United States Patent [19]

Franek et al.

[11] **3,730,381**

[45] **May 1, 1973**

[54] **CAN END OPENING MEANS**

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[73] Assignee: **The Metal Box Company Limited,** London, England

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[21] Appl. No.: **229,849**

[30] **Foreign Application Priority Data**

Mar. 2, 1971 Great Britain.....5,773/71

[52] **U.S. Cl.**.....**220/54,** 220/27

[51] **Int. Cl.**.....**B65d 17/24**

[58] **Field of Search**.....220/54, 27, 48

[56] **References Cited**

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Primary Examiner—George T. Hall

Attorney—Charles E. Brown et al.

[57] **ABSTRACT**

In a can end comprising an end closure member having a line of weakening which defines a removable panel and which carries a pull tab for removal of the panel, the pull tab is a rigid member attached rigidly to the removable panel. The can is opened by rocking the pull tab back and forth so as to deform the material of the panel adjacent to the pull tab and partly bonded by a portion of the line of weakening. This causes strain reversal and consequent fatigue failure in the said portion of the line of weakening.

8 Claims, 16 Drawing Figures

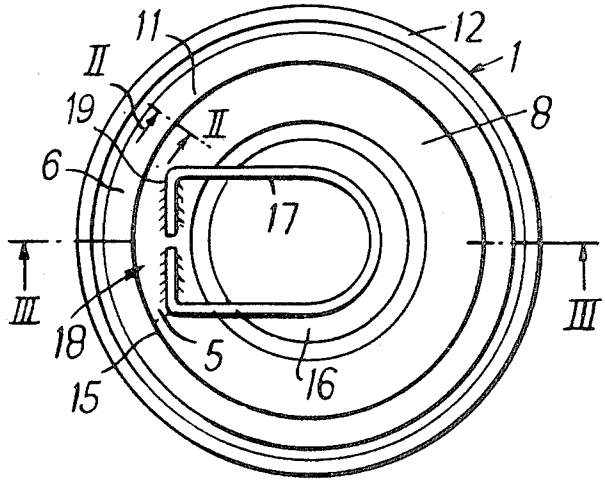


FIG. 1

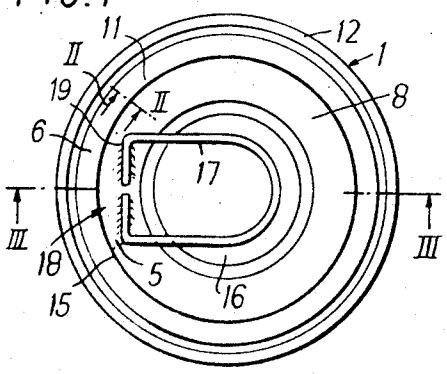


FIG. 2

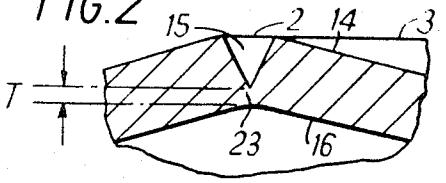


FIG. 3

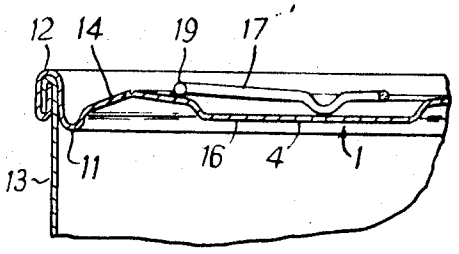


FIG. 4

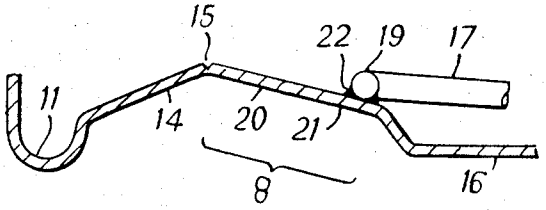


FIG. 5

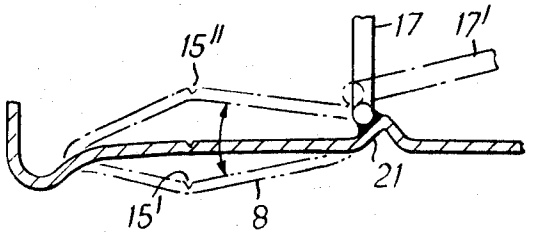


FIG. 6

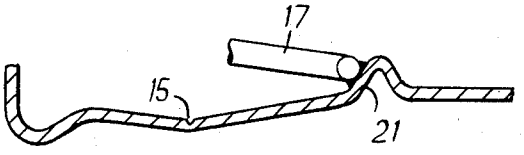


FIG. 7

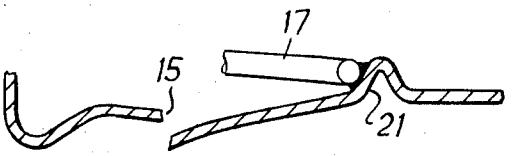


FIG. 8a

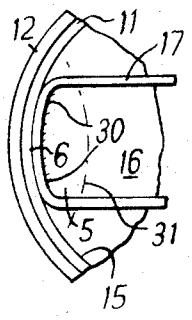


FIG. 8b

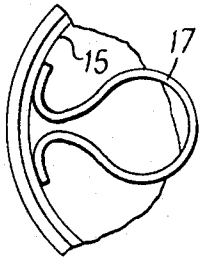


FIG. 8c

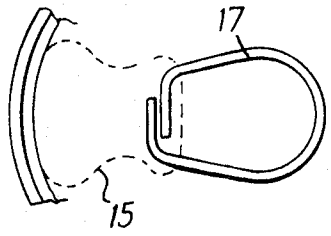


FIG. 9

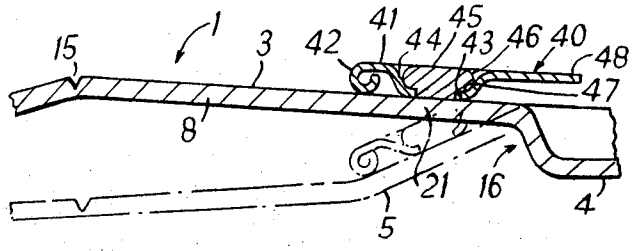


FIG. 10

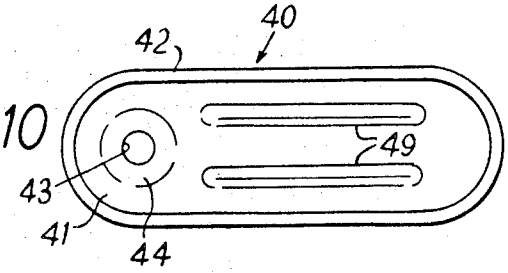


FIG. 12

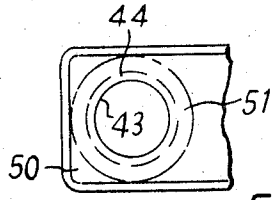


FIG. 11

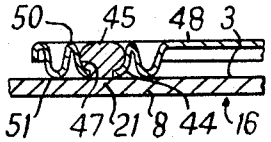


FIG. 13

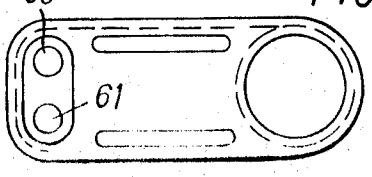
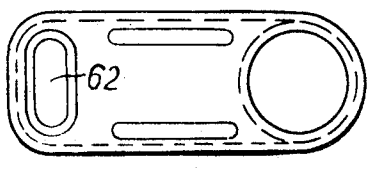


FIG. 14



CAN END OPENING MEANS

BACKGROUND OF THE INVENTION

This invention relates to can ends of the kind comprising an end closure member, having a line of weakening defining a removable panel, a pull tab, adapted to be moved so as to fracture the line of weakening, being disposed so as to overlie the removable panel and joined thereto; and to cans incorporating such a can end.

