METHOD FOR FORMING A RIVET AND ATTACHING A PULL TAB THEREWITH


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9 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure has to do with the forming of a rivet and attaching a pull tab therewith. The rivet is formed by first drawing a relatively large protuberance, and thereupon reshaping the protuberance in a series of steps to reduce the diameter of the protuberance and to increase the thickness of the metal thereof so as to define a rivet having a wall thickness substantially equal to the original thickness of the metal. The rivet, after a pull tab has been position thereon, is upset or folded so as to define a bead which retains the pull tab in place.

This invention relates in general to new and useful improvements in container elements having means for facilitating the opening thereof without the use of any type of tool, and more particularly relates to a novel method of attaching pull tabs to removable portions of containers.

For many years it has been desirable to provide container ends which have self-opening features in order that the contents of the container may be readily dispensed. This is particularly true of beverage containers. In the past numerous types of tear strips have been provided. However, when the beverage is disposed within the container under pressure, the tear strips have not been proven to be economically feasible in that special precautions must be taken in outlining the tear strip by a scoring operation and more particularly in securing the pull tab to the tear strip.

Recently, it has become economically feasible to form can ends of aluminum which, as compared to steel, is relatively soft and easily tears. A practical way for attaching a pull tab to a tear strip of an aluminum container end has been found to be providing the tear strip with an integral rivet and then utilizing the rivet in the attachment of the pull tab to the tear strip. With this arrangement no opening is formed in the container end which must be sealed against escape of gases and liquid under pressure. It has proved feasible to upset the end of a rivet formed in the manner stated above for the purpose of securing the pull tab to the tear strip when the container end is formed of a relatively thick aluminum, for example aluminum having a thickness of approximately 0.015 inch. However, in order to reduce the cost of containers, it is desirable to utilize a relatively hard aluminum instead of the customary soft aluminum with the result that container ends previously formed of 0.015 inch soft aluminum sheet may now be formed from 0.008 inch hard aluminum sheet. On the other hand, such a relatively thin and hard sheet does not permit the previous forming of a rivet and then the upsetting of the rivet in that the upsetting of the rivet results not only in the thinning of the metal, but extremely sharp bends which are subject to cracking and loss of pressure within the container.

The current trend towards cost reduction has further led to the development of thin gauge tinplate for commercial use in metal cans, and this invention makes possible the provision of a rivet formation in a can end made of this thin gauge tinplate which otherwise could not be achieved by presently known methods.

In view of the foregoing, it is the primary object of this invention to provide a novel method of forming a can end having an integral rivet for the attachment of a pull tab wherein the rivet has a wall thickness throughout substantially the same as the thickness of the can end from which it is formed and which rivet has sufficient material for the folding or crimping of the rivet to retain a pull tab thereon without the undesired thinning of the rivet in a manner which would subject the rivet and adjacent portions of the can end to failure under pressure.

Another object of this invention is to provide a novel method of forming an integral rivet on a removable portion of a can end wherein a large area of the can end is first punched from the plane of the can end followed by the reforming of this large area by a series of operations into a rivet of a greatly reduced size as compared to the original deformed area and wherein in the reforming of the metal, that metal which becomes the rivet is compressed and any tendency to unduly thin the metal in the forming of the rivet is eliminated.

Yet another object of this invention is to provide a novel method of forming a can end having a removable portion which is formed with an integral rivet for the attachment of a pull tab thereto to facilitate the removal thereof, the rivet being initially formed by deforming a large area of the can end, and then through a series of punching operations, the large deformed area is first shaped into a large diameter rivet formation which is followed by a series of reformations in the diameter and the height thereof so that the finally formed rivet is shaped by compressive forces, and during the reforming of the metal, there is a tendency to increase the thickness of the metal as opposed to the usual tendency of thinning the metal as occurs in customary drawing operations, the removable portion of the can end then being outlined by a score line formed in the can end around the rivet.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

IN THE DRAWINGS

FIGURE 1 is a plan view of a can end formed in accordance with this invention and shows the general arrangement of the tear strip and pull tab thereof.

FIGURE 2 is an enlarged vertical sectional view taken through the can end of FIGURE 1 substantially along the line 2—2 of FIGURE 1, and shows the specific details of the riveted connection between the tear strip and the pull tab.

