United States Patent [19]

Brown

[11] **3,851,793**

[45] **Dec. 3, 1974**

[54] **EASY OPENING CONTAINER WALL**

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[73] Assignee: **Ermal C. Fraze,** Dayton, Ohio

[22] Filed: **May 7, 1973**

[21] Appl. No.: **357,869**

Related U.S. Application Data

[60] Division of Ser. No. 464,909, June 18, 1965, Pat. No. 3,812,803, which is a continuation-in-part of Ser. No. 288,204, June 17, 1963, abandoned.

[52] **U.S. Cl.**.....**220/270,** 215/255

[51] **Int. Cl.**..... **B65d 17/20**

[58] **Field of Search**..... 220/54, 48, 27; 113/121; 29/509

[56] **References Cited**

UNITED STATES PATENTS

3,191,564	6/1965	Fraze	113/121
3,307,737	3/1967	Harrey et al.	220/54
3,387,481	6/1968	Harvey et al.	72/379
3,602,980	9/1971	Heffner	29/509
3,688,385	9/1972	Brown	29/509

Primary Examiner—George T. Hall

Attorney, Agent, or Firm—George F. Smyth

[57] **ABSTRACT**

An easy opening container having a sheet metal wall with a line of scoring forming a tear strip and having a tab attached to the tear strip for manual severance thereof. The tab is attached to one end of the tear strip by a rivet formed integral with the metal wall in which the rivet has a peripheral wall and a transverse head where the peripheral wall is formed of material displaced from the material of the wall surrounding the rivet.

