

Easy Open Closure

TECHNICAL FIELD

5 The invention relates to an easy-open closure with improved abuse resistance and opening performance and, in particular to an easy-open can end. The can end is typically of the “full aperture opening” type, in which the end has a circumferential score which enables a generally circular panel of the end to be removed and thereby give full access to a product within the can body to which the can end is fixed.

10 BACKGROUND

Easy-open metal closures, and in particular easy-open can ends, are known to comprise a metal panel, defined by a score (i.e. a line where the metal is of reduced thickness), which when broken allows the panel to be removed. The panel is removed
15 by the use of a tab, whose main features are a strong front end and a ring, and which is attached to the panel by a rivet. The ring is lifted, levering the strong front end into the score, thereby initiating a tear in the score. The ring is then pulled to complete the removal of the panel, thereby opening the can without the need for a can opener. Easy-open can ends can be made of steel or aluminium and come in a variety of shapes
20 including round, rectangular and oval. They are typically used in food or beverage cans.

Easy-open can ends have a number of functional requirements to fulfil. They must provide long-term, high-integrity seals capable of resisting internal and external
25 pressures, and capable of resisting a wide range of temperatures which may be applied during can sterilisation/pasteurisation and cooling processes. They must be resistant to abuse occasioned by can-handling systems used in can mass-production and distribution. They must also be easy to open by the end consumer. An effect that may occur during processing, handling and storage of filled metal cans is increased
30 internal pressure which can give rise to so-called “peaking” which may deform the can end, possibly even causing accidental fracturing along the score.

Each of the functional requirements of the easy-open can end must be balanced against the others. For example, whilst increasing the thickness of the can end and
35 score may improve the can end integrity and ability to resist pressure, it comes at the

cost of being more difficult to open; defeating the purpose of being an easy-open can end. An alternative to increasing thickness is to introduce “furrows”, also known as beads, into the can end to provide additional strength whilst minimising the metal thickness requirement. These beads are elongate beads.

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One issue faced by can manufacturers and designers is that even small changes in can design may have significant cost consequences when scaled up to the high-volume mass production that takes place in can manufacturing plants. A small increase in metal used per can may increase the total production cost significantly when scaled to production rates in the hundreds of thousands or more cans per day. Another issue faced by can manufacturers and designers is that design changes may require production lines to be stopped while new machines are fitted, tested and calibrated before production can resume. Time during which production is “offline” may significantly increase costs. Another problem that arises from changes in design is that each of the features is highly dependent on the others. Varying the size, position, shape and/or thickness of one feature can result in other features no longer functioning as intended. For example, a feature in one position intended to provide strength to the can end may weaken the can end if moved to another position. As a result, even small design changes may require a redesign of the entire can end and/or recalibration of the machines and tools on a production line to ensure consistent production to within accepted dimension error margins.

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A plan view of a known easy-open can end is shown in Figure 1. The can end includes a series of terraces 101, a circumferential score 102, a seaming panel 103, and wing shaped beads 104 adjacent a rivet 105. The can end of the type shown in Figure 1 has a specific chord length along which the panel folds when the tab 106 is raised for opening. This chord is illustrated by the broken line 109. The can end design of Figure 1 may achieve improved pressure performance by including a bead 107 that extends around the entire circumference of the closure, and which passes between the score 102 and the nose portion 108 of the tab 106. The bead 107, and its location close to and parallel with the score 102, strengthens the closure in the region of the score 102, tending to prevent unintended fracturing of the score.

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The can end of the type shown in Figure 1 has a number of disadvantages. Whilst it does achieve a satisfactory pressure performance, its opening performance is not

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satisfactory primarily due to the short length of the chord 109 between the two points where it intersects with the score 102 which tends to prevent an initial fracture of the score, induced when the tab is raised, from propagating around the score to a sufficient extent.

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A solution to this problem is to terminate the bead 107 on each side of the tab 106, i.e. to provide a break in the bead 107 in the region behind the tab. However, it has been found that merely terminating the bead 107 results in an increased risk of peaking along the score line in the region of the break. A further solution to this problem, proposed in EP1577222, is to maintain the bead 107 as shown in Figure 1 but also to introduce an additional pair of relatively short beads on either side of the rivet. The additional beads provide a fold line about which the closure tends to fold when the tab is raised, counteracting the strengthening effect of the bead 107 and ensuring the can remains easy to open.