FIGURE 3 is an enlarged fragmentary plan view of the can end prior to the securing of the pull tab thereto and shows the eccentric relationship of the rivet with respect to the generally circular end of the tear strip.

FIGURE 4 is a vertical sectional view similar to FIGURE 2 and shows a slightly modified form of pull tab and the manner in which it is secured to the tear strip of the can end.

FIGURE 5 is a schematic vertical sectional view taken through a typical die assembly utilized in the forming of the integral rivet on the can end.

FIGURE 6 is a vertical sectional view taken through a central portion of a blanked out can end prior to the
provision of the can end with the easy opening feature of this invention.

FIGURE 7 is a schematic vertical sectional view taken through the can end portion of FIGURE 6, and shows the same after an initial forming operation wherein a large area dimple is formed in the can end.

FIGURE 8 is a schematic vertical sectional view taken through a die assembly, such as that shown in FIGURE 5, wherein the dimple in the can end is being re-formed by a punching operation with the metal being re-formed under compression and a large diameter rivet being shaped.

FIGURE 9 is a schematic vertical sectional view taken through a next die unit in accordance with this invention and shows the details of a second re-forming operation wherein the diameter and height dimensions of the rivet shown in FIGURE 8 are altered.

FIGURE 10 is another fragmentary schematic vertical sectional view taken through a third re-forming die unit and shows the diameter and height dimensions of the rivet of FIGURE 9 being further modified.

FIGURE 11 is a schematic fragmentary vertical sectional view taken through a scoring die unit wherein the tear strip is outlined by a score line formed in the upper surface of the can end.

FIGURE 12 is a schematic vertical sectional view taken through a precrimping die unit utilized for the purpose of precrimping the rivet after the pull tab has been applied thereto.

FIGURE 13 is a schematic fragmentary vertical sectional view taken through the final crimping die unit wherein the rivet is finally crimped to a pull tab retaining portion.

FIGURE 14 is a schematic fragmentary vertical sectional view taken through a modified form of precrimping die unit wherein the rivet is precrimped prior to the application of the pull tab thereto.

FIGURE 15 is a schematic fragmentary vertical sectional view showing a slightly modified form of the final crimping die unit of FIGURE 13 particularly adapted for crimping a rivet over an upstanding annular flange of a pull tab.

Referring now to the drawings in detail, reference is first made to FIGURES 1, 2 and 3 wherein there is illustrated a can end formed in accordance with this invention wherein the end is generally referred to by the numeral 15. The can end, except for an easy opening feature thereof which will be described hereinafter, is of a conventional construction and includes a peripheral curl 16 for facilitating the attachment thereof to a can body by means of a conventional sealing operation.

The can end 15 including an end panel 17 which is provided with a score line 18 defining a removable portion or tear strip 19. The tear strip 19 is of a shape to facilitate drinking from a can of which the can end 15 is a part and includes an outer triangular portion 20 and an inner generally straight portion 21. The straight portion 21, as is best shown in FIGURE 3, terminates in its inner end in a generally circular starting portion 22. The starting portion 22 is provided with an integral rivet 23 which is utilized to secure a pull tab 24 to the tear strip 19 to facilitate the removal thereof without the use of any tools or other implements separate from the can of which the can end 15 is a part.

At this time it is pointed out that the rivet 23 is eccentrically positioned with respect to the generally circular starting portion 22 and is positioned more closely to that extreme inner part of the tear strip 19. By positioning the rivet 23 as closely as possible to the inner part of the score line 18, a maximum leverage is obtained to facilitate the opening of the can. Further, by restricting the length of the tear strip between the rivet and the score line to a minimum, insufficient material is available for bending of the tear strip without effecting a rupture of the end panel 17 along the score line 18. Thus, the specific position of the rivet 23 with respect to the score line 18 permits the opening of a can with a minimum twisting which is being exerted on the rivet and thereby reduces the necessary strength of the connection the tear strip 19 and the pull tab 24.

Referring once again to FIGURE 2, it will be seen that the pull tab 24 is provided with an upwardly sloping terminal flange 26 to facilitate the lifting of the pull tab to effect the removal of the tear strip 19 from the end panel 17. The pull tab 24 is reinforced against transverse bending by a plurality of longitudinally extending ribs 27.