It is well known to provide such a can end in which the end closure member is of metal and the pull tab has a nose, pointed or otherwise, which bears down on the line of weakening to fracture the adjacent portion of the line of weakening when the tab is initially lifted. In such can ends the line of weakening must be so arranged that the so-called "residual" thickness (the thickness of the material which constitutes the line of weakening) shall be sufficiently small to fracture easily in a single movement of the pull tab without undue effort on the part of the user. On the other hand the residual thickness should be as great as possible because the line of weakening is inherently a weakness in the can end; and the smaller the value of the residual thickness, the greater is the danger of accidental fracture during handling or storage. It is not possible to obtain satisfactory consistency of residual thickness when this thickness is below a certain critical value, and it is therefore necessary to keep the residual thickness above the critical value to minimize the likelihood of a normal distribution falling below this critical value. Again, if the thickness is as low as the critical value, special steps may have to be taken, for example by applying a protective lacquer after the line of weakening has been formed, to protect it from the excessive corrosion which is found to occur in many cases. A further disadvantage is that such a thin line of weakening often gives rise to a dangerously sharp edge after the can has been opened.

The actual value of the critical thickness depends on the material being used, among other factors: for tinplate, for example, it may be typically about 0.05 mm.

The actual value of the maximum practicable residual thickness will depend on a number of factors, among them the mechanical advantage provided by the tab. The residual thickness is limited accordingly.

SUMMARY OF THE INVENTION

According to the present invention, a can end comprises an end closure member having a line of weakening defining a removable panel, and a substantially rigid pull tab at least partially overlying the removable panel, the pull tab having an anchor portion joined sufficiently rigidly, at a junction adjacent to a portion of the line of weakening, to a zone of the removable panel extending from said portion of the line of weakening and including said junction, so that when the pull tab is rocked back and forth with respect to the line of weakening, said zone of the removable panel is thereby deformed whereby to strain, and consequently rupture residual material in at least said portion of the line of weakening.

The invention thus provides a means whereby the line of weakening is initially fractured by local flexure of the material in said weakening line resulting from the tab movements mentioned above. Consequently, the residual thickness can be made greater than would be necessary if rupture were to be achieved by a single movement of the pull tab exerting a direct leverage through the said pull tab to pierce the line of weakening.

The end closure member is preferably of metal, but may for example be of plastics material.

The pull tab is preferably a separate member secured at said junction to the said zone of the removable panel. In a preferred form of the invention the said anchor portion of the pull tab is in a generally sheet-like form.

Preferably, the said anchor portion of the pull tab has a hole or holes formed through a portion thereof projecting towards the removable panel, the anchor portion being secured to the removable panel by a plug or plugs of bonding material cohering to said zone of the removable panel and projecting through the hole or holes in the anchor portion, the plug or plugs each having a portion which substantially overlaps the periphery of the hole to overlie a zone, encircling the hole, of an outer surface of the anchor portion in such a manner as to secure the pull tab rigidly to the removable panel. Where the end closure member is of metal, the anchor portion of the pull tab, at least in the said zone thereof encircling the hole, is preferably such as not to be readily bonded to said bonding material. In this case the bonding material is preferably solder, but it may for example be a suitable cement such as a cold setting or thermosetting resin. If the actual material of the pull tab is not such as to resist bonding to the bonding material (and if such resistance is required) the pull tab, or its outer surface, or merely the said zone encircling the hole, may be coated with a material having resistance to bonding with the bonding material. For example, a metal pull tab may be coated with a suitable plastics material.

In respect of the joining of two sheets together by means of a solder plug engaging through a hole in one of the sheets, we are aware of British Pat. application No.5055/70, claiming priority from a patent application filed in Denmark on Feb. 18 1969.

The pull tab must be substantially rigid in order that it may effectively, when rocked back and forth, transmit the resulting reversing forces to the junction between the pull tab and the end closure member. Similarly the junction itself must be rigid, that is to say it must be such that the lifting and subsequent rocking of the pull tab must not cause any significant relative movement between the anchor portion of the pull tab and the zone of the removable panel to which the anchor portion is immediately attached. This is because, in order to set up strain reversals in the line of weakening efficiently, the movement of the pull tab must be accompanied by consequential deformation of the can end panel adjacent the part of the line of weakening to be initially fractured.

The pull tab may be formed integrally with the end closure member, especially if the latter is of plastics material. It will be realized that a suitably stiff material must be chosen.

The pull tab may comprise a finger ring portion attached rigidly to, or integral with, the anchor portion of the pull tab. For example, the pull tab may consist of a wire ring or loop, which may be formed from a length of wire bent so that two end portions thereof form the

anchor portion of the pull tab and said end portions may substantially abut each other endwise.