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An important feature of can ends is their ability to resist abuse during transport and stacking. A particular problem in this regard is the possibility that when a filled can is stacked on top of another filled can, e.g. during transport, the base of the upper can pushes down on the tab of the lower can causing the score on the lower can to fracture in some instances. This problem can also arise more generally in other contexts where a force pushes down on the tab (e.g. accidentally by an end consumer). With particular reference to Figure 1, downwards pressure on the nose portion 108 of the tab 106 may cause an unintentional initial fracturing of the score 102. A known solution to this problem is to form a pair of downwardly projecting points or nibs on either side of the tab which project slightly further than the point of the tab nose. These additional points typically make contact with the surface of the can end and, in the event of impact e.g. due to stacking, prevent the nose from coming into contact with the surface. When the handle of the tab is raised to open the can however, the tab tends to pivot about these points allowing the nose to impact and fracture the score. It is possible to achieve a similar effect by providing a pair of raised dimples or so-called "pips" on the can end, under and intended to be in contact with the tab. Whilst pips may prevent the tab nose from coming into contact with the surface, they introduce weakness into the surface of the can end and therefore reduce the can end's pressure resistance.

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SUMMARY

5 According to a first aspect of the invention there is provided a metal closure for
seaming onto the end of a container, the closure comprising a centre panel defined by
a circumferential score, a tab fixed to the panel by a rivet formed in the panel. The tab
has a heel portion radially inside of the rivet and a nose portion radially outside of the
rivet and adjacent to a radially inner edge of the score, such that lifting of the heel
10 portion forces the nose portion into contact with a region of the panel adjacent to the
radially inner edge of the circumferential score, thereby causing the closure to fracture
partially along the score. The closure comprises two spaced apart, elongate raised
beads formed in the panel, extending with a circumferential component of direction,
and each having an end terminating under the tab radially between the rivet and the
score to allow the tab to pivot about the two raised beads.

15 According to an embodiment, the two raised beads may be substantially parallel to the
circumferential score.

20 According to an embodiment, each of the ends terminating under the tab may
terminate at an angular extent of between 5 degrees and 15 degrees, or preferably
between 7 degrees and 13 degrees, from a line defined between the geometric centre
of the rivet and the geometric centre of the centre panel.

25 According to an embodiment, each of the two raised beads may have an angular
extent of between 25 degrees and 35 degrees, or between 15 degrees and 25
degrees, or between 5 degrees and 15 degrees.

30 According to an embodiment, there is provided a circumferentially extending
strengthening bead in the panel, adjacent to and substantially parallel to the
circumferential score.

35 According to an embodiment, the regions between the circumferential strengthening
bead and the two raised beads may slope substantially continuously with respect to the
plane of the centre panel.

According to an embodiment, each of the ends terminating under the tab may terminate in a region radially between the rivet and the circumferential strengthening bead.

- 5 According to an embodiment, one or more terracing features formed in the centre panel is provided.

According to an embodiment, a circumferential countersink and chuck wall radially outside of the score is provided.

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According to a second aspect of the invention, a container is provided comprising a container body and a metal closure according to the first aspect of the invention. The closure is seamed onto the container body.

15 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a plan view of a prior art easy-open closure.

Figure 2 shows an isometric view of an easy-open closure according to an embodiment.

- 20 Figure 3 shows a plan view of the easy-open closure of Figure 2.

Figure 4a shows a section view of the easy-open closure of Figure 2 through the line A-A in Figure 3.

Figure 4b shows an isolated cross-section view taken from Figure 4a.

- 25 Figure 5a shows a section view of the easy-open closure of Figure 2 through the line B-B in Figure 3.

Figure 5b shows an isolated cross-section view taken from Figure 5a.

Figure 6 shows an isometric view of a can onto which the easy-open closure of Figure 2 has been seamed.

30 DETAILED DESCRIPTION

With reference to Figure 1, the problems associated with known can closures have been discussed above. In particular, a need has been identified for a can closure that has both satisfactory abuse resistance and satisfactory opening performance, whilst

retaining satisfactory pressure performance. Such a can closure will now be described with reference to Figures 2 to 5.