8 Claims, 12 Drawing Figures

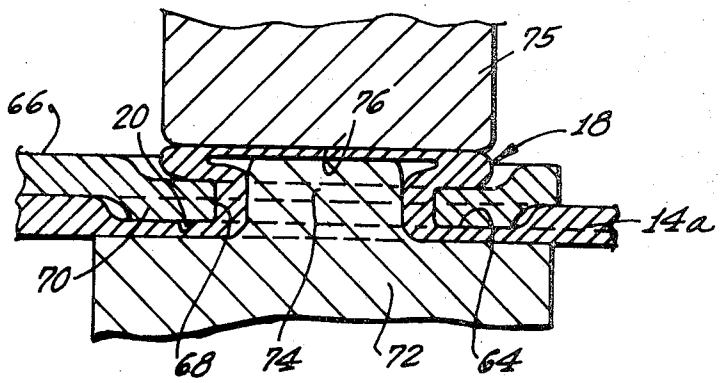


Fig. 1

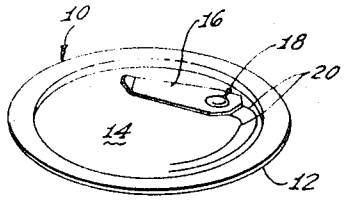


Fig. 2

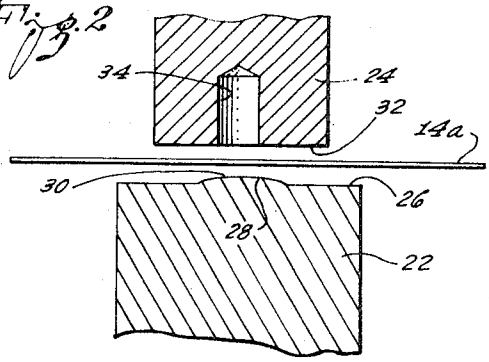


Fig. 3

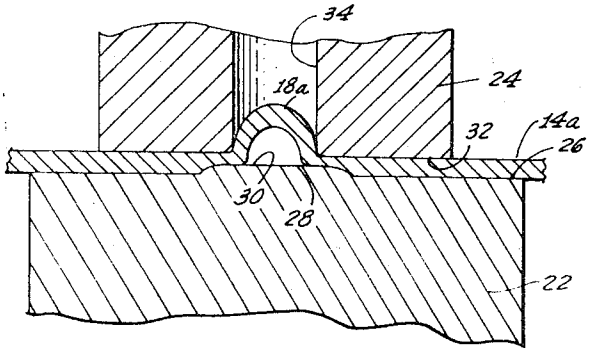


Fig. 3a

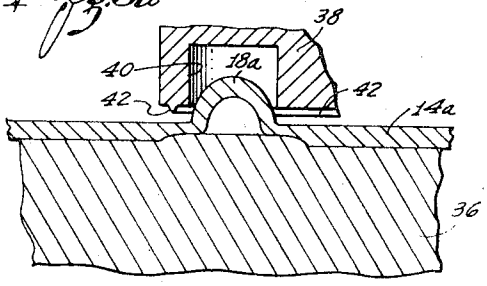


Fig. 4

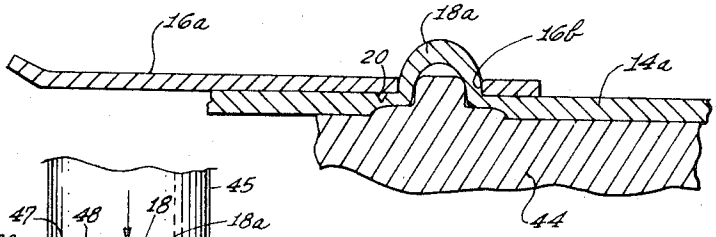


Fig. 5

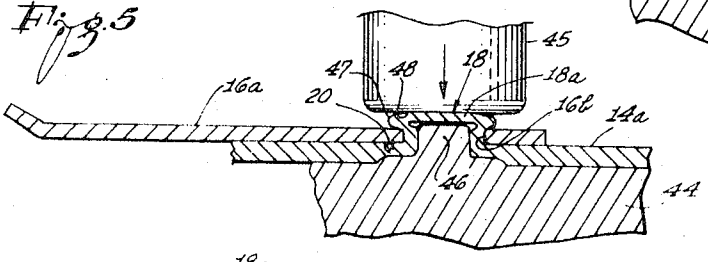


Fig. 6

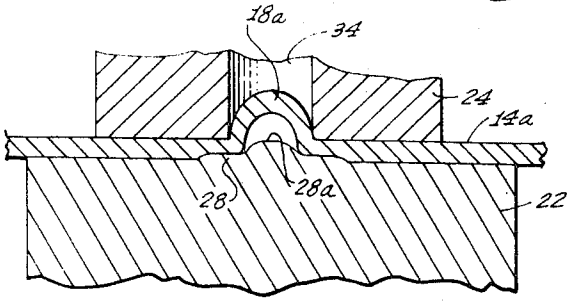


Fig. 7

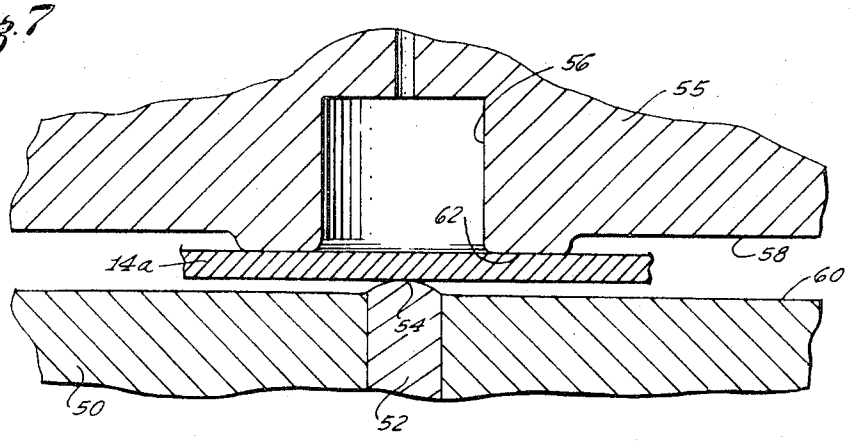


Fig. 8

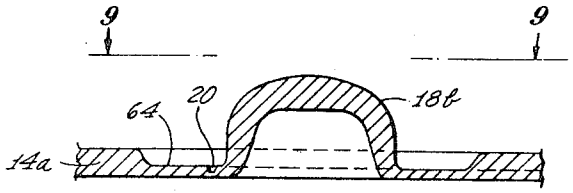


Fig. 10

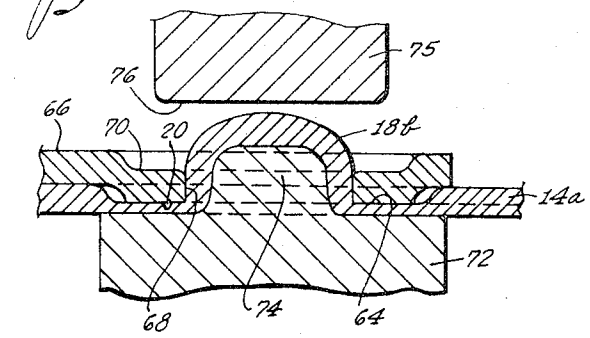


Fig. 9

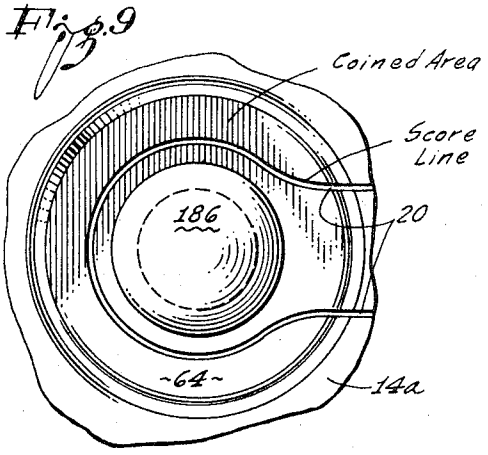
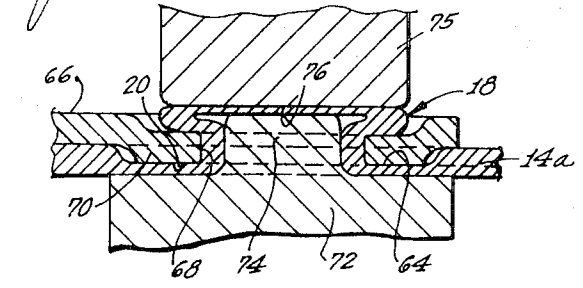


Fig. 11



EASY OPENING CONTAINER WALL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional of my copending application Ser. No. 464,909, filed June 18, 1965 now U.S. Pat. No. 3,812,803, which is a continuation-in-part of my application Ser. No. 288,204, filed June 17, 1963, now abandoned, the subject matter of which is incorporated by reference into the present application. This invention relates to metal forming operations and more particularly to methods for forming rivets used in attaching tear tabs to containers and especially can tops thereof, although the invention is not necessarily so limited.

SUMMARY OF THE INVENTION

An object of this invention is to provide a new method of forming a protuberance such as a hollow rivet in a sheet metal wall of a container.

Another object of this invention is to provide an improved method for forming a protuberance in a container, the protuberance to be used as a hollow rivet by which a tear tab may be attached to the container.

Still another object of this invention is the provision of a novel method for attaching tear tabs to sheet metal walls of containers.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture and the mode of operation, as will become more apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings:

FIG. **1** is a simplified perspective view of a can top to which a tear tab has been applied in accordance with this invention;

FIG. **2** is a schematic, cross-sectional illustration of a pair of die members and a can top blank used in the method of forming the can top of FIG. **1**;

FIG. **3** is an enlarged view of a portion of the elements shown in FIG. **2** at a later stage in the operation thereof;

FIG. **3***a* is a fragmentary cross-sectional view showing how a scoring die may be employed to form a tear strip in the can top blank after a rivet of initial configuration has been formed in the blank;

FIG. **4** is a fragmentary cross-sectional view showing an apertured tab positioned on the can top and showing die means poised for deforming the hollow rivet into engagement with the tab;

FIG. **5** is a similar view showing how the die means deforms or heads the hollow rivet into its final configuration in engagement with the tab;

FIG. **6** is a sectional view similar to FIG. **3** showing how the lower die may be provided with a small central boss to facilitate the formation of the hollow rivet;

FIG. **7** is a sectional view showing how a different set of dies may be employed to form a hollow rivet;

