Sept. 20, 1966 E. C. FRAZE 3,273,744

CONTAINER OPENING DEVICES

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Fig. 1

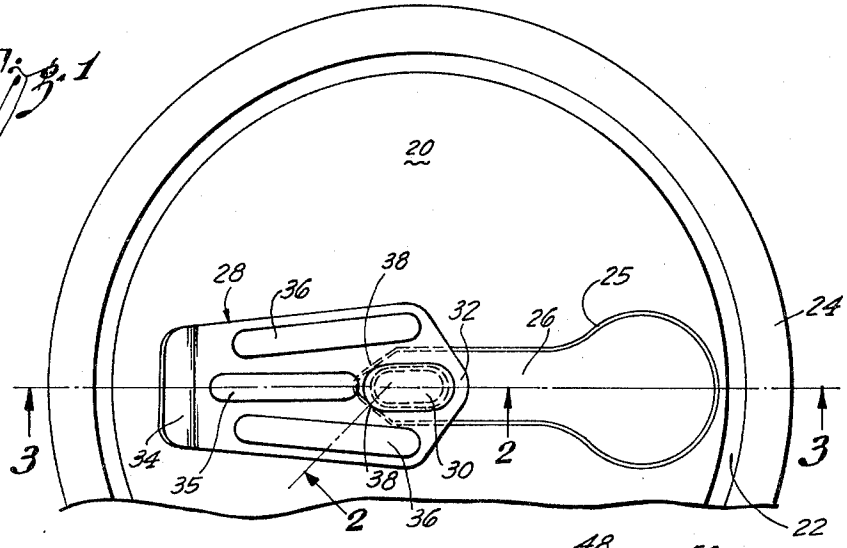


Fig. 6

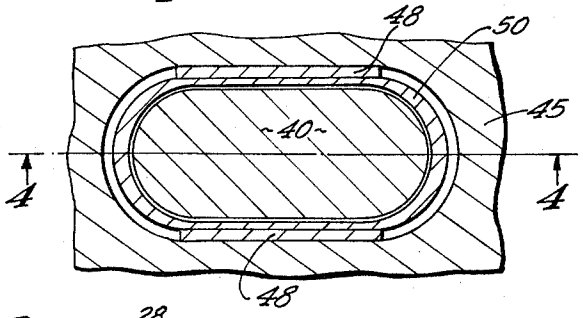


Fig. 2

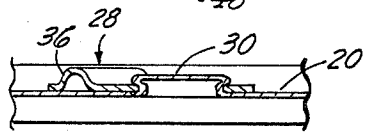


Fig. 3

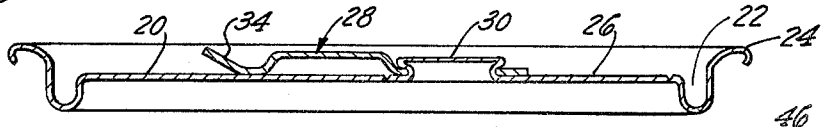


Fig. 4

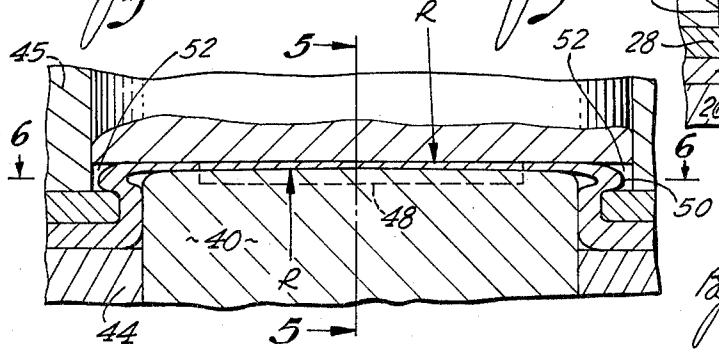
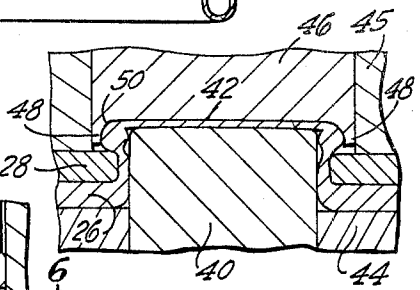


