METHOD OF MAKING AN END CLOSURE

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FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

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METHOD OF MAKING AN END CLOSURE

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ABSTRACT OF THE DISCLOSURE

A lift-tab is secured to the scored area of an end closure for a can by forming in the end closure a downwardly facing dimple which is subsequently reformed into an upwardly extending rivet of a smaller diameter than the dimple which rivet is indented downwardly at its head wall and then staked to secure the lift-tab, the reforming of the rivet to extend from the side opposite to that from which the dimple extends, allowing the rivet to be drawn to a greater height than would otherwise be possible.

The present invention relates generally to a method for making an easily openable metal end closure for a tubular can body, and more particularly to a new and improved method of forming an integral rivet in the end closure which is utilized to secure a pull tab or lever to a tear-out area provided in the end closure.

In the method presently being used to form such an integral rivet in this type of end closure, an upwardly or outwardly extending dome or dimple is first formed in the central panel of the end closure. The dome is then forcibly reduced in a drawing operation to form a hollow, upwardly extending rivet which is adapted to fit within a mounting aperture in the pull tab and which is of a height greater than the thickness of the tab. Thereafter, a score line is formed in the end closure which closely surrounds the rivet to define a tear-out area having the rivet positioned on one end thereof. The tab is then placed on the end closure panel with the rivet extending through the aperture therein, and the upwardly extending rivet is then forced back into the area of the end closure panel adjacent the rivet. Since the amount of reduction in thickness of the rivet is greatly reduced in thickness to displace sufficient material therefrom in a substantially vertically outward direction to overlie the portion of the tab defining the aperture therein and thus to secure the tear-out area.

While the above method has been successfully utilized in the production of such easily openable end closures, it possesses certain disadvantages. When the original upwardly extending dimple is forcibly reduced to form the upwardly extending rivet, the generally cylindrical side wall of the rivet is reduced in thickness and metal is forced back into the area of the end closure panel adjacent the rivet. Since the amount of reduction in thickness of the rivet is determined by the height of the rivet, it imposes a limitation on the height of the rivet in order to prevent excessive thinning and possible cracking or fracture of the rivet side wall during the rivet forming operation.

This limitation on the height of the rivet also limits the amount of metal that will overlie the tab when the upper wall of the preliminary rivet is forcibly reduced after it has been positioned within the tab aperture. One disadvantage of the above method, therefore, is that the limitation on the height of the rivet sometimes results in the radially outward displacement over the tab of an amount of metal in the rivet head which is insufficient to retain the tab on the tear-out area when the tab is pulled by the consumer, with the resultant failure to remove the tear-out area from the end closure panel.

Secondly, the forcing of the metal from the upwardly extending dimple back into the end closure panel during the formation of the rivet tends to cause the formation of ripples or wrinkles in the circular area of the panel surrounding the rivet. When the score line is thereafter formed in the panel to define the tear-out area therein, the depth of the score through the wrinkled area of the panel is not uniform and may be of insufficient depth in certain portions thereof, with the resultant possibility of an uneven tearing action through the wrinkled area and thus some difficulty in the removal of the tear-out area from the panel.

Thirdly, when the end wall or head of the rivet is forcibly decreased in thickness to displace metal therefrom in a radially outward direction over the tab to secure it to the tear-out area, some metal is displaced downwardly into the rivet side wall and tends to disturb the score line formed in the portion of the closure panel surrounding the rivet. Thus, there is the possibility of fracture of the panel along the portion of the score line adjacent the rivet.

The aforementioned disadvantages of the above method are overcome by the new and improved method of the instant invention. This is accomplished by first forming a downwardly (or inwardly) rather than an upwardly extending dimple in the end closure panel. The dimple is then forced upwardly and reduced in a drawing operation to form the upwardly extending rivet in the panel. The forming of a downwardly extending dimple which is then reformed to the upwardly extending rivet is advantageous in that the metal of the end closure panel is successively deformed in opposite directions. This deformation serves to mechanically stress-relieve the metal in the panel and thereby increases the ductility of the metal and insures that will yield uniformly during the rivet forming and tab securing operations. Since the metal is more ductile, rivets of sufficient height to consistently produce rivet heads of adequate size can be formed in the panel without the danger of cracking or fracture of the side walls of the rivet during the forming operation.