FIG. **8** shows the hollow rivet formed by the dies shown in FIG. **7** and further shows the result of scoring the sheet metal blank;

FIG. **9** is a fragmentary plan view of the hollow rivet of initial configuration shown in FIG. **8** showing how the score line extends into the annular region where the metal is thinned around the base of the rivet;

FIG. **10** is a fragmentary sectional view showing how a special tab may be positioned for engagement by the hollow rivet and also showing die means poised for deforming the hollow rivet into engagement with the tab; and

FIG. **11** is a view similar to FIG. **10** showing the completion of the die operation for deforming or heading the hollow rivet into engagement with the tab.

DETAILED DESCRIPTION OF THE INVENTION

Great difficulty has been experienced in attempting to mechanically attach tear tabs to containers, especially non-ferrous metal containers. The use of separate rivets or other fastening devices is generally undesirable. Forming a hollow rivet in the container itself has also been difficult, since the metal tends to shear or fracture when the hollow rivet is being initially formed or when the head is being subsequently formed on the hollow rivet. The steps taken in the past to avoid shearing or fracturing the metal have been time-consuming and expensive. In accordance with this invention, however, a hollow rivet may be formed in an aluminum or other metal container in one operation with a pair of die members, the hollow rivet being formed in the container metal itself. As will appear more fully below, the hollow rivet so formed is nearly ideally suited for its purpose.

Illustrated in FIG. **1** is a can top, generally designated **10,** having the usual raised annular rim **12** and flat central portion **14.** A tear tab **16** is shown attached to the can top **10** by a hollow rivet **18** which is integral with the central portion **14** of the can top. The tear tab **16** is adapted to tear away part of the central portion **14** bounded by score lines **20,** which are only partially shown in FIG. **1.** The score lines **20** may take any desired form adequate to enable part or all of the body portion **14** of the lid to be removed. Examples of such score lines are illustrated in U.S. Pat. No. 2,946,478.

In accordance with this invention, the shank of the hollow rivet **18** is formed by placing an annular region of the can top blank under compression whereupon the hollow rivet protrudes from the area of the can top blank enclosed within the annular region. The extrusion of the hollow rivet may be accomplished by a pair of dies **22** and **24,** illustrated in FIGS. **2** and **3.** The first or lawer die **22** has a first working surface **26** with a central portion **28** offset towards the second die **24.** The offset portion **28** may be termed a plateau and in this instance the plateau has a slightly convex surface **30** but, if desired, may have a planar surface. The second or upper die **24** has a planar working surface **32** and is formed with a central recess **34,** the cross-sectional area of which is the cross-sectional area of the desired hollow rivet. It is to be noted that the plateau **28** of the first or lower die **22** is of larger area than the cross-sectional area of the recess **34.**

In FIG. **2** a sheet metal blank for a can top, designated **14***a*, is supported between the working surfaces of the two dies **22** and **24.** In practice the blank may initially rest on the plateau **28** of the lower die **22.** The upper die **24** is forcefully and rapidly advanced or impacted against the upper surface of the blank **14***a*. Upon striking the upper surface of the blank, the sheet metal blank is placed under compression in a continuous zone around the area of the recess **34,** the continuous zone being an annular zone where the working surface of the upper die **24** overlies the circumferential

marginal portion of the plateau **28** of the lower die **22.** At the same time, the remaining outer radial portion of the upper die surface **32** approaches the corresponding outer radial portion of the lower die surface **26** sufficiently to clamp the corresponding portion of the sheet metal against the lower die without compressing or deforming the blank.

As well known to those skilled in the art, metals tend to flow when subjected to compression and the sheet metal in the annular zone surrounding the recess **34** accordingly tends to flow in opposite radial directions. The resistance to outward radial flow is many times the resistance to inner radial flow, however, because on the one hand, the recess **34** provides a free space into which metal may flow and, on the other hand, solid metal blocks outward radial flow and especially so when the die surface cooperate to prevent thickening of the sheet metal in the outer radial region that surrounds the annular zone where the squeezing of the metal occurs. Consequently, the metal displaced by the squeezing action in the annular zone is extruded radially inward into the recess **34** with the result that the sheet metal bows into domed-shaped configuration in the recess. This configuration, which is designated **18***a* in FIGS. **3, 3***a* and **4,** may be termed the initial configuration of the hollow rivet, i.e. the configuration of the hollow rivet before it is deformed to form a head or bead.