Fig. 5



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CONTAINER OPENING DEVICES

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Fig. 7

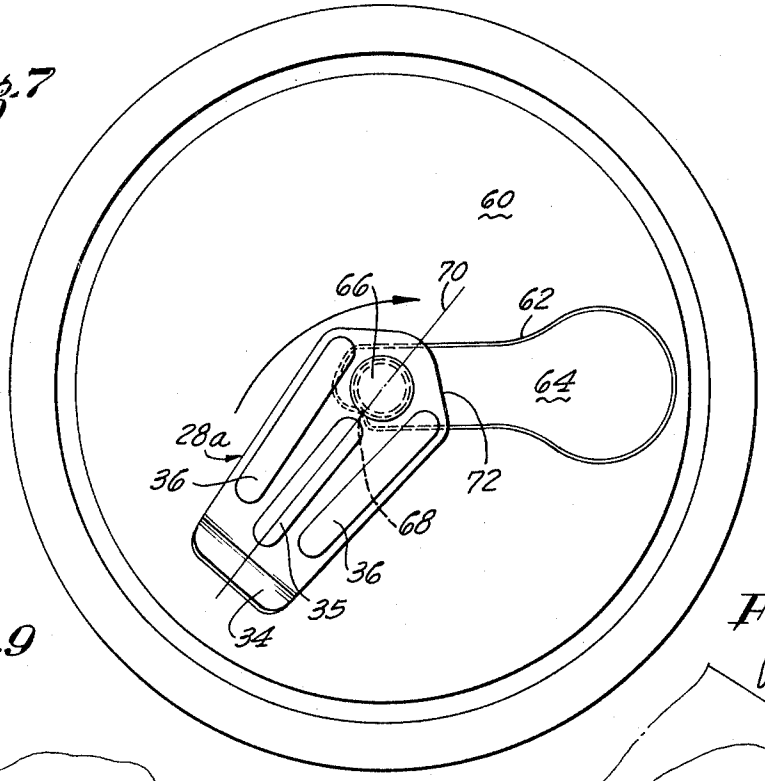


Fig. 9

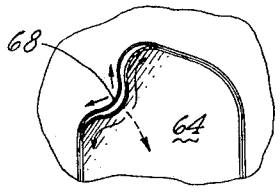


Fig. 8

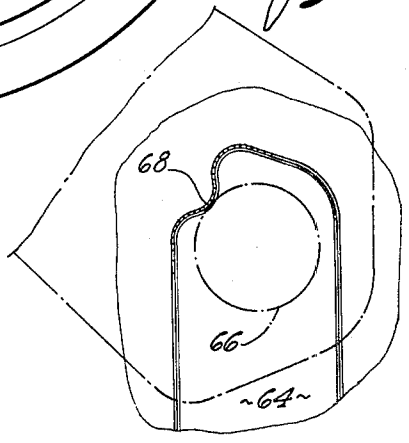
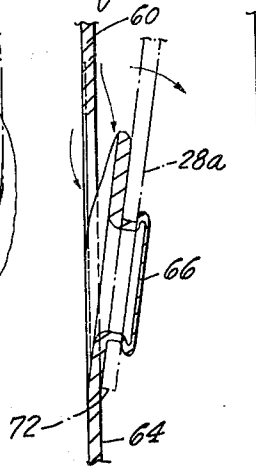