If the pull tab is a separate member it may be attached rigidly to the end closure member by any suitable means. One such means has been described hereinbefore. Examples of alternatives include rivetting by means of a separate rivet or rivets engaging through a hole or holes in the pull tab anchor portion and sealingly through a hole or holes in the removable panel; a rivet or rivets integral with the removable panel and deformed or upset over the outer surface of the pull tab after the latter has been positioned with the rivet or rivets extending through a hole or holes in the anchor portion of the pull tab; and bonding the pull tab directly to the removable panel. It will be understood that any one of these means of attachment may be employed whether the end closure member or the pull tab, or both, be of metal or plastics. For example, where at least those surfaces of the said zone of the removable panel, and of the anchor portion of the pull tab, to be bonded together are both of metal or both of plastics, they may be bonded together by welding or cementing. Where both said surfaces are of plastics, flame welding may for example be employed. If, on the other hand, both surfaces are of metal, they may be soldered or brazed together. If one of said surfaces is of plastics and the other of metal, they may be cemented together by means of a suitable cement.

In the can ends of the present invention, it will be understood that the primary cause of initial fracture of the line of weakening is flexure of the material in said line of weakening resulting from rocking the pull tab back and forth: and not the exertion of a direct force by the pull tab on the line of weakening to pierce or cut it as in known forms of can end in which the pull tab incorporates a sharp or blunt nose portion arranged to engage the line of weakening and to exert such direct force thereon. While it is not normally necessary to provide such a nose portion on the pull tab of can ends according to this invention, it may in some cases be desired to provide such a nose portion to exert a direct force on the line of weakening, as a secondary cause only of initial fracture of the line of weakening. Such a nose portion, if provided, will be arranged so that it applies the said force to the line of weakening only when the pull tab is at or approximately at the appropriate limit of its rocking motion, so as to reinforce the applied strain on the line of weakening at that limit and so not to hinder the freedom of the tab to be rocked back and forth before the line of weakening is initially fractured.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

FIG. **1** is a plan view of a can end in one form according to the invention;

FIG. **2** is a greatly enlarged scrap section on the line II—II in FIG. **1**;

FIG. **3** is an enlarged sectional elevation taken along line III—III in FIG. **1**;

FIG. **4** is another sectional elevation taken along the line III—III, but on a larger scale than FIG. **3**;

FIGS. **5**, **6** and **7** are views corresponding to FIG. **4** but showing steps in the opening of the same can end;

FIGS. **8***a*, **8***b*, and **8***c* are scrap plan views showing other versions of the same embodiment.

FIG. **9** is a sectional elevation through part of a can end in another form according to the invention;

FIG. **10** is an inverted plan view of one form of pull tab for use in a can end of the kind shown in FIG. **9**;

FIG. **11** is a sectional elevation through part of a can end in yet another form according to the invention;

FIG. **12** is an inverted plan view of the anchor portion of a pull tab forming part of the can end shown in FIG. **11**; and

FIGS. **13** and **14** are plan views of pull tabs with finger loops and different attachment systems.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **1** to **7**, the can end illustrated therein comprises a metal end closure member **1** having a line of weakening **15** comprising a conventional score **2**, FIG. **2**, (shown here by way of example as being of substantially a V section) extending part-way through the thickness of the metal from the outer or top surface **3** thereof to a depth such as to leave residual material indicated at **23**. Where the end closure member **1** is of tinplate, the thickness T of the residual **23** is substantially greater than 0.05 mm, and is preferably in the range 0.075 – 0.1 mm. for food can ends of approximately 50 to 80 mm. diameter.

The end closure member **1** comprises a conventional peripheral seaming flange **12** joined by a peripheral channel to a coaxial ridge or bead **14** which merges with a flat central panel portion **4** of the member **1**. The line of weakening **15** is formed along the top of the bead **14**. The seaming flange **12** is arranged to be seamed conventionally to one end of a can body **13**, FIG. **3**. The line of weakening **15** defines a removable panel **16** which consists of the material of the member **1** encircled by the line **15**. The removable panel **16** includes a circular portion **8** of the bead **14**, extending radially inwards from the line of weakening **15**.