Thereafter, the score line is formed in the closure panel surrounding the rivet and, simultaneously, the end wall or head of the rivet is indented downwardly into a cup-like configuration. This indentation of the rivet head facilitates the subsequent outward displacement of the metal in the rivet head over the tab to secure it to the tear-out area. The simultaneous scoring serves to support the scored portion of the closure panel during the indenting operation, and causes a sharp corner to be formed between the scored panel portion and the rivet side wall. This sharp corner resists movement of metal into the scored panel portion during the tab-securing or staking operation and thus effectively prevents disturbance of the score line.

It is accordingly an object of the present invention to provide a new and improved method of forming an integral rivet or embossment in a first metal member which can be utilized to secure a second member thereto.

Another object is the provision of such a method for forming an integral rivet or embossment in the central panel of an end closure so that a pull tab or lever may be secured to a tear-out area provided in the end closure panel.

A further object is to provide such a method of forming an integral rivet wherein there is little or no possibility of fracture of the metal in the end closure panel which is deformed and displaced during the formation of the rivet therein.

Still another object is the provision of such a method which produces a rivet of sufficient height in the end closure panel to insure that a sufficient amount of metal in the rivet head is displaced laterally over the subjacent portion of the pull tab to firmly secure it to the end closure panel.

All still further objects is to provide a method for form-
ing an integral rivet or embossment in a metal panel which prevents the formation of undesirable wrinkles or ripples in the portion of the panel adjacent the rivet.

An additional object is the provision of a method of forming an integral rivet in a closure panel for securing a pull tab thereto, wherein the rivet is so formed as to facilitate the displacement of the metal in the head thereof in an outward direction over the tab, and this metal is effectively prevented from being displaced downwardly into the rivet side wall to such an extent as to disturb the scored portion of the closure panel disposed adjacent the side wall.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, disclose a preferred embodiment thereof.

Referring to the drawing:

FIG. 1 is a plan view of an end closure formed by the method of the instant invention, the view showing the end closure prior to its attachment to a can body; and

FIGS. 2 through 6 illustrate the successive steps of the instant method for forming an integral rivet in the end closure panel and forming a pull tab lever onto the central panel by flattening the upper end of the rivet over the tab to form it into a laterally enlarged rivet head.

As a preferred and exemplary embodiment of the instant invention, FIGURE 1 shows an end closure generally designated 10 which is of a type that could be formed by the method of the instant invention. The end closure 10 comprises a substantially flat central panel 22 surrounded by a peripheral, depressed reinforcing groove 14 which merges into a vertically extending countersink wall 16 which in turn merges with a peripheral curved flange 18 having adhered to its underside a sealing material which forms a gasket (not shown). The end closure 10 is adapted to be joined and hermetically sealed to a tubular can body (not shown) by the well-known procedure of interlocking the end flange 18 and a peripheral can body flange to form a conventional double seam, the end flange gasket (not shown) serving to provide a hermetic seal therebetweens. While the end closure 10 shown in the drawing is circular in shape, it is to be understood that it may be of any suitable or desirable shape, depending on the can body.

Extending generally radially from the center of the panel 12 is a removable or tear-out area 22 completely enclosed within and defined by an endless score line 24. While the tear-out area 22 may have shapes other than that illustrated, it usually is completely removable, i.e., defined by an endless score line comprising a plurality of connected portions having a predetermined orientation and shape. The radially extending tear-out area 22 shown in FIG. 1 is particularly suitable for cans containing pourable, potable beverages, such as beer, ale and soft drinks (such as carbonated soda) which are either packed under pressure or generate their own pressure.