It is important to note that the hollow rivet at its initial configuration **18***a* has a circumferential wall and a transverse end wall and the transverse end wall or the central area of the rivet is of substantially the same thickness as the original thickness of the blank **14***a* since this central area of the sheet metal has not been subjected to a squeezing action. Since the metal flows in the formation of the initial configuration **18***a* of the hollow rivet and does not bend there is little or no tendency for the metal to shear or crack around the edge or base of the hollow rivet. Conventional stop blocks or the like (not shown) may be used in a well known manner to limit the travel of the upper die **24** so as to avoid compressing the sheet metal surrounding the annular region where the metal is squeezed or thinned to form the hollow rivet.

One important advantage of the described method of forming a rivet is that the rivet may be formed close to the rim of the can top. Another advantage is that the rivet may be relatively small if desired.

After the dies shown in FIGS. **2** and **3** form a hollow rivet of initial configuration **18***a*, suitable dies are employed as indicated in FIG. **3***a* to form the previously mentioned score lines **20** that define the tear strip that is to be removed by the tab **16.** The dies shown in FIG. **3***a* produce a score line of the configuration in plan indicated in FIG. **9** where it may be seen that the score line **20** passes around three sides of a hollow rivet.

The die means shown in FIG. **3***a* comprises a lower die **36** shaped to conform to the underside of the can top blank **14***a* and an upper die **38** that has a cavity **40** dimensioned to clear the hollow rivet **18***a*. The upper die **38** is formed with an integral scoring element **42** which follows the score pattern indicated in FIG. **9.** The scoring groove produced by the die operation is shown in cross section at **20** in FIG. **4.**

It is contemplated that the scoring die will penetrate the sheet metal to substantially uniform depth so that the residual web of metal left by the scoring operation will be of minimum thickness in the annular zone around the hollow rivet where the sheet metal is of minimum thickness. Thus the residual web is thinnest at the leading end of the tear strip to facilitate initial severance of the tear strip. It is also to be noted that squeezing the sheet metal in the annular zone before the scoring operation work-hardens the metal to make the residual web relatively strong but at the same time somewhat brittle to favor initial severance of the tear strip.

Referring to FIG. **4,** a tab **16***a* is shown resting on the upper surface of the can top blank **14***a* which blank has formed therein a rivet **18***a* of the initial configuration. The tab **16***a* has an aperture therein, designated **16***b*. The rim of the aperture **16***b* may be beveled to avoid shearing or fracturing the face of the hollow rivet **18***a* when the hollow rivet is deformed into engagement with the tab.

FIG. **4** shows a lower die **44** and an upper die **45** which may be employed to head or deform the hollow rivet **18***a* into permanent positive engagement with the tab **16***a*. The lower die **44** has a boss or upward projection **46** dimensioned to extend into the interior of the hollow rivet **18***a* to prevent axial collapse of the hollow rivet. The upper die **45** has a planar working face **48** which cooperates with the die boss **46** in the manner shown in FIG. **5.**

FIG. **5** illustrates the relationship of the tab **16***a*, the can top blank **14***a* and the hollow rivet after the hollow rivet has been headed or deformed to the final rivet configuration **18** in permanent engagement with the tab.

In the die operation illustrated in FIG. **5,** the upper die **45** cooperates with the boss **46** of the lower die to squeeze the transverse end wall of the rivet across its thickness and thereby causes the metal of the end wall to be extruded radially in all directions with the consequence that the rivet is expanded to form a head or hollow bead **47** on the rivet in overlapping engagement with the tab **16***a*.