Overlying the removable panel **16** is a pull tab **17** which has an anchor portion **18**, joined rigidly as indicated at **22** by soldering, brazing, welding, or by cementing using a suitable cement such as a cold setting or thermosetting resin, directly to a zone, indicated approximately by chain-dotted lines at **5** in FIG. **1** of the removable panel **16**. The zone **5** is part of the bead portion **8** extending radially inwards from the adjacent portion **6** of the line of weakening and including the junction portion **21** of the bead portion **8** to which the anchor portion **18** of the pull tab is secured. The junction **21** is adjacent the line of weakening, but in this example it is separated therefrom by a relatively narrow element **20** of the zone **5**.

The pull tab **17** is a wire ring or loop, formed from a length of wire bent so that two end portions **19** thereof substantially abut each other endwise as seen in FIG. **1**, so as to form the anchor portion **18** of the pull tab.

Initially the pull tab **17** lies close to the removable panel **16** as shown in FIGS. **1**, **3** and **4**. To open the can end, the pull tab **17** is first lifted to approximately the vertical position shown in full lines in FIG. **5**. This causes corresponding movement of the junction portion **21** to which the pull tab is rigidly attached, thus deforming the zone **5** of the removable panel **16** to draw the element **20** and the line of weakening **15**

downwards, at once imposing a strain on the residual material 23 on the portion 6 of the line 15 adjacent the zone 5. The pull tab 17 is now rocked back and forth about the anchor portion 18. First it is rocked to the position shown in FIG. 6, in which further deformation of the panel zone 5 depresses the line of weakening 15 further. This new position of the line 15, shown in FIG. 6, is also indicated at 15' in FIG. 5. The pull tab is then rocked back to the position shown at 17' in FIG. 5, and this raises the line 15 to the position indicated at 15''.

It can be seen that this rocking action of the pull tab 17, and consequent deformation of the zone 5, sets up severe strain reversal in the residual material 23 in the adjacent portion 6 of the line of weakening, so that this material 23 in the portion 6 finally ruptures, as indicated in FIG. 7, resulting from these strain reversals, in the score residual 23.

The pull tab 17 can then be returned to the upright position shown in FIG. 5 and pulled upwards to tear the remainder of the line of weakening 15 and allow the panel 16 to be removed.

Tests on some can ends of the kind shown in FIGS. 1 to 7 have shown that initial fracture of the line of weakening usually occurs after the pull tab has been rocked to its FIG. 6 position two or three or more times, depending on the materials used and the design of the tab, the end and the attachment.

In the can end shown in FIG. 8*a*, the only modification is that the end portions 30 of the pull tab are curved to conform with the shape of the line of weakening 15 and are welded, soldered, brazed or cemented along the inner edge of the line 15. Strain reversal in the line of weakening is thus set up in this case as a direct result of the deformation of the junction portion to which the pull tab is rigidly attached, when the pull tab is rocked back and forth, the zone 5 which is deformed by movement of the pull tab extending in practice radially inwards to a hinge line indicated approximately at 31.

FIG. 8*b* shows a tab which performs in a manner similar to that shown in FIGS. 1 to 7, but with the ends not abutting.

FIG. 8*c* shows a tab which extends beyond the removable panel 16.

Referring now to FIG. 9, there is shown therein part of a can end comprising an end closure member 1, which in this example is as described hereinbefore with reference to FIG. 1, and a pull tab 40 overlying the removable panel 16. The pull tab 40 is made substantially rigid and has an anchor portion 41 joined rigidly at the junction portion 21 of the removable panel to the zone 5 thereof.

The anchor portion 41 of the pull tab is in generally sheet-like form, reinforced by being curled at the edge as indicated at 42, and has a hole 43 formed through a cup-like portion 44 projecting towards the removable panel 16. The anchor portion 41 is secured to the panel 16 by a plug 45 of bonding material, preferably solder, where the end closure member 1 is of metal, cohering to the outer surface 3 of the zone 5 of the removable panel at the junction portion 21. The plug 45 projects through the hole 43 and has a portion 46 which substantially overlaps the periphery of the hole to form a rivet head overlying a zone 47, encircling the hole 43, of the outer surface 48 of the anchor portion 41. In this way the pull tab 40 is rigidly secured to the removable panel 16.

The anchor portion 41, at least in the zone 47, is preferably such as not to be readily bonded to the material of the plug 45. Thus if for example, the plug 45 is of solder and the pull tab 40 of solderable metal, the outer surface 48 of the pull tab may be coated with a lacquer or other suitable agent to prevent cohesion between the plug 45 and the zone 47 which it engages.