Figures 2 and 3 respectively show an isometric view and a plan view of an improved can closure, indicated generally as 201. The can closure 201 includes a number of conventional features including:

- A panel 202.
- A circumferential score 203 that is fractured to open the can closure which extends around the panel 202.
- A shaped circumference 204 suitable for seaming onto a can.
- A tab 205 riveted to the can closure with rivet 206. The tab has a nose portion 207.
- Panel steps 210 which give rise to a terracing profile across the diameter of the can closure, such that the region in which the tab 205 is riveted to the closure is raised with respect to a finger receiving region 211. These panel steps 210 also improve pressure and opening performance.
- A chuck wall 212.
- A circumferential strengthening bead 209 inside the score 203 following the line of the inner edge of the score 203 around the closure in so far as it is adjacent to and parallel with the score 203.

In order to provide a satisfactory pressure performance and abuse resistance, two spaced apart, elongate raised radial beads 208 are provided inside the score 203, terminating under the nose end of the tab 205 but not extending so far as to underlie the nose portion 207. Unlike “furrowed” beads which dip into the surface of the panel 202, the two raised radial beads 208 are ridge-like in appearance, protruding above the surface of the panel 202, and are situated radially on the inside of and in proximity to the circumferential strengthening bead 209. The two raised radial beads 208 are substantially parallel to the circumferential strengthening bead 209.

The ends of the strengthening beads which are located under the tab are located at an angle, measured with respect to a line A-A defined between the geometric centre of the rivet and the geometric centre of the closure (see Figure 3), of between 5 and 15 degrees, more preferably between 7 and 13 degrees, and more preferably still of

substantially 10 degrees. Each of the beads extends over an angle of 30 degrees or less, optionally 20 degrees or less, or optionally 15 degrees or less. In a particularly preferred embodiment, each bead extends from 10 degrees to 40 degrees measured with respect to the line A-A.

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As is apparent in Figure 3, both the panel and the tab have reflection symmetry about line A-A. When opening a can closure in accordance with its envisaged normal use, the symmetry of the tab is approximately aligned with that of the panel as this ensures the nose portion 207 is in an optimal position to fracture the score 203 when the tab 205 is lifted. Whilst it may be possible to force the can closure open without such an alignment, doing so would be difficult as the nose portion 207 would no longer be aligned in an optimal position with the score 203. This would defeat the purpose of the can closure being "easy-open". Thus, whilst in some instances the tab may rotate about the rivet outside of normal use (e.g. in storage, in transit, or during other abuse), the symmetry of the tab is intended to be re-aligned with that of the can-closure prior to normal use.

The two raised radial beads 208 are formed in the panel and terminating under the nose end of the tab 205. When downward pressure is exerted on the nose portion 207 (e.g. caused by can stacking), the pressure may cause the nose end of the tab 205 to come into contact with the two raised radial beads 208. The pressure is thereby transferred through the nose end of the tab 205 and onto the two raised radial beads 208 which provide support against the downward pressure. In this way, the two raised radial beads 208 prevent the nose portion 207 (situated above the gap between the ends of the two raised radial beads 208) from accidentally contacting and fracturing the score 203 when the closure is subject to abuse from e.g. stacking. This functionality is similar to a pip. However, unlike with pips which create weakness in the panel 202 and which are not elongate, the two raised radial beads 208 strengthen the panel 202 by providing additional resistance against internal and external pressures. When the handle of the tab 205 is raised to open the can, the tab 205 tends to pivot about the two raised radial beads 208 allowing the nose portion 207 to impact and fracture the score 203. The two raised radial beads 208 therefore provide the functionality of a pip whilst simultaneously improving closure strength.

The two raised radial beads 208 additionally assist in maintaining satisfactory “ease of opening” performance by providing a suitable lever point about which the nose portion 207 can be levered during opening. The closer the lever point is to the score 203, 303, the less force is required when handle of the tab 205 is raised.

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By providing support to the tab 205, the two raised radial beads 208 additionally prevent the nose portion 207 from accidentally contacting other surfaces of the closure, thereby countering the risk of nose breakage.

10 Figures 4a and 4b respectively show a section view of the improved easy-open closure, indicated generally by reference numeral 201, through the line A-A in Figure 3, and an isolated cross-section view of the profile through line A-A. As noted above, whilst the two raised radial beads (not shown in Figures 4a and 4b) extend at least partially under the nose end of the tab 205, they do not extend so far as to underlie the
15 nose portion 207. Thus, as is apparent in Figures 4a and 4b, there is a direct path for the nose portion 207 to take to contact and fracture the score 203 when the handle of the tab 205 is raised sufficiently to pivot around the two raised radial beads. Figures 4a and 4b also illustrate that the circumferential strengthening bead 209 is situated inside of and adjacent to the score 203 but outside of the rivet 206.