Fig. 11



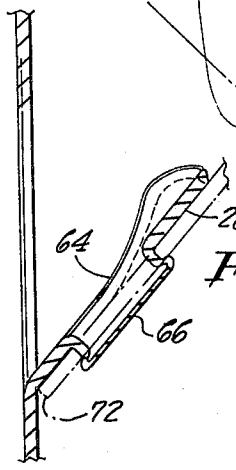


Fig. 12

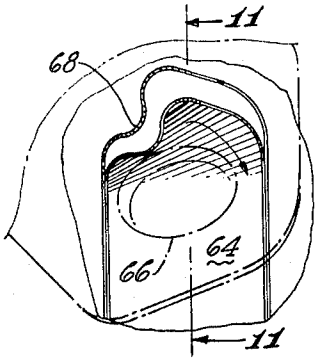


Fig. 10

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CONTAINER OPENING DEVICES

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Filed Mar. 2, 1964, Ser. No. 348,618
8 Claims. (Cl. 220—54)

This application is a continuation-in-part of my copending application Serial No. 280,545 filed May 15, 1963 which in turn is a continuation-in-part of my application Serial No. 193,060 filed May 2, 1962, which is turn is a continuation-in-part of my application Serial No. 130,884 filed August 11, 1961.

This invention relates to a container of the type which has a metal wall with a score line forming a tear strip thereon and has a tab connected to the tear strip to function as a manually operable second-class lever to initiate severance of the tear strip.

The present invention is directed towards certain needs for improvement which have become apparent with the development of a mass market for containers of this type.

One need is to increase the reliability and efficiency of the lever action for severance of the tear strip. The primary problem with respect to reliability is to keep the tab from tearing loose from the tear strip when the lever action is initiated. In the type of construction to which the invention pertains the tear strip is connected to the tab by a hollow rivet that is formed in the metal of the tear strip and extends through an aperture of the tab in overlapping engagement with the tab. One difficulty is that the lever action of the tab initially tilts the hollow rivet and the high stress that is created tends to cause the metal of the tab to pull free from the hollow rivet on the side of the hollow rivet that is initially lifted.

Another difficulty is that in the usual construction, exceedingly high stress is necessary to initiate severance of the tear strip because the stress is distributed along a substantial portion of the scored line instead of being concentrated on at a point on the scored line. When the stress is distributed over a substantial portion of the scored line, increased force is necessary to initiate severance of the tear strip and the increased force increases the tendency for the metal of the tear strip to pull away from the rivet.

One embodiment of the invention meets both of these difficulties by a number of provisions, namely: first, tapering the leading end of the tear strip; second, by providing a hollow rivet which is elongated in plan; third, favoring initiation of the severance in a particular region by placing the hollow rivet as close as possible to the tapered end of the tear strip so that two points of the score line that form the tapered end of the tear strip are located immediately adjacent opposite sides of the rivet respectively to favor initiation of the severance of the tear strip at the particular region of the two points; and, fourth, carrying out the operation of heading the elongated rivet in such manner that the metal that forms the head is displaced towards the tapered end of the tear strip to counter the tendency of the metal of the tear strip to pull away from the rivet.

In another embodiment of the invention, the same purpose is served by using a round rivet and favoring initiation of the severance at a particular region by making the score line reentrant relative to the rivet. Thus the scored line is offset towards the rivet to a point close to the rivet to cause initiation of the severance of the tear strip to occur at the reentrant point.

The features and advantages of the invention may be understood from the following detailed description and the accompanying drawings.

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

FIG. 1 is a fragmentary plan view of a can top embodying one practice of the invention;

FIG. 2 is a fragmentary section along the angular line 2—2 showing one of the two points at which the score line is immediately adjacent the hollow rivet;

FIG. 3 is a section of the can top taken along the diameter 3—3 of FIG. 1;

FIG. 4 is a section along the line 4—4 of FIG. 6 showing how a pair of dies cooperate to head the hollow rivet;

FIG. 5 is a transverse section of the rivet in the two dies taken along the line 5—5 of FIG. 4;

FIG. 6 is a section along the line 6—6 of FIG. 4 showing how the metal that forms the head of the rivet is displaced towards the two opposite ends of the rivet;

FIG. 7 is a plan view of a can top illustrating a second practice of the invention;

FIG. 8 is an enlarged fragment of FIG. 7 with a portion of the tab removed to reveal the reentrant scored line under the tab;

FIG. 9 is a fragmentary section similar to FIG. 8 indicating the initiation of the severance of the tear strip;

FIG. 10 is a similar view showing the severance operation at a more advanced stage;

FIG. 11 is a fragmentary section along the line 11—11 of FIG. 10; and

FIG. 12 is a sectional view similar to FIG. 11 showing a more advanced stage in the severance of the tear strip by the tab.

