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(54) BEVERAGE CAN ENDS SUITABLE FOR SMALL DIAMETERS

(57) A beverage can end (14,14a) and container (12) have a removable panel (32a) that is actuated by a tab (44a). The tab is smaller than conventional full aperture ends but enables opening because of the lower pull force required smaller ends or scores (30a) formed in less malleable allows that conventional food can ends (14,14a). A stay-on-tab is also provided.

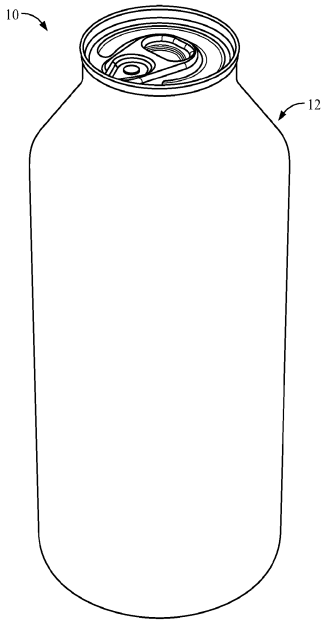

FIG. 2

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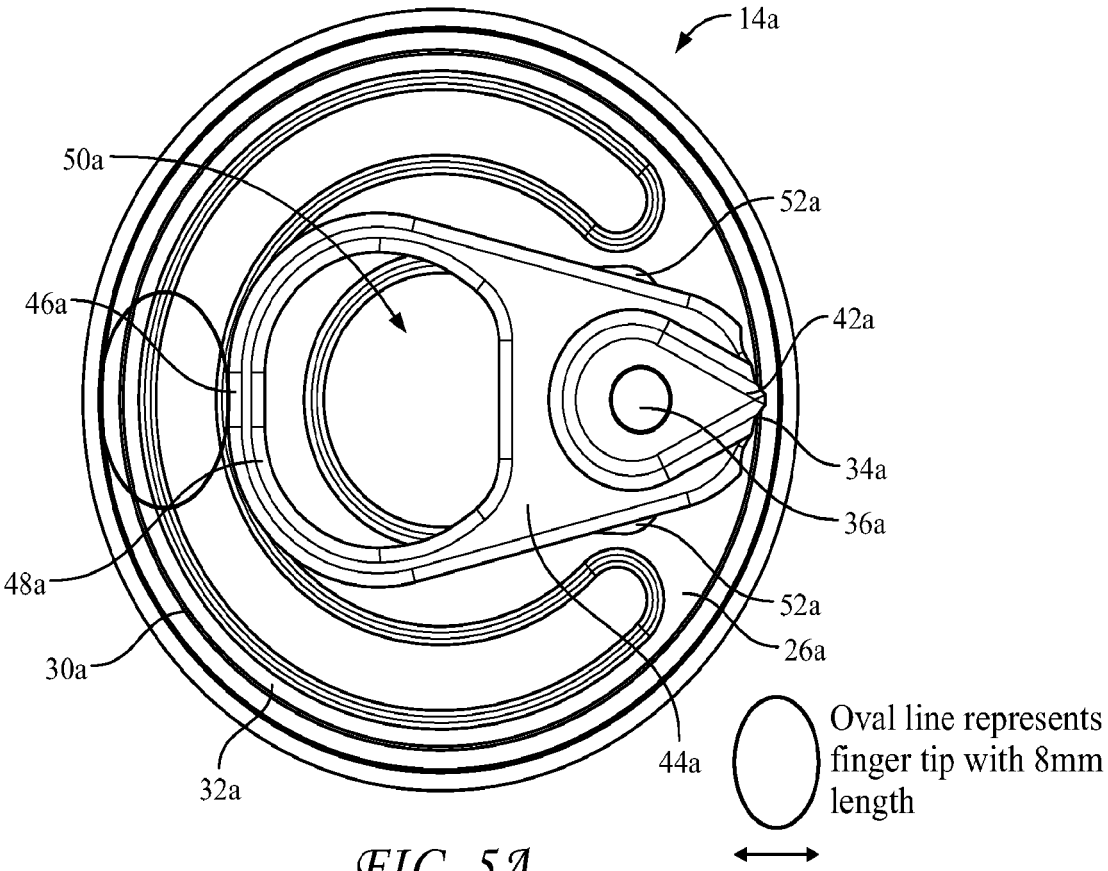
14a
50a
52a
46a
42a
34a
36a
48a
52a
26a
30a
44a
32a
Oval line represents finger tip with 8mm length

FIG. 5A

Description

BACKGROUND

[0001] The invention relates to beverage containers, and more particularly to structures for forming an opening for beverage containers.