As the first step in the forming of the rivet 23, the end panel 17 is provided with a protrusion 28 by a pair of the elements or parts 29 and 30. The die element 29 is provided with a generally part spherical projection 31 disposed in alignment with an opening 32 of the die part 30. The opening 32 is provided with a lower rounded corner 33 to facilitate the shaping of the metal in the forming of the protrusion 28.

In FIGURE 6 there is illustrated the end panel 17 as it appears before the protrusion 28 is formed. It is to be understood that the protrusion 28 may be formed after the can end 15 has been blanked out in a normal blanking operation, or the protrusion 28 may be formed at the same time the can end is blanked out and shaped. If the protrusion 28 is formed during the blanking and shaping of the can end 15, then the die parts 29 and 30 will be portions of the conventional dies utilized in the blanking out and shaping of the can ends.

Reference is now made to FIGURE 5 in particular, wherein there is illustrated the details of a die unit of the general type utilized hereinafter in the re-forming of the protrusion 28 to form the rivet 23. The die unit 34 includes a back-up block 36 which may be mounted in a press structure in any desired manner. The back-up block 36 has seated therein a die center pad 37 which is provided with a stepped opening 38 therethrough defining an intermediate shoulder 39. A die center pad insert 40 of a stepped construction is positioned within the press as shown and includes an upper portion 41 of a reduced cross section. The lower portion of the insert 40 is provided with a centrally located bore 42 in which there is positioned a spring 43. The spring 43 has its lower end seated on the back-up block 36 and normal retains the insert 40 in an uppermost position with a shoulder 44 of the insert 40 in abutting engagement with the shoulder 39 of the die center pad 37.

The die unit 34 also includes a pressure ring 45 which is mounted for upward movement with respect to an upper portion of a press (not shown) by means of springs 46. The pressure ring 45 is provided with a central opening 47 in which there is mounted for relative movement a punch center 48. The punch center 48 is provided with a bore 49 having a rounded lower corner 50.

Referring now to FIGURE 8 in particular, it will be seen that in the use of the die unit 34 in re-forming the protrusion 28, the pressure ring 45 first clamps the portion of the end panel 17 surrounding the protrusion 28 against the die center pad 37. Then the punch center 49 comes into engagement with the protrusion 28 and forces the outer material of the protrusion downwardly and inwardly about the upwardly projecting portion 41 of the insert 40. The material of the protrusion 28 is thus re-formed about the insert 40 in the manner shown in FIGURE 8 to define a generally tubular member 51. Since the re-forming of the protrusion 28 into the tubular member 51 is accomplished with the metal being in compression, it will be seen that there is a slight increase in the thickness of the metal, which increase is relatively minute as is the decrease in the thickness of the metal of the end panel 17 in the formation of the protrusion 28.

Referring now to FIGURE 9 in particular, it will be
seen that there is illustrated another die unit 52 which generally corresponds to the die unit 34 and which may be mounted in a punch in the same manner. The die unit 52 includes a die center pad 53 having a stepped opening 54 therethrough. The opening 54 in part defines an intermediate transverse shoulder 55. A die center pad insert 56 is positioned within the opening 54 and is of a stepped construction to provide a projecting upper portion 57 of a reduced cross section. The formation of the upper portion 57 of a reduced cross section results in the formation of a shoulder 58 which opposes the shoulder 55 and in the open position of the die unit 52 engages the shoulder 55 to limit the movement of the insert 56. The lower portion of the insert 56 is provided with a spring 59 which normally urges the insert 56 upwardly. It is to be understood that the die unit 52 will include a back-up block, such as the back-up block 36, and the spring 59 will be seated thereon. Also, the downward movement of the insert 56 to the position shown in FIGURE 9 will be limited by the back-up block.

The die unit 52 also includes an upper pressure ring 60 which is resiliently mounted by means of a plurality of springs 61. The pressure ring 60 is provided with a centrally located bore 62 in which there is mounted for relative movement a punch center 63. The punch center 63 is provided with a central opening 64 aligned with the upper portion 57 of the insert 56 and cooperating therewith to reshape the tubular member 51.