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Figures 5a and 5b respectively show a section view of the improved easy-open closure, indicated generally by reference numeral 201, through the line B-B in Figure 3, and an isolated cross-section view of the profile through line B-B. One of the two raised radial beads 208 is shown in contact with and supporting the nose end of the tab 205. If
25 downward pressure is applied to the tab (e.g. from can stacking), the raised radial beads 208 provide support against that pressure. When the handle of the tab 205 is raised sufficiently to pivot around the raised radial beads 208, the can is opened in the usual way. It is also apparent from Figures 5a and 5b that the raised radial beads 208 are not only parallel to but also coincide with the circumferential strengthening bead 209 in that the regions between the circumferential strengthening bead 209 and the two
30 raised beads 208 slope continuously with respect to the plane of the centre panel 202. In other words, the circumferential strengthening bead 209 is positioned radially close enough to the two raised beads 208 such that the slopes 214 between the lowest part of the strengthening bead 209 and the highest parts of the raised beads 208 are
35 continuous.

Figure 6 shows an isometric view of a can 213 onto which the easy-open closure 201 has been seamed.

- 5 It will be appreciated by the person skilled in the art that various modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, the size of the two raised radial beads 208 shown in Figures 2-5 are optimised and sized for the purpose of that design but may be increased to improve light weighting or alternatively decreased in size in response to
- 10 other design considerations. Additionally, the shape of the can 213 in Figure 6 is illustrative only and other shaped cans (e.g. shorter/taller, narrower/wider, and/or non-circular shapes such as rectangular) are also envisaged. Whilst the arc ranges of the raised radial beads 208 above are such that the extreme ends of the beads do not meet, it is also envisaged that the arc of each bead may extend around the
- 15 circumference of the closure such that they join each other at the opposite side of the closure to the nose end of the tab 205. The angles given above are whole numbers but deviations from these within accepted margins are also envisaged.

CLAIMS:

1. A metal closure for seaming onto the end of a container, the closure comprising:
 - 5 a centre panel defined by a circumferential score;
a tab fixed to the panel by a rivet formed in the panel, the tab having a heel portion radially inside of the rivet and a nose portion radially outside of the rivet and adjacent to a radially inner edge of the score, such that lifting of the heel portion forces the nose portion into contact with a region of the panel adjacent to the radially inner edge of the circumferential score, thereby causing the closure to fracture partially along the score; and
two spaced apart, elongate raised beads formed in the panel, extending with a circumferential component of direction, and each having an end terminating under the tab radially between the rivet and the score to allow the tab to pivot about the two raised beads.
2. A closure according to claim 1, wherein the two raised beads are substantially parallel to the circumferential score.
- 20 3. A closure according to claims 1 or 2, wherein each said end of the two raised beads terminating under the tab terminates at an angular distance of between 5 degrees and 15 degrees, or preferably between 7 degrees and 13 degrees, from a line A-A defined between the geometric centre of the rivet and the geometric centre of the centre panel.
- 25 4. A closure according to any one of the preceding claims, wherein each of the two raised beads has a circumferential angular extent from beginning to end of between 25 degrees and 35 degrees, or between 15 degrees and 25 degrees, or between 5 degrees and 15 degrees.
- 30 5. A closure according to any one of the preceding claims and comprising a circumferentially extending strengthening bead in the panel, adjacent to and substantially parallel to the circumferential score.

6. A closure according to claim 5, wherein the regions between the circumferential strengthening bead and the two raised beads slope substantially continuously with respect to the plane of the centre panel.
- 5 7. A closure according to claims 5 or 6, wherein each said end of the two raised beads terminates in a region radially between the rivet and the circumferential strengthening bead.
8. A closure according to any one of the preceding claims and comprising one or
10 more terracing features formed in the centre panel.
9. A closure according to any one of the preceding claims and comprising a circumferential countersink and chuck wall radially outside of the score.
- 15 10. A container comprising a container body and a metal closure according to any one of claims 1 to 9 seamed onto the container body.