[0002] The most popular opening mechanism for beverage cans is a stay-on-tab that opens a hinged tear panel. The tab is affixed to the can end by a rivet that is in the center of the end on all commercially produced, stay-on-tab beverage cans. Full aperture food can ends are also known.

[0003] Some beverage cans have been produced having a removable panel. Removable panels for beverage cans are, for example, described in United States Patent Application Number 12/797171, entitled "Full Aperture Beverage End," which is owned by the assignee of the present invention. As shown in Figure 1A, a prior art full aperture beverage can 110 includes a 211 size beverage can body 112 that is necked to accommodate a 206 size end 114. End 114 includes an inclined wall 122, a reinforcing bead 124, a removable panel 126, and a score 130. Pull tab 140 is attached to panel 126 at a rivet 136. Pull tab 140 includes an aperture into which an adult finger can fit.

[0004] The industry convention of can sizes employs three digits to represent inches and the quantity of 16^{th} inches. Thus, a 211 can body has a nominal 2 and 11/16 inch diameter. As is understood in the art, and as employed throughout this disclosure, nominal beverage can end sizes do not refer to exact measurements to the outside of the seam. Rather, the nominal size is an industry standard that no longer corresponds to exact diameter because the beverage industry switched to the seaming technology generally referred to as a "mini-seam." In this regard, the nominal size refers generally to the diameter of the outside of the seam plus reduction in the diameter corresponding with the change from an old double seam to a modern, mini-seam.

[0005] Removable panels for food cans ends are more commercially popular than removable panels for beverage can ends. Removable panels for opening food containers typically have an end seamed onto a tin plate body. The removable panel is formed by a continuous score that is opened by a tab having an opening through which an average adult user can insert an index finger up to the first knuckle. The user initiates the opening process by lifting a heel of the tab to pivot the tab about a rivet formed in the removable panel such that a nose of the tab ruptures a short portion of the score. A user then inserts his finger into the opening in the tab to enable pulling with a force sufficient to propagate the score rupture around the removable panel and to detach the removable panel from the remainder of the end. The opening process for prior art, full aperture beverage cans is the same as described above for food cans.

[0006] The diameter of a conventional, commercial, tinplate, full aperture score commonly used on a food can end is typically at least 2.345 inches. The conventional full aperture ring pull tab is typically 1.3 inch long with a finger hole diameter of 0.6 inches, or 0.283 square inches. The dimension from the rivet center to the tip of the heel of a conventional commercial tinplate full aperture end is 1.00 inches. The smallest commercially-popular, tinplate, removable panel or full aperture end is a 201.

[0007] United States Patent Number 8,109,406 discloses an end on a tapered can neck. In a first embodiment, a tab includes an elongate body to which a rivet is attached, a heel at one end of the body, and a nose at an opposing end of the body. The rivet is offset from the centerline of the end opposite the tear panel that forms the opening. In other words, in the prior art end, the center of the end is between the rivet and the tear panel. To open it, a user pivots the end over the seam of the can such that the heel is cantilevered in space. In other embodiments in the 8,109,406 patent, a user grips an end of an unconventional pull tab to bend the tab at a hinge until a portion of the tab is upright. The score is opened upon the second step of pulling the tab straight up to apply a downward force through a puncturing nose.

SUMMARY

[0008] The present invention encompasses beverage can ends having a stay on tab or having a removable panel, such as a full aperture end. For full aperture ends, the pull force required for propagating the score after initial rupture for smaller ends is less than the corresponding pull force required for conventional opening sizes. For example, can ends of size 200 or smaller, such as 114, 112, and 108 sizes, require significantly lower pulling force than that for larger can end diameters, which is a clear benefit for opening full aperture ends. One of the reasons for the diminished pull force required for smaller ends is that smaller ends tend to be made of thinner material (compared with larger ends) to take advantage of the inherent advantage in buckle performance for smaller ends.

[0009] The inventors surmise another, esoteric reason for the diminished pull force: increased doming under pressure. Before pressure is applied, the score of a full aperture end is formed when the plate is flat. All commercial ends dome to some extent upon pressurization of the end after filing with a carbonated beverage. But smaller, thinner ends deform plastically to a greater extent (that is, the radius of curvature is smaller) compared with larger ends. The inventors surmise that the magnitude of the deformation upon pressurization of the smaller ends, which creates greater curvature in the region of the score, encourages peeling such that the when peeling is actuated by a consumer, a lower pull force is required. This phenomenon should exist in tinplate (that is, ends comprising steel) and in aluminum ends, and it is understood that the pull force would be lower in aluminum

because it is less malleable and has a lower yield point than that of tinplate.