In the second re-forming operation on the can end 15, the end panel 17 is first clamped against the die center pad 53 by the pressure ring 60, after which the tubular member 51 is compressively engaged by the punch center 63. As the punch center 63 moves downwardly, the material of the tubular member 51 is forced inwardly about the upper portion 57 of the insert 56 to effect a reshaping of the tubular member 51 under compression to define a second tubular member 65 which is reduced in diameter and increased in height as compared to the tubular member 51. Since the tubular member 65 is formed from the tubular member 51 with the metal under compression, there is a slight increase in the thickness of the metal forming the tubular member 65.

Reference is now made to FIGURE 14 wherein there is illustrated a die unit 84 which is also of a construction similar to the die unit 34. The die unit 86 includes a die center pad 67 which is provided with a stepped opening 68 therein. A die center pad insert 85 is positioned within the opening 68 and includes a large diameter lower portion 70 and a smaller diameter upwardly projecting upper portion 71. The differential in diameters of the portions 70 and 71 results in the formation of an upwardly facing shoulder 72 which opposes a downwardly facing shoulder 73 resulting from the formation of the opening 68. The insert 85 is normally urged upwardly by means of a spring 74 which has its upper end seated in an opening 75. The spring 74 has its lower end resting upon a typical back-up block (not shown) and the downward movement of the insert 85 is restricted by the back-up block.

The die unit 66 also includes a pressure ring 76 having a plurality of openings therein in which there are seated 78 resiliently mounting the pressure ring 76 for upward movement. The pressure ring 76 is provided with a central bore 79 in which there is mounted for relative movement a punch center 80 of a tubular construction while having a bore 81 aligned with the insert 69.

In the use of the die unit 66, the can end 15 with the tubular member 65 formed therein is positioned on the die center pad 67 and the die unit 66 is closed with the pressure ring 76 first engaging and clamping the end panel 17 surrounding the tubular member 65, after which the tubular member 65 is engaged by the punch center 80 and the material thereof forced inwardly around the upper portion 71 of the insert 69 to define the rivet 23.

It is to be noted that the rivet 23 has a tubular body portion 82 and a closed end 83.

It is to be noted that the forming of the rivet 23 from the tubular member 65 is accomplished by the punch center 80 in a manner wherein the material of the tubular member 65 is under compression and due to the restraint of the material against flow outwardly, in the reduction of the diameter of the tubular member 65 to form the rivet 23, there is a further slight increase in the wall thickness so that the wall thickness of the rivet 23, for all practical purposes, is the same as that of the original wall thickness of the end panel 17. Thus, there is no reduction in strength of the end panel 17 in the forming of the rivet 23 therefrom.

Referring now to FIGURE 11 in particular, it will be seen that the can end 15 is next placed in a die unit 84. The die unit 84 includes a die center pad 85 in which there is resiliently mounted a die center pad insert 86 for supporting and centering the rivet 23. The die unit 84 also includes an upper die member 87 which is provided with a downwardly projecting rib 88 engageable with the upper surface of the end panel 17 to form the score line 18. The die member 87 is provided with a central bore 89 for snugly receiving the rivet 23 during the scoring operation.

After the rivet forming and scoring operations have been completed on the can end 15, the can end 15 is positioned in a prestaking die unit 89. The prestaking die unit 89 includes a die center pad 90 having resiliently mounted therein a die center pad insert 91 for reception within the rivet 23. The pull tab 24 is positioned over the rivet 23 and is then loosely staked in place by the upper portion of the die unit 89 which includes a pressure ring 92 having a shape for engaging the pull tab 24 around the rivet 23. The pressure ring 92 is provided with a central bore 93 aligned with the insert 91. A punch 94 having a convexly curved lower end 95 is mounted within the bore 93 for movement relative to the pressure ring 92 and when brought into engagement with the end wall 83 of the rivet 23 effects a slight outward folding of the tubular body portion 82 at its intersection with the end wall 83 to form a slightly projecting bead 96 of a size to retain the pull tab 24 on the rivet 23.

The assembled pull tab and can end are then worked upon by a final staking die unit, generally referred to by the numeral 97. The die unit 97 includes a die center pad 98 having a die center pad insert 99 resiliently mounted within a center bore or opening 100 therein. The insert 99 is of a size to be received within the rivet 23.