FIGS. 1, 2 and 3 illustrating one practice of the invention show the metal top 20 of a can that is intended to contain a beverage under pressure, the can top being made of a suitable material such as aluminum or steel. In preparation for joining the can top to a cylindrical can body the can top 20 is offset in a conventional manner to form a circumferential groove 22 and a peripheral flange 24. The can top is scored along a continuous line 25 to form a tear strip 26 for severance from the can top to provide a pour opening for the liquid content. A feature of this particular embodiment of the invention is that the leading end of the tear strip, i.e., the end where the severing action is to be initiated, is tapered to a point.

A sheet metal tab, generally designated 28, serves as a second-class lever to initiate severance of the tear strip at the pointed leading end of the tear strip. For this purpose the tab 28 is connected to the tear strip 26 by a hollow rivet 30 which is formed in the tear strip and extends through an aperture in the tab in overlapping engagement with the outer surface of the tab. The tab has a fulcrum end 32 which overlies the tear strip 26 and has a free end with a bent up end portion 34 which free end is intended to be swung upward for the leverage action to initiate the severance of the tear strip.

It is important that the tab 28 be longitudinally rigid to serve its basic function as a lever and for this purpose the metal may be offset in any suitable manner to increase the stiffness of the tab. In the construction shown, the tab 28 is embossed outward to form a central stiffening rib 35 and a pair of similar outer side ribs 36, the pair of ribs straddling the rivet 30. With the two outer ribs 36 extending over the major length of the tab and straddling the rivet 30 there is no tendency for the tab to buckle adjacent the rivet when the tab functions as a lever.

The rivet 30 lies as close as possible to the two tapered edges at the leading end of the tear strip and for this purpose the rivet is elongated longitudinally of the tear strip and is narrowed relative to the width of the tear strip. With this arrangement, two points 38 on the scored line 25 are immediately adjacent the rivet 30 to favor initia-

tion of severance of the tear strip at the two points. In effect, the rivet is narrowed and is nested into the angle of the tapered end of the tear strip to place the two points 38 relatively close together and relatively close to the leading end of the tear strip.

It is apparent that since the hollow rivet 30 is in firm overlapping engagement with the tab 28, the hollow rivet functions in effect as an integral portion of the tab in the leverage action and since the tab is connected to the tear strip by the hollow rivet the initial stress in the leverage action to initiate the severance of the tear strip is maximum at the two points 38 and therefore it is at these two points that the tab tends to pull away from the hollow rivet in the leverage action. As heretofore stated, this tendency for separation of the tab from the hollow rivet in the region of the two points 38 is countered by displacing metal of the hollow rivet towards the two opposite ends of the rivet as the rivet is viewed in plan.

FIGS. 4, 5 and 6 show how the operation of expanding or heading the rivet into engagement with the tab may be formed in a manner that creates the desired displacement of the rivet material. In preparation for the heading operation shown in FIGS. 4, 5 and 6, the hollow rivet is formed in the sheet metal of the can top and then the hollow rivet is inserted through the aperture in the tab 28. To carry out the heading operation, a lower die or anvil 40 of a cross section to fit snugly into the hollow rivet is inserted into the hollow rivet into contact with the transverse end wall 42 of the hollow rivet. The two layers of metal surrounding the hollow rivet are then engaged under compression between a lower annular pressure pad 44 and an upper annular pressure pad 45. Then an upper die or impact member 46 moves rapidly downward inside the upper pressure pad 46 to cooperate with the lower die 50 to squeeze the transverse end wall 42 across its thickness and thus cause the metal of the end wall to be displaced or extruded in all radial directions with consequent expansion of the hollow rivet in the region of the transverse end wall, the expansion of the hollow rivet causing the rivet to make overlapping engagement with the tab 28.

