relative to the panel. By virtue of this construction the tab 16 is initially held in substantially parallel spaced relation to the tear panel 12, the tab being so held in a yielding manner by the deformable bosses.

In the preferred sequence of steps for fabricating the can lid, the bosses 20 together with the rivets 18 are formed before the can end is scored along the line 14 to define the tear panel. Since the rivets 18 are relatively close to the score line and since the operation of scoring the sheet metal has a spreading action on the sheet metal which tends to cause slight shift in the location of the bosses, provision is made to isolate the two bosses from the spreading action of the metal. For this purpose, the tooling that forms the score 14 simultaneously forms a narrow arcuate groove 25 that lies close to the score 14 between the score and the two bosses 20. The depression of the metal to form the narrow arcuate groove 25 is relatively light to leave a residual web of metal that is relatively thick to avoid any tendency for the sheet metal to be severed along the groove. The portion of the tooling that forms the light groove 25 serves as a barrier against radially inward displacement of the metal by the scoring operation with the consequence that the scoring operation causes the sheet metal to bow outward slightly between the score 14 and the groove 25 as may be seen in FIG. 2.

The tab 16 which is made of sheet metal is in the form of a lever having a rearwardly extending ring-shaped handle 26 and a forwardly extending tapered lever arm 28. For stiffness the tab may be formed with a curled bead 30 inside the circumference of the ring shaped handle 26 and may be formed with an outer curled bead 32 that extends around the ring-shaped handle and along the opposite sides of the tab with its two ends spaced apart at the forward end of the lever arm 28. For additional stiffness the lever arm 28 has two upwardly embossed longitudinal ribs 34 and a central downwardly embossed longitudinal rib 36 which extends to the end of the lever arm and which forms a nose 37 on the end of the lever arm. As best shown in FIG. 12, the nose 37 constitutes a narrow end portion of the lever arm and protrudes downward below the level of the remainder of the lever arm, i.e. below the level of the outer curled bead 32.

A feature of the invention is that the tear panel is weakened to provide a transverse bend line rearward of the two bosses 20. For this purpose the sheet metal of

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the tear panel is scored to form what may be termed an indentation line 38 which intersects the longitudinal axis of the tab perpendicularly thereto and which at its opposite ends may be slightly curved inward as may be seen in FIG. 1. The purpose of the indentation line 38 is to form a line of least resistance for the bending inwardly of a segment of the tear panel 12 by the initial lever action of the tab 16. In the absence of the indentation line 38 the sheet metal of the tear panel would tend to bend in a region closer to the score line 14 and thus lessen the size of the inwardly bent segment of the tear panel with consequent reduction in the extent of the arc along which the tear panel is severed by the initial lever action.

The manner in which the tab 16 functions to sever the tear panel 12 in two steps may be readily understood from the foregoing description. Preliminary to the first step, the handle 26 of the tab is elevated slightly to cause the tab to rock slightly from the elevated parallel position shown in FIG. 6 to bring the narrow nose 37 of the lever arm into contact with the perimeter of the tear panel at the score line 14, as shown in FIG. 7, this preliminary rocking movement of the tab being accommodated by deformation of the two bosses 20. It is apparent that the mounting of the tab on the two bosses has one advantage in that it causes the tab to be tilted relative to the plane of the tear panel when the tab makes initial contact with he panel thereby assuring that the pressure exerted against the panel by the tab will be concentrated at the forward end of the lever arm. A second advantage is that the preliminary tilting of the tab elevates the handle of the tab to facilitate manual gripping of the tab, adequate room under the handle for insertion of the user's thumb being further provided by the previously mentioned central depression of the tear panel.

In the lever action for initially rupturing the metal at the score line 14, the pressure against the tear panel is concentrated at the forward end of the lever arm 28 by the tilted position of the tab and the pressure against the tear panel is further concentrated because only the relatively narrow nose 37 of the tab makes initial contact with the perimeter of the tear panel. The concentrated downward pressure of the nose of the tab initiates the rupture of the sheet metal at the score 14 and once the metal is ruptured the lever action by the tab depresses the panel in a zone that expands in both circumferential directions to cause severance of the perimeter of the tear panel along an arc that is progressively extended in the two opposite circumferential directions.