Although the invention described herein may be used with a variety of metals, it is intended primarily for use with aluminum. The size of the can top blank **10** and the initial rivet **18***a* to be formed therein can be varied in accordance with the requirements of the finished product. The invention has been successful, for example, with sheet aluminum 0.008 inches thick, using a die member **24** having a recess **34** therein of a diameter of 0.200 inches. The raised portion or plateau **28** of the die **22** was generally spherical and raised above the surface **26** by 0.0035 inches. The diameter of the plateau **28,** as measured across the surface **26,** was approximately 0.300 inches. The height of the initial rivet configuration **18***a* depends upon the degree of compression of the sheet metal and the area of plateau **28.** The area of the annular working surface **32** of the upper die **24** was large in relation to the recess **34,** as illustrated in FIGS. **2** and **3.**

In FIG. **6,** a die **22** is illustrated having a working surface somewhat different from that described above. In this case, a small circular boss **28***a* of curved cross section is formed centrally of the plateau **28** and co-axially of the upper die recess **34,** the diameter of the boss being substantially smaller than the diameter of the recess. The result of the die operation illustrated in FIG. **6** is the same as the result of the previously described die operation illustrated in FIG. **3,** but the boss **28***a* is

advantageous in diverting the extruded metal upward into the recess **34.**

The supports for the die have not been shown since such supports may be conventional. Actually, the formation of the initial rivet configuration **18***a* may be accomplished simply by striking the upper die **24** with a hammer.

In the practice of the invention described to this point, the metal is squeezed in an annular zone around the base of the rivet by a die operation which indents the can top blank from its underside, i.e. from the side opposite to the side from which the hollow rivet protrudes. For this purpose the offset or plateau **28** that creates the squeezing action in the annular zone is on the lower die.

In the practice of the invention illustrated by FIGS. **7** to **11,** the can top blank is indented on its upper side instead of on its under side, the plateau to create the annular compression zone being on the upper die instead of the lower die.

The lower die **50** in FIG. **7** has an insert **52** which forms a small central boss **54** which has the same function as the previously described boss **28***a* in FIG. **6.** The upper die **55** in FIG. **7** has the usual recess **56** to provide a free space in which the hollow rivet may be formed. The upper die **55** has a working surface **58** to cooperate with the working surface **60** of the lower die **50** and the working surface **58** is offset towards the lower die to form an annular plateau **62** around the entrance to the recess **56.**

At the limit closed position of the two dies shown in FIG. **7,** the annular plateau **62** penetrates the sheet metal of the can top blank **14***a* and the remaining outer radial portion of the working surface **58** reaches a limit position which is spaced from the working surface **60** by the thickness of the can top blank. It is apparent that the squeezing of the sheet metal by the annular plateau **62** causes a hollow rivet to be formed of an initial configuration **18***b* shown in FIG. **8,** the base of the hollow rivet being surrounded by an annular zone in the form of an indentation **64** on the upper side of the can top blank **14***a*. After the hollow rivet **18***b* is formed in this manner, scoring dies such as the previously described scoring dies are employed to form the usual score line **20.** As may be seen in FIG. **9,** the score line **20** enters the annular zone of annular indentation **64** and after passing around three sides of the hollow rivet **18***b* leaves the annular zone.

FIG. **10** shows how a tab **66** may be provided with the usual aperture **68** to receive the hollow rivet **18***b* and may be further provided with an annular offset **70** to nest into the annular identation **64.** FIGS. **10** and **11** show how the hollow rivet at its initial configuration **18***b* may be deformed or headed into positive permanent engagement with the tab **66.** For this purpose a pair of dies is used in the manner heretofore described, a lower die **72** being formed with a boss **74** to fit into the interior of the hollow rivet and an upper die **75** being provided with a planar working face **76.** When the two dies close in the manner indicated in FIG. **11,** the upper die **75** cooperates with the boss **74** to squeeze the end wall of the hollow rivet **18***b* thereby converts the hollow rivet to the final headed rivet **18.**

A special advantage of the construction shown in FIG. **11** may be understood by a comparison with the construction shown in FIG. **5.** One of the problems in the design of a can of this type is to keep the hollow rivet from protruding above the plane of the rim or chime of the can. This problem is especially troublesome when the hollow rivet is in the central region of the can top and the can top is bulged outward by a pressurized content such as a carbonated beverage.