The die unit 97 also includes a resiliently mounted pressure ring 101 which is engaged by springs 102. The pressure ring 101 is provided with a downwardly projecting central boss 103 for engaging and clamping the pull tab 24 surrounding the rivet 23 and holding the pull tab 24 in engagement with the end panel 17.

The pressure ring 101 is also provided with a central bore 104 in which there is mounted for relative movement a punch 105 having a flat lower end 106 which is engageable with the end wall 83 of the rivet 23. The relative proportions of the components of the die unit 97 are such that the die unit 97 effects a further outwardly folding of the outer portion of the tubular body portion 82 to define a definite annular bead 107 which clamps the pull tab 24 to the tear strip 19. The connection between the pull tab 24 and the tear strip 19 is such that when the right-hand end of the pull tab 24 is lifted, as is shown in FIGURE 2, the score line 18 will rupture immediately adjacent the rivet 23 and continued upward movement of the pull tab 24 will result in the tearing of the tear strip 19 from the end panel 17.

It is to be noted that in the staking of the rivet 23 to secure the pull tab 24 to the tear strip 19, it is merely a folding operation wherein there is no material reduction in the wall thickness of the rivet 23. Thus, the staking operation in no way decreases the strength of the end
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Accordingly, the above-disclosed method of forming the rivet 23 and staking the rivet 23 to secure the pull tab 19 is suitable for use where the can end 15 is formed of a relatively thin and hard aluminum or tin plate as compared to the presently utilized relatively thick and soft aluminum or tin plate. The disclosed method of securing a pull tab to the tear strip 19 makes it possible to utilize relatively economical panelling having an inside width of 0.008 inch as compared to the presently utilized more expensive soft aluminum having a thickness of 0.015 inch, or relatively thin gauge tin plate.

Reference is now made to FIGURE 14 wherein there is illustrated a die unit 108 which constitutes a modification of the die unit 66. The die unit 108 includes a die center pad 109 which carries a resiliently mounted die center pad insert 110. The insert 110, in lieu of having a flat upper end as in the case of the insert 69, is provided with an upper end having an outer upwardly projecting annular rib 111 for a purpose to be described hereinafter.

The die center insert 114 is provided with a central bore 117 in which there is mounted a further punch 118. The punch 118 is provided with a wedge-shaped lower portion 119 which is centrally located and which is generally complementary to the upper end of the insert 110.

When the can end having the tubular member 65 is worked upon by the die unit 108, there results a rivet 116 having a tubular wall portion 120 of the same diameter as the tubular wall portion 82 of the rivet 23. The rivet 116 also has a closed end 121 of which the outer portion is in the form of an outwardly directed annular bead 122 to facilitate the folding of the rivet in the securement of the pull tab 24 to the tear strip 19.

It is to be understood that after a pull tab 24 has been placed over the tubular rivet 116, the tubular rivet 116 may be folded in the manner disclosed with respect to the tubular rivet 23.

In FIGURES 4 and 15 there is illustrated a modified form of pull tab which is generally referred to by the numeral 124. The pull tab 124 differs from the pull tab 24 only in that it is provided with an upstanding flange 125 surrounding the rivet receiving opening 126 therein. This feature 125 reinforces the pull tab 124 around the opening 126 to prevent any possible tearing of the pull tab out from the openings 126 and off of the rivet on which the pull tab 124 is mounted.

It is to be understood that due to the upstanding flange 125, the die unit 17 must be provided with a rivet which is increased in height as compared to the rivet 23. This rivet is generally referred to by the numeral 127.

A modification of the die unit 97 is required to stake the rivet 127 and secure the pull tab 124 in place therein. This die unit is generally referred to by the numeral 123 and includes a die center pad 128 with a pressure ring 131 which is provided with a depending central portion 132 for cooperation with the die center pad 128 in clamping the pull tab 124 around the rivet 127 and the end panel 17. The pressure ring 131 is resiliently mounted by means of springs 133 and is provided with a central bore 134 in which there is mounted for relative movement a punch 135.

It will be seen that when the die unit 123 is utilized, the resultant rivet 127 has an end wall 136 and a tubular body portion 137 which is outwardly folded to form an annular bead 138 at the intersection of the tubular body portion 137 with the end wall 136. The annular bead 138 is of a size to fully clamp the pull tab 124 to the tear strip 19.