To cause the metal to be displaced towards the opposite ends of the rivet as the rivet is viewed in plan and at the same time to strengthen the bead along the two opposite longitudinal sides of the rivet, the upper die 46 is formed with two downwardly extending longitudinal flanges 48 on its opposite longitudinal sides as shown in FIG. 5 to limit the extent to which the metal may be displaced laterally in the formation of the head or bead 50 of the rivet. On the other hand, as indicated in FIG. 4 there is ample clearance space 52 at the two ends of the rivet when the two dies close together and consequently the metal tends to take the path of least resistance which is towards the two opposite end clearance spaces 52. As a consequence, the bead 50 of the rivet overhangs the metal of the tab to maximum extent at the two opposite ends of the rivet and especially in the region of the two points 38 of the scored line 25 that are nearest to the rivet. At the same time, a second important result of limiting the lateral spread of the metal of the rivet is that the portions of the bead 50 on the two opposite longitudinal sides of the rivet are thickened vertically for high strength in those regions.

The manner in which this first embodiment of the invention serves its purpose is readily understood. When the free end of the tab 28 is swung upward, the fulcrum end of the tab bears downward on the tear strip 26 and the hollow rivet pulls upward on the tear strip with maximum effectiveness at the two points 38. Severance of the tear strip from the metal top begins at the two points 38 and quickly spreads first to the pointed end of the tear strip and then towards the opposite end of the tear strip.

FIG. 7 illustrating a second embodiment of the invention shows a metal can top 60 of the same general character as the previously described can top 20, the can top being scored in the usual manner along a continuous line

62 to form an elongated tear strip 64. A tab 28*a* of the character heretofore described is attached to the tear strip 64 by means of a hollow rivet 66 that is formed in the tear strip and extends through the tab in overlapping engagement with the tab. The tab 28*a* has the usual longitudinal ribs 35 and 36 and the usual bent-up free end 34.

The second embodiment of the invention differs from the first embodiment in three respects: first, in the hollow rivet 66 being round in plan instead of elongated; second, in the score line 62 being reentrant towards the rivet at a single point 68; and, third, in the tab 28*a* being positioned at an angle to the tear strip instead of being in longitudinal alignment with the tear strip.

The longitudinal axis of the tab 28*a* is indicated by the line 70 and it is to be noted that the reentrant point 68 of the scored line 62 is substantially on this axis. It is also to be noted that the leading end of the tab 28*a* is tapered to provide a straight edge 72 which as viewed from the free end of the tab is inclined towards the right longitudinal edge of the tab and towards the free end of the tab. The edge 72 forms an acute angle with the longitudinal axis of the tab, the apex of the angle being towards the fulcrum end of the tab. The edge 72 may aptly be termed a fulcrum edge because when the tab is lifted at its free end it tends to rock or fulcrum about the edge as an axis.

In the leverage action of the tab 28*a* the initial stress as well as the maximum stress is generated in the region of the reentrant point 28 to favor in a highly effective manner initiation of severance of the tear strip at the reentrant point, the tearing action extending in both directions from the reentrant point 68 along the scored line 62.

As the tab is lifted for its leverage action and rocks about the fulcrum edge 72, the fulcrum edge guides the tab in a leverage movement that describes a portion of a cone, the fulcrum edge 72 being the axis of the cone. Thus the free end of the tab describes an arc which is relatively low compared to the high arc that the free end of the tab in FIG. 1 describes. The relatively low arc followed by the tab 28*a* is a path that is natural for the user when the user's thumb and forefinger grasp the free end of the tab and are moved arcuately by rotation of the user's wrist. It has been found that this arcuate movement is not only natural for the user, but is also highly efficient in that it applies maximum severance force to the tear strip with minimum muscular effort. After the leading end of the tear strip is severed by the leverage action, it is a simple matter for the user to follow through with wrist action to severe the remainer of the tear strip from the can top.