In FIG. **5** the whole of the circumferential bead of the rivet lies above the plane of the upper surface of the tab, whereas in FIG. **11** the fact that the tab is countersunk, i.e. formed with the annular indentation **64** permits the circumferential bead of the hollow rivet to extend partially into the plane of the tab. Thus the circumferential bead of the hollow rivet shown in FIG. **11** is lowered into the level of the tab to permit reduction in the length of the finished hollow rivet and corresponding reduction in the extent to which the rivet extends above the rest of 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 an easy opening container having a sheet metal wall weakened along a line of scoring to form a tear strip with a tab attached to the tear strip for manual severance thereof, the improvement comprising:

the sheet metal being thinned in a zone around the leading end of the tear strip, said zone being substantially wider than the line of scoring, with the line of scoring extending into said zone to provide a residual web of metal along the line of scoring of minimum thickness at the leading end of the tear strip to facilitate initial severance of the tear strip at the leading end thereof.

2. In an easy opening container having a sheet metal wall with a line of scoring forming a tear strip and having a tab attached to the tear strip for manual severance thereof, the improvement comprising:

the sheet metal wall being formed into a hollow rivet in engagement with the tab;

the sheet metal being indented from the same side as the rivet around the base of the rivet to form a continuous zone in which the sheet metal is reduced in thickness, the radial dimension of said zone being wider than the line of scoring; and

the line of scoring extending into said zone to form the leading end of the tear strip and to provide a residual web of metal of minimum thickness to facilitate initial severance of the tear strip at the leading end thereof.

3. In an easy opening container having a sheet metal wall with a line of scoring forming a tear strip and having a tab attached to the tear strip for manual severance thereof, the improvement comprising:

the sheet metal wall being formed into a hollow rivet in engagement with the tab;

the sheet metal wall being indented around the base of the rivet from the side of the sheet metal opposite the side from which the hollow rivet extends, the indentation forming a continuous zone in which the sheet metal is reduced in thickness, the radial dimension of said zone being wider than the line of scoring; and

the line of scoring extending into said zone to form the leading end of the tear strip and to provide a residual web of metal of minimum thickness to facili-

tate initial severance of the tear strip at the leading end thereof.

4. In an easy opening container having a tear strip with a tab attached thereto by a hollow rivet formed in the tear strip with the hollow rivet extending through an aperture in the tab and with a circumferential bead of the hollow rivet in overhanging engagement with the rim of the aperture, the improvement comprising:

said tab being offset downward around the rivet to lower the rim of the aperture thereby to reduce the extent to which the hollow rivet protrudes from the plane of the tear strip.

5. In a wall fabricated from sheet stock; means to accommodate an overlying member with an aperture therein; and a permanent connection between the member and the wall comprising an imperforate tubular rivet projecting from and integral with the wall and extending through the aperture in the member, said rivet having a peripheral wall and transverse head, the first mentioned wall being of reduced thickness surrounding the rivet and with material thereof being moved into said peripheral wall, said peripheral wall of the rivet being initially formed of material displaced solely from the material of the wall surrounding said rivet, and said head being supported out of the plane of the first mentioned wall by said material displacement forming said peripheral wall.

6. A device according to claim **5** wherein the transverse head is initially unworked and is radially extended from the peripheral and substantially unmoved rivet wall to overly and clampingly engage the rim of the aperture in said member.

7. A device according to claim **5** wherein the transverse head is initially unworked and is reduced in thickness and radially extended from the peripheral and substantially unmoved rivet wall to overly and clampingly engage the rim of the aperture in said member.

8. In a wall fabricated from sheet stock; a removable wall area; means to remove said wall area and comprising an overlying force applicating tab with an aperture therein; and a permanent connection between the tab and said wall area comprising an imperforated tubular rivet projecting and integral with the removable wall area and extending through the aperture in the tab, said rivet having a peripheral wall and a transverse head, the first mentioned wall being of reduced thickness surrounding the rivet and with material thereof being moved into said peripheral wall, said peripheral wall of the rivet being initially formed of material displaced solely from the material of the removable wall area surrounding said rivet, and said head being supported out of the plane of the first mentioned wall by said material displacement forming said peripheral wall.

* * * * *