Secured to the tear-out area 22 at its innermost end, where the parallel portions of the score line 24 are joined by an arcuate portion 25, is a substantially rigid, flat lift-tab or opening lever 26. The lever 26 is punched or cut from a strip of flat metal stock and, to increase its rigidity there are formed therein longitudinally extending ribs or embossments 28. As shown in FIG. 1, the lever 26 is secured at its innermost end to the tear-out area 22 by means of a peened-over embossment or rivet 29 which is formed integral with and drawn from the central panel 12, the rivet 29 extending upwardly through an aperture 30 in the innermost end of the lever 26 and having its upper end peened or deformed outwardly to form it into a rivet head to secure the lever 26 in place. The drawing and flattening operations, to be described hereinafter, which create the peened-over embossment or integral rivet 29 cause a thinning of the metal in the generally circular portion A of the end panel 12 immediately surrounding the rivet. In the drawing, this area A is defined by an imaginary broken circular line C (see FIG. 1).

From the point of securing of the lever 26 to the tear-out area 22, and initially lying flat on the panel 12, the lever 26 extends generally along a radius which preferably is different from the radius along which the removable tear-out area 22 extends. The outer or free end 30 of the lever 26 may be upturned and hemmed slightly away from the adjacent panel 12, thereby allowing the fingertip of the consumer to readily indent and under the free end 30 of the lever 26 for the purpose of removing the tear-out area 22 from the end closure panel 12.

In the formation of the end closure 10, by utilizing the method steps of the instant invention, a blank for the end closure 10 is first subjected to a drawing operation in a die mechanism 40 (See FIG. 2). The central panel 12 of the end closure blank is positioned between an upper clamping member 42 and a lower clamping member 44, and a vertically reciprocal punch member 46, mounted on the upper clamping member 42, engages the central portion of the panel 12 and depresses it into the reduced 48 by the scoring and indenting operation, the panel 12 is disposed on a lower support plate 68 having a supporting member 70

Referring now to FIG. 3, the end closure blank having the downwardly extending dimple 50 formed in the center portion thereof is then subjected to a redraw operation in a second die mechanism 52. An upstanding forming projection or protuberance 54 on a lower die member 56, placed next to and parallel to the punch member 46, pushes it upwardly into a recess 58 of an upper clamping member 60 to form an upwardly extending rivet 62 in the panel 12 which is of a smaller diameter than that of the dimple 50 and which has a substantially flat transverse head wall 63.

The forming of the downwardly extending dimple 50 to the upwardly extending rivet 62, in the die mechanism 52, is particularly advantageous in that the metal of the end closure panel 12 is successively deformed in opposite directions. This deformation serves to mechanically stress-relive the metal in the panel 12 and thereby increases the ductility of the metal and ensures that it will yield uniformly during withdrawal of the rivet 62. Since the metal is more ductile, a rivet 62 of a predetermined height can be formed in the panel 12 without the danger of cracking or fracture of the sidewall of the rivet during the forming operation.

Also, the stress-relieving of the metal in the panel 12 enables metal from the dimple 50, which is not utilized to form the rivet 62, to be forced back into the plane of the panel during the redraw operation without forming wrinkles or ripples in the circular area A (see FIG. 1) of the panel adjacent to and surrounding the rivet 62. The circular panel area A, therefore, has a substantially smooth upper surface and is uniform in thickness. To ensure that this metal from the dimple 50 is forced back into a substantially common plane, the lower die member 56 and the upper clamping member 60 are mutually upwardly curved portions of the panel 58 and pushes, respectively, to cause the metal to initially travel beyond the plane of the panel and thus remove any trace of the dimple 50.