Although only a die unit corresponding to the die unit 97 has been illustrated and described with respect to the pull tab 124 and the rivet 127, it is to be understood that a prestaking die unit corresponding to the prestaking die unit 89 may be provided.

It will be readily apparent from the foregoing that there has been devised a novel can end having a self-opening feature which is positive in operation, which may be formed from relatively inexpensive thin gauge metals, such as aluminum, tin plate or other suitable materials, and which easy opening feature is of a nature wherein leakage through the can end is eliminated while assuring the opening of the can end when desired. It is to be noted that all of this has been accomplished due to the fact that there is substantially no thinning of the material of the resultant rivet as compared to the original thickness of the sheet from which the rivet is formed.

Although only preferred embodiments of the invention have been specifically illustrated and described herein, it is to be understood that minor modifications may be made in the several disclosed embodiments of the invention within the spirit and scope thereof, as defined in the appended claims.

1. A method of securing a pull tab to a removable portion of a metal container panel comprising the steps of forming a large diameter relatively shallow protrusion, then working on the protrusion in a series of compressive forming steps to form the protrusion by decreasing the diameter thereof and forcing material of the protrusion laterally inwardly to form a closed tubular rivet having a wall thickness of substantially the same thickness as the original thickness of the sheet, positioning the pull tab on the rivet, prestaking the rivet to define a minor laterally extending outer bead loosely retaining the pull tab on the rivet, and finally staking the rivet to further shape the laterally extending outer bead with the head clamping the pull tab to the removable portion, all of said steps being performed without materially reducing the thickness of the sheet adjacent the rivet and while maintaining the external configuration of the sheet.

2. A method of securing a pull tab to a removable portion of a metal container panel comprising the steps of forming a large diameter protrusion on a container panel, then acting on the protrusion in a series of combined punching and compressive forming steps wherein the metal of said protrusion is progressively reduced in diameter and decreased in axial extent until a tubular rivet having a body and an integrally closed end is formed integrally with said container panel, the combined efforts of said combined punching and compressive forming steps substantially maintaining the thickness of the metal of said protrusion wherein the thickness of the metal of the rivet is substantially the same as that of the container panel and the formed rivet being of an axial extent materially greater than the thickness of the pull tab; positioning the pull tab on the rivet in telescoped relation with the rivet extending through and beyond the pull tab; and then staking the rivet and thereby reversely folding that portion of the rivet body extending beyond the pull tab to form a laterally extending outer bead clamping the pull tab to the removable panel portion.

3. The method of claim 2 wherein in at least one of the combined punching and compressive forming steps the metal of the protrusion is first axially elongated and then compressively formed.

4. The method of claim 2 wherein in at least one of the combined punching and compressive forming steps the metal of the protrusion is first axially elongated about a punch element and then compressively radially inwardly formed about the punch element.

5. The method of claim 2 wherein in at least one of the combined punching and compressive forming steps the metal of the protrusion is first axially elongated about a punch element, the panel clamped in place around the
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9. The method of claim 2 wherein the combined effect of the punching and compressive forming steps is a minute increase in the thickness of the metal of the rivet as compared to the thickness of the metal of the protrusion.

7. The method of claim 2 wherein the bead is formed in the rivet body without reducing the thickness of the rivet closed end.

8. A method of securing a pull tab to a removable portion of a metal container panel comprising the steps of forming a large diameter protrusion in said container panel, next reshaping the protrusion to decrease the diameter and height thereof by forcing the metal of the protrusion laterally inwardly, and then further re-forming the protrusion by performing at least one combined punching and compressive forming step wherein the protrusion is further reduced in diameter and increased in axial extent and thereby forming the protrusion into a rivet having a body and an integral closed end with the thickness of the metal of the rivet being substantially the same as that of the container panel and the formed rivet being of an axial extent materially greater than the thickness of the pull tab; positioning the pull tab on the rivet in telescoped relation with the rivet extending through and beyond the pull tab; and then staking the rivet and thereby reversely folding that portion of the rivet body extending beyond the pull tab to form a laterally extend-

ing outer bead clamping the pull tab to the removable panel portion.

9. The method of claim 8 wherein the forming steps performed on the protrusion to shape the protrusion into the rivet reduce the height of the protrusion with the height of the rivet being less than that of the protrusion.

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