The pull tab 40 can conveniently be fixed to the end closure member 1 by a method such as that described in the aforementioned application No.5055/70; in such a method the pull tab is placed in position on the member 1 with the hole 43 overlying the junction portion 21, and drops of liquid solder are fed downwards into the hole 43 to adhere to the portion of the surface 3 below it. If the zone 47 of the pull tab outer surface is rendered resistant, as discussed above, to adherence with the solder, the solder forms a globule within the cup-like projection 44. This globule hardens on cooling to form the rivet head portion 46.

If the zone 47 is adherable to the solder then the solder within the cup-like projection 44 will tend to spread so as to fill or substantially fill it and become bonded to the zone 47.

The plug 45 may alternatively be for example of a suitable cement such as a cold setting or thermosetting resin.

In opening the can, the pull tab 40 is lifted and rocked back and forth generally as described hereinbefore with reference to FIGS. 1 to 7. One position of the pull tab, during the rocking, and a typical corresponding configuration of the zone 5 of the end closure member, are indicated by chain-dotted lines in FIG. 9.

FIG. 10 shows one possible form of the pull tab 3, comprising a sheet-like member reinforced by the curve 42 extending around its entire periphery, and by longitudinal ribs 49. The pull tab may however take any suitable form for use with an arrangement such as that shown in FIG. 9. For example it may be formed from sheet material, or moulded in plastics material, with a finger ring in known manner, the anchor portion being in generally sheet-like form as described and the pull tab being substantially rigid.

Referring now to FIGS. 11 and 12, there is shown therein one of many possible modifications to the arrangement described with reference to FIG. 9. In FIGS. 11 and 12 the sheet-like portion 50 of the pull tab again has a cup-shaped projection 44 provided with the hole 43, but a reinforcing ring portion 51, preferably engaging the outer surface 3 of the end closure member to give added rigidity between the pull tab and the removable panel 16, is provided encircling the projection 44 and providing additional rigidity to the anchor portion 50.

Referring to FIGS. 13 and 14 there are shown therein other of the many possible variations, including two attachment points, 60 and 61, on one tab and a non-round attachment point 62 on a tab, respectively.

It will be understood that the end closure member may be of any form which can be provided with a line of weakness defining a removable panel and in which a pull tab can be attached to or incorporated in the removable panel so as to function according to the present invention. The form of end closure member

having the bead 14 is described herein by way of example only: the end closure member may for instance, in one other suitable arrangement, simply comprise the seaming flange 12 and channel 11, the area surrounded by the channel 11 being flat.

We claim:

1. A can end comprising an end closure member having a line of weakening defining a removable panel, and a substantially rigid pull tab at least partially overlying the removable panel, the pull tab having an anchor portion joined sufficiently rigidly, at a junction adjacent to a portion of the line of weakening, to a zone of the removable panel extending from said portion of the line of weakening and including said junction, so that when the pull tab is rocked back and forth with respect to the line of weakening, said zone of the removable panel is thereby deformed whereby to strain, and consequently rupture residual material in at least said portion of the line of weakening.

2. A can end as claimed in claim 1, wherein the end closure member is of metal.

3. A can end as claimed in claim 1, wherein the pull tab is a separate member secured at said junction to the said zone of the removable panel.

4. A can end as claimed in claim 3, wherein the said anchor portion of the pull tab is in a generally sheet-like form.

5. A can end as claimed in claim 4, wherein the said anchor portion of the pull tab has at least one hole formed through a portion thereof projecting towards the removable panel, the anchor portion being secured to the removable panel by at least one plug of bonding material cohering to said zone of the removable panel and projecting through the at least one hole in the anchor portion, the at least one plug having a portion which substantially overlaps the periphery of the hole to overlie a zone, encircling the hole, of an outer surface of the anchor portion in such a manner as to secure the pull tab rigidly to the removable panel.

6. A can end as claimed in claim 5 in which the end closure is of metal, wherein said zone of the pull tab anchor portion encircling said hole is resistant to bonding to said bonding material.

7. A can end as claimed in claim 6, wherein said bonding material is solder.

8. A can end as claimed in claim 3, wherein the anchor portion of the pull tab is bonded directly to said zone of the removable panel by a material selected from weld material, solder, braze metal and cement.

* * * * *