Thereafter, the score line 24 is cut in the central panel 12 by a scoring member 64 and, simultaneously, the rivet head wall 63 is indented downwardly into the die configuration by the curved head 65 of a punch member 66 which is vertically reciprocally mounted within the scoring member 64, as shown in FIG. 4. During this scoring and indenting operation, the panel 12 is disposed on a lower support plate 68 having a supporting member 70.
inserted within the lower portion of the rivet 62. Since the panel area A surrounding the rivet 62 is substantially smooth and uniform in thickness, the depth of score through this area is uniform and accurately controllable, thereby facilitating the initial breaking through the metal in this portion of the score line when the opening lever 26 is lifted upwardly to open the rivet.

This indentation of the rivet head wall 63 facilitates the subsequent outward displacement of the metal thereon over the tab 26 to secure it to the tear-out area 22, as will be more fully described hereinafter. Also, the simultaneous scoring of the closure panel 12 by the scoring member 64 serves to support the portion of the panel adjacent the rivet during the indenting operation and prevents any disturbance of this panel portion along the score line. This support of the scored portion of the panel while the rivet head wall 63 is being pushed downwardly by the punch 66, and the interior support of the rivet by the supporting member 78, causes a sharp corner 67 to be formed between the rivet side wall and the adjacent panel portion. The sharp corner 67 serves to resist the flow of metal from the rivet into the scored portion during subsequent deformation of the rivet in the tab securing operation, and thus effectively prevents disturbance of the tab 26.

After the scoring and indenting operation, the closure panel 12 is disposed on a support 71 having a supporting member 73 which may be adjustable, disposed within the rivet 62. The lift tab or lever 26 is positioned over the end closure panel 12 and is engaged by a plunger 72 to press the lever against the panel 12 and to tightly force the rivet 62 through the aperture 30 in the tab 26 (see FIG. 5). The plunger 72 is provided with a recess 74 to accommodate the upwardly extending rivet 62 during the pressing operation.

Finally, the end closure panel 12 is positioned between an upper clamping member 76 and the support 71, the clamping member 76 having a recess 78 therein to accommodate the pull tab 26 and the rivet 62. The central panel 12 and rivet 62 may be disposed on the support 71 and the supporting member 73, respectively, during this operation, or may be supported in any other suitable manner, it being noted that the supporting member 73 preferably occupies a lower position during this operation than during the tab positioning operation. A vertically reciprocable compression member or plunger 80 is mounted within the clamping member 76 and is movable downwardly into the recess 78 and into engagement with the outer portion of the indented head wall 63 of the rivet to compress it against the supporting member 73 and to reform the upper end of the rivet into a laterally expanded rivet head 63. Because of the indentation of the rivet wall 63, the metal tends to flow radially outwardly rather than downwardly into the rivet side wall, thereby facilitating the formation of the expanded rivet head 82 and further insuring against disturbance of the score line 24 in the portion of the panel adjacent the rivet side wall. During this operation, the indented rivet wall 63 is forcibly decreased in thickness by the compression member 80 to displace sufficient material therefrom in a substantially radially outward direction to overlie the portion of the tab 26 defining the aperture 30 therein, thereby securing the tab to the tear-out area 22 in the panel 12.

While specific forms of apparatus have been shown and described herein for performing the steps of the instant method, it is noted that any suitable apparatus could be used to perform these steps, without departing from the spirit or scope of the instant invention.

Also, while the instant method has been disclosed as a method for forming an integral rivet in an end closure panel so that a lift tab may be secured thereto, it is obvious that it is applicable to the forming of a rivet of any type of metal panel or member, regardless of its purpose. It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, line, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

What is claimed is:

1. A method of securing a generally flat member having an aperture therein to a substantially flat metal panel, comprising the steps of:
   - drawing a curved circular dimple in said panel, said dimple extending from one side of said panel;
   - redrawing said dimple into a cylindrical rivet which extends from the other side of said panel, said rivet being of a diameter less than that of said dimple and having a generally flat transverse head, pressing said member into engagement with said panel so that said rivet extends through said member aperture, and securing said rivet to said member to fasten said member to said panel.