As the depression of the perimeter of the tear panel proceeds beyond the point of initial rupture of the sheet metal, an expanding segment of the panel is bent inward from the initial angle shown in FIG. 8 to a greater angle as shown in FIG. 9. Thus as the initial severance of the tear strip by lever action progresses, an expanding segment of the panel that is bent inward is defined by the indentation line 38 and the expanding arc along which the sheet metal is severed.

It is apparent that the pivoting of the tab for the preliminary rocking movement into contact with the tear panel occurs in the region of the two rivets 18 and but as the severance of the initial portion of the tear panel by the lever action progresses the effective pivot of the tab shifts to the indentation line 38, the effective length of the forward lever arm being correspondingly increased.

When the initial severance by the lever action of the tab is completed, as indicated in FIG. 9, the tab is manipulated like a handle to exert upward and rearward pull on the tear panel to complete the severance of the tear panel in the manner indicated in FIG. 10. The fact that the lever action initially severs an arc of at least 30-40° makes the upward and rearward pulling force highly effective for continuing the severance beyond the initial arc. It is also to be noted that the bending of the segment of the panel along the indentation line 38 stiffens the panel to minimize the bowing of the panel that uses up part

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of the pulling force, the panel being further stiffened by the concentric offset 15 formed by the previously mentioned central depression.

Our description in specific detail of the selected embodiment of the invention will suggest various changes, substitutions and other departures from our disclosure within the spirit and scope of the appended claims.

We claim:

1. In a can end having a score line defining a substantially full-sized tear panel with a tab attached thereto to serve initially as lever means to initiate severance along a minor portion of the score line and to serve subsequently as a pull handle for a pulling operation to complete the severance,

the improvement comprising:

the sheet material of the tear panel being weakened to form a bend line transversely of the longitudinal axis of the tab to define a segment of the panel,

the tab being relatively rigid to serve as a lever and extending across the bend line to the periphery of the panel, the tab being attached to the segment radially outwardly of the bend line, whereby lifting the inner end of the tab causes the tab to function as a lever to initiate severance of the panel along an arc along the outer edge of the segment with the pivotal fulcrum action of the lever provided primarily by bending of the panel along the bend line.

2. An improvement as set forth in claim 1 in which the tab is pivotally attached to the tear panel and at the region of attachment the tear panel is locally offset outwardly to elevate the pivotal attachment to assure that initial contact of the tab with the panel in the lever action of the tab occurs at the outer end of the tab.

3. An improvement as set forth in claim 1 in which the tab is attached to the defined segment of the panel at two spaced points to maintain the tab in a given orientation relative to the panel.

4. An improvement as set forth in claim 3 in which the tab is attached to the tear panel by a pair of hollow rivets formed in the panel and in which the panel is locally offset to space the hollow rivets above the plane of the panel to initially space the tab above the plane of the panel.

5. An improvement as set forth in claim 4 in which the sheet material of the outwardly offset portion of the panel is reduced in thickness to permit the offset portion to yield by deformation to permit the tab to be swung into contact with the periphery of the panel.

6. An improvement as set forth in claim 1 in which the outer end of the tab has a narrow central portion that protrudes downward from the rest of the outer end of the tab to initially concentrate the pressure of the lever action of the tab on a narrow portion of the perimeter of the tear panel.

7. An improvement as set forth in claim 6 in which the tab is formed with a central longitudinal downwardly embossed rib and said narrow central portion of the outer end of the tab is the outer end of said rib.

8. An improvement as set forth in claim 1 in which the tear panel is formed with two outward bosses on opposite sides of the longitudinal axis of the tab and in which the tab is mounted on the two bosses for pivotal action relative to the panel.

9. An improvement as set forth in claim 1 in which a continuous offset is formed in the central region of the panel so that during the pulling operation the panel is stiffened against flexure both by the continuous offset and by the bending of the panel along the bend line.