FIG. 8 shows the state of the tear strip before the tab is lifted and FIG. 9 shows how the initial lifting of the tab causes severance of the tear strip from the can top to proceed progressively in opposite directions from the point 68. FIG. 10 shows how the severance proceeds to a more advanced stage. When the tab is further lifted to a relatively high angle, as indicated in FIG. 12, the initial severance of the tear strip by the leverage action is completed and continued severance is accomplished by using the tab as a handle to pull the rest of the tear strip away from the can top.

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

I claim:

1. In the structure of a container wherein a metal wall of the container is scored along a line to form a tear strip and a hollow rivet is formed in the tear strip in overlapping engagement with a tab for use of the tab as a lever to initiate severance of the tear strip at a particular

region near one end of the tear strip, the improvement comprising:

said rivet being elongated in plan towards the particular region and the overhanging metal of the rivet also being displaced longitudinally towards the particular region with consequent greater overhang of the bead in the portion of the joint between the tab and the tear strip where maximum stressing of the joint between the tear strip and the tab is created by the lever action.

2. The improvement as set forth in claim 1 in which said end of the tear strip is tapered.

3. In the structure of a container wherein a metal wall of the container is scored along a line to form a tear strip and a hollow rivet is formed in the tear strip in overlapping engagement with a tab for use of the tab as a lever to initiate severance of the tear, the improvement comprising:

one end of the tear strip having two converging edges that give the end of the tear strip a tapered configuration; and

said rivet being located between and immediately adjacent to the two converging edges whereby two points on the converging edges, respectively, of the tear strip are points on the scored line at a minimum distance from the rivet to favor initiation of the severance of the tear strip at the two points.

4. The improvement set forth in claim 3 in which the rivet is elongated towards the tapered end of the tear strip and is thus narrowed to place two said points relatively close to the end of the tear strip.

5. The improvement set forth in claim 4 in which the rivet is formed with a bead in overlapping engagement with the tab; and

in which the metal of the bead is displaced towards the tapered end of the tear strip to strengthen the joint between the tab and the tear strip at the two points.

6. In a container having a sheet metal wall wherein scoring in the metal wall outlines a tear strip and wherein a tab to serve as a second-class lever to fulcrum at one end to initiate severance of the tear strip from the remainder of the metal wall has a minor portion including its fulcrum end overlapping one end of the tear strip with the minor portion attached to the tear strip and with the fulcrum end extending beyond the connection to the tear strip, the improvement comprising:

forming the scored line with a portion offset towards the side of the rivet that is furtherest removed from the fulcrum end of the tab to provide a point on the scored line of minimum spacing from the rivet in the region of initial stress in the lever action to cause initiation of the severance of the tear strip at said point.

7. The improvement set forth in claim 6 in which the longitudinal axis of the tab is at an acute angle to the tear strip and the fulcrum end of the tab is tapered to provide a fulcrum edge at an acute angle to the longitudinal axis of the tab to cause the tab to rock about the fulcrum in its lever action and thereby describe a portion of a cone concentric to the fulcrum edge.

8. In a container having a sheet metal wall wherein scoring in the metal wall outlines a tear strip and wherein a tab to serve as a second-class lever to fulcrum at one end to initiate severance of the tear strip from the remainder of the metal wall has a minor portion including its fulcrum end overlapping one end of tear strip with the minor portion attached to the tear strip and with the fulcrum end extending beyond the connection to the tear strip, the improvement comprising:

said one end of the tear strip being attached to said minor portion of the tab by a hollow rivet formed in the tear strip and extending through an aperture in the tab with a bead of the hollow rivet in overlapping engagement with the tab,

the hollow rivet being elongated longitudinally of the tab and the metal of the bead being displaced longitudinally of the hollow rivet towards the free end of the tab to reinforce the engagement of the hollow rivet with the tab on the side of the hollow rivet that is subject to maximum stress in the initial lever action of the tab.

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