[0010] The diminished pull force required for smaller ends and/or for ends made from aluminum alloys can be generated without the conventional ring pull, which has an opening large enough for an adult finger to insert his index finger to the first knuckle. The diminished pull force further enables pull tabs having new configurations, such as a length that is shorter than conventional pull tabs. Aspects of the present invention apply the inventors' insights into the opening process to enable the use of tabs that are unconventional and offset from the center of the end.

[0011] According to a first aspect of the invention, a beverage can end for a small diameter having a stay-on-tab includes: a peripheral curl, a wall structure extending from the curl, and a center panel extending inwardly relative to the wall structure. The peripheral curl is capable of being seamed together with a beverage can flange to produce a seam that defines an end size of no more than 200. The end has a discontinuous score formed in the center panel that defines a tear panel, the tear panel being openable to form an opening of at least 0.35 square inches (225.806 square mm). A rivet is offset from a center of the center panel. A pull tab is coupled to the center panel by the rivet. The pull tab has a nose configured to rupture the score upon actuation of the pull tab and a heel opposite the nose. The pull tab heel is spaced apart from the seam by at least 0.3 inches (7.62 mm) to enhance finger access. The term wall structure is used in this specification and claims to refer to a wall of a shell and optionally encompasses an annular reinforcing bead.

[0012] The opening of the beverage can end preferably has an aspect ratio that is at least 1.75 and no more than 3.5, more preferably at least 2.0 and no more than 3.0, and most preferably at least 2.5 and no more than 2.75. The end may be formed of a 3000 series aluminum alloy. As advantages of the end may occur at smaller end sizes, preferably the end size is no more than 114, no more than 112, or no more than 110.

[0013] According to another aspect of the invention, a full aperture beverage can end comprises a peripheral curl, a wall structure extending from the curl, and a center panel extending inwardly relative to the wall structure. A score, which is formed in the center panel, defines a removable panel. A rivet is offset from a center of the center panel. A pull tab is coupled to the removable panel by the rivet, the pull tab having a nose located proximate the rivet and configured to rupture the score. The pull tab includes a finger opening having a length of less than 0.5 inches and configured to restrict complete insertion of an average adult finger and permit insertion of an average adult fingertip.

[0014] Preferably the finger opening has a height (measured in line with the elongate tab) of at least 0.2 inches and a width of between 0.4 and 1.0 inches, more preferably a height of between 0.2 and 0.4 inches and a width of between 0.4 and 0.8 inches. The tab length from a distal end of the nose to a distal end of the heel is no more than 1.15 inches, more preferably no more than 1.05 inches, and more preferably no more than 1.00 inches.

[0015] The area of the finger opening preferably is no more than 0.25 square inches, preferably no more than 0.20 square inches, and more preferably no more than 0.15 square inches. The center panel preferably has an end size of no more than a 200 size, no more than a 114 size, more preferably no more than a 110 size, and more preferably no more than a 108 size. Similarly, preferably the center panel has a diameter of no more than 1.7 inches, preferably no more than 1.6 inches, more preferably no more than 1.5 inches, and more preferably no more than 1.25 inches, and even more preferably no more than 1.0 inches.

[0016] Another way of measuring the size of the structure is by a characteristic dimension of the removable panel. For a circular panel, the characteristic dimension is the diameter. For a non-circular panel, the characteristic dimension is the largest, straight line distance measured anywhere on the panel. Preferably, the characteristic dimension of the removable panel is no more than approximately 1.65 inches, preferably no more than approximately 1.55 inches, more preferably no more than approximately 1.45 inches, more preferably no more than approximately 1.20 inches, more preferably no more than approximately 1.00 inches. And preferably an area defined by the removable panel is greater than 60 percent of an area defined by the center panel, more preferably greater than 75 percent, more preferably greater than 85 percent of an area defined by the center panel. Because the panel is removable, the score is continuous.

[0017] Any of the ends described herein may be formed of aluminum, such as a 3000 series aluminum alloy or a 5000 series aluminum alloy.

[0018] The end may also employ lift features. A full aperture beverage can end comprises a peripheral curl, a wall structure extending from the curl, and a center panel extending inwardly relative to the wall. A score, which is formed in the center panel, defines a removable panel. A rivet is offset from a center of the center panel. A pull tab is coupled to the removable panel by the rivet. The pull tab has a nose that is located proximate the rivet and configured to rupture the score, a heel that is opposite the nose, an aperture formed by a body located between the heel and the nose, and a lift surface that is spaced apart from the heel. The lift surface is adapted for contact by a user to lift the tab from its rest position to a position in which the tab aperture is accessible for further lifting. The lift surface may be formed by a rearward projection from the body proximate the rivet or may be formed by at least one outwardly lateral projection from the tab body. In this regard, the projection interrupts the curvature of the aperture.