10. In a can end having a tear panel defined by a score line with the tab attached to the panel to serve initially as lever means to initiate severance along a minor portion of the periphery of the panel and to serve subsequently as pull means to complete the severance,

the improvement comprising:

said tab having a rearward handle and a forward lever arm overhanging a peripheral portion of the panel to initiate severance of the panel by depressing the peripheral portion of the panel, a portion of said tab intermediate its length being attached to the panel,

said panel being offset outwardly of its plane in the region where the tab is attached thereby to space said portion of the tab outwardly of the plane of the panel with freedom for the tab to rock relative to the panel whereby the tab is inclined relative to the panel when said lever arm initially touches the panel thereby to restrict the initial output of forces by the tab to the end of the lever arm.

11. An improvement as set forth in claim 10 in which the attachment of the tab to the outwardly offset portion of the panel initially maintains the tab in position with its lever arm spaced above the peripheral portion of the panel;

and in which said outwardly offset portion is yieldable by deformation to permit the lever arm of the tab to be swung into contact with the peripheral portion of the panel to carry out the initial severance of the panel.

12. An improvement as set forth in claim 11 in which the outwardly offset portion of the panel is reduced in thickness relative to the remaining portion of the panel to facilitate deformation thereof.

13. An improvement as set forth in claim 11 in which the tab is apertured and the outwardly offset portion of the panel protrudes through the apertured tab for attachment of the tab to the panel.

14. An improvement as set forth in claim 10 in which the outwardly offset portion of the panel is in the form of a pair of bosses spaced apart on opposite sides of the longitudinal axis of the tab and in which the tab is attached to the two bosses.

15. An improvement as set forth in claim 14 in which the two bosses form hollow rivets on their outer ends and in which the hollow rivets extend through the tab to attach the tab to the panel.

16. An improvement as set forth in claim 15 in which the walls of the two bosses are substantially thinner than the rest of the panel to make the bosses yieldable for pivot action of the tab relative to the panel.

17. In an easy opening closure of sheet material having a wall formed with a line of score defining a panel severable from the wall with a rivet formed integrally with the panel clampingly mounting a tab adjacent an end opposite a handle end portion to said panel to serve as a manually operable lever element to initiate severance of the panel by rupture of the line of score, an improvement to facilitate manual operation of the tab to elevate the handle end portion of said tab for gripping by a user, comprising:

the wall being formed with a flexing segment of such a reduced thickness and at such a location on the wall relative to the location of the rivet that the flexure of the segment in response to the force exerted against the rivet by the initial lifting of said handle end portion pivotally moves the rivet to position the tab with the handle end portion spaced outwardly of the wall to facilitate manual gripping of the said handle end portion to bring about the lever action required to initiate rupture of the line of score.

18. An improvement as defined in claim 17 wherein said flexing segment is annular and surrounds said rivet.

19. A rivet construction as defined in claim 17 wherein said flexing segment is in the form of a protruding boss and said rivet is supported on said boss out of the plane of said wall.

20. In an easy opening container wall, the combination of:

a container wall of sheet material of preselected thickness having a line of weakness therein defining a tear portion at least partially removable therefrom;

a hollow rivet formed integrally with the sheet material of the tear portion, said hollow rivet having a peripheral wall and a transverse end wall;

a tab overlying said tear portion and having at least substantial longitudinal rigidity for initiating removal of the tear portion, said tab having a rupturing end, a lifting end and an aperture extending therethrough intermediate said ends for receiving said rivet, some of the material of at least one of said walls of said rivet forming a bead for tightly clamping the tab to the tear portion, said rupturing end of said tab lying closely adjacent said line of weakness; and

the sheet material of said tear portion in a zone at least substantially surrounding said rivet being thinned to less than said preselected thickness and sufficiently to yieldingly deform in response to movement of the lifting end of the tab away from the container wall to thereby permit limited pivotal movement of the tab relative to the container wall to facilitate gripping of the lifting end whereby further movement of the lifting end away from the container wall forces said rupturing end against the sheet material adjacent the line of weakness with sufficient force to rupture the sheet material along the line of weakness.

21. A combination as defined in claim 20 wherein said zone is in the form of a hollow base protruding out of the plane of the container wall and supporting said hollow rivet thereon.

References Cited

UNITED STATES PATENTS

3,301,432	1/1967	Novak	220-54
3,322,296	5/1967	Khoury	220-54

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