2. A method of securing a generally flat member having an aperture therein to a substantially flat metal panel, comprising the steps of:
   - drawing a curved, circular dimple in said panel which extends from one side of said panel, redrawing said dimple into a cylindrical rivet which extends from the other side of said panel, said rivet being of a diameter less than that of said dimple and having a generally flat transverse head, pressing said member into engagement with said panel so that said rivet extends through said member aperture, and securing said rivet to said member to fasten said member to said panel.

3. A method of securing a generally flat member having an aperture therein to a metal panel, comprising the steps of:
   - drawing a generally curved circular dimple in said panel which extends from one side of said panel and is of greater lateral area than that of said member aperture, redrawing said dimple into a generally cylindrical rivet which extends from the other side thereof said panel and has a substantially transverse head wall, said rivet being of a size substantially the same as that of the member aperture, pressing said member into engagement with said panel so that said rivet extends through said member aperture and beyond said member, and forcibly decreasing the thickness of said rivet head wall to displace metal therefrom over the portion of said member adjacent said aperture therein to secure said member to said panel.

4. A method of securing a generally flat member having an aperture therein to a metal panel, comprising the steps of:
   - drawing a generally curved circular dimple in said panel which extends from one side thereof and is of greater lateral area than that of said member aperture, redrawing said dimple into a generally cylindrical rivet which extends from the other side of said panel and has a substantially transverse head wall, said rivet being of a area substantially the same as that of the member aperture, indenting said rivet head wall towards said panel into a cup-like configuration, pressing said member into engagement with said panel so that said rivet extends through said member aperture and beyond said member, and reforming said indented rivet head wall to decrease the thickness thereof and to replace metal therefrom over the portion of said member adjacent said aperture therein to secure said member to said panel.

5. The method of claim 4 wherein during said indenting step, the panel portion adjacent said rivet is supported on both sides thereof to cause the formation of a sharp corner between said rivet and said panel portion, said sharp
corner serving to reduce the flow of metal into said panel portion during said tab-securing step.

6. A method of securing a pull tab having a circular aperture therein to a central panel of an end closure, comprising the steps of:
   drawing a generally curved circular dimple in said panel which extends from one side thereof and has a diameter greater than that of the tab aperture,
   redrawing said dimple into a generally cylindrical rivet which extends from the other side of said panel and has a substantially flat transverse head wall, said rivet having an outer diameter which is substantially the same as that of the tab aperture,
   pressing said tab into engagement with said panel so that said rivet extends through said tab aperture and said rivet head wall extends beyond said tab, and forcibly decreasing the thickness of said rivet head wall to displace metal therefrom in a generally radially outward direction over the portion of said tab adjacent the aperture therein to secure said tab to said panel.

7. The method of claim 6 wherein, after said redrawing steps, said central panel is scored to provide a tear-out area in said panel which includes said rivet, thereby enabling said pull tab to be secured to said tear-out area.

8. A method of securing a pull tab having a circular aperture therein to a central panel of an end closure, comprising the steps of:
   drawing a generally curved circular dimple in said panel which extends from one side thereof and has a diameter greater than that of the tab aperture,
   redrawing said dimple into a generally cylindrical rivet which extends from the other side of said panel and has a substantially flat transverse head wall, said rivet having an outer diameter which is substantially the same as that of the tab aperture,
   indenting said rivet head wall towards said panel and simultaneously scoring said panel in the portion thereof surrounding said rivet to form a tear-out area including said rivet,
   pressing said tab into engagement with said panel so that said rivet extending through said tab aperture and said rivet head wall extends beyond said tab, and reforming said indent rivet head wall to decrease the thickness thereof and to displace metal therefrom in a generally radially outward direction over the portion of said tab adjacent the aperture therein to secure said tab to said tear-out area.

9. The method of claim 8 wherein during said simultaneous indenting and scoring step, the panel portion adjacent said rivet is supported on both sides thereof to cause the formation of a sharp corner between said rivet and said panel portion, said sharp corner serving to reduce the flow of metal into said panel portion during said tab securing step.

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