[0019] A clearance distance between the tab heel and the end wall is less than 0.5 inches, preferably less than

0.4 inches, more preferably less than 0.3 inches.

[0020] The present invention also encompasses a solid tab. A full aperture beverage can end comprises a peripheral curl, wall extending from the curl, and a center panel extending inwardly relative to the wall. A score, which is formed in the center panel, defines a removable panel. A rivet is offset from a center of the center panel and formed on the removable panel. A pull tab is coupled to the removable panel by the rivet. The pull tab has a nose that is located proximate the rivet and configured to rupture the score, a heel that is opposite the nose, and a body between the heel and the nose that is solid without a finger aperture. The heel of the tab is configured to be spaced apart from the center panel when the can end is seamed to a pressurized can to enable actuation of the tab. Also, the center panel may include a recess beneath or near the heel to enhance finger access thereto.

[0021] The present invention encompasses ends of a 200 size or smaller having a stay-on-tab or having a removable panel, such as a full aperture end. The ends described herein preferably encompasses ends having a size no more than 114 size, nor more than 112 size, and no more than a 110 size, and no more than a 108 size. The present invention also encompasses ends larger than 200 size for certain configurations, and also encompasses ends having an asymmetrical opening. Accordingly, the inventors intend for the invention to be given the full scope of the original and future wording of the claims.

BRIEF DESCRIPTION OF THE FIGURES

[0022]

Figure 1A is an illustration of a prior art full aperture can for a beverage can;

Figure 1B is an illustration of a 200 size can end;

Figure 2 is a perspective view of a full aperture beverage end having its tab in its at rest position, the end is affixed to a beverage can that is highly necked;

Figure 3 is a perspective view of the full aperture end and beverage can of Figure 1 having its tab in a partially actuated state such that the can is "popped";

Figure 4 is a perspective view of the full aperture end and beverage can of Figure 1 having had its removable panel removed;

Figure 5A is a top view of a full aperture beverage can end in a 112 size;

Figure 5B is a cross sectional view of a full aperture beverage can end of Figure 5A;

Figure 6A is a top view of a full aperture beverage can end in a 108 size;

Figure 6B is a cross sectional view of a full aperture beverage can end of Figure 6A;

Figure 7 is a top view of a full aperture beverage can end of a 108 size showing a grip feature internal to the tab aperture;

Figure 8 is a top view of a full aperture beverage can end of a 108 size showing a filled in tab that has no aperture;

Figure 9 is a side view of a full aperture beverage can end of Figure 8;

Figure 10 is a top view a stay-on-tab type beverage can end having a 112 size and an offset rivet with the tab removed for illustration purposes;

Figure 11 is a top view of the end shown in Figure 10 including the tab;

Figure 12 is a cross sectional view of an end showing its size relative to end bottom of a corresponding can body.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0023] The present invention encompasses ends, and can assemblies employing the ends, having a removable aperture panel, such as ends known as "full aperture ends," and ends having a hinged panel that employ a stay-on-tab. Referring generally to the figures, beverage can assembly 10 of either end-type includes a can body 12 and a can end 14 that are joined at a seam 20, which preferably is a conventional double seam common to beverage cans. Reference numeral 14 refers generally to the inventive ends disclosed herein, including both removable panel-type ends, such as full aperture ends, and stay-on-tab-type ends. Embodiments of the ends will have a letter appendage.

[0024] The present invention is not limited to a particular can size, can materials, end material, or end size except where expressly set out in the claims. Accordingly, to illustrate aspects of the present invention, a 211(66 mm) size can body shown in the figures is highly necked, which necking may be performed by conventional necking machinery and techniques, as will be understood by persons familiar with can making technology. Preferably can body 12 is a one-piece, drawn and ironed beverage can body formed of an aluminum alloy, such as a 3000 series alloy.

[0025] Can body 12 preferably has a neck 16 such that seam 20 formed by the combined can body and end preferably has a diameter that is smaller than a 211 size, and therefore end 14 has a size smaller than 211. For example, a 211 can body (or other can body diameter, such as a 58 mm can body) can be necked to correspond to any end size 200 or smaller, such as the 112 (44 mm) or 108 (38 mm) end sizes illustrated in the figures. Even though the inventive ends disclosed herein are not limited to any material or to any diameter or material, they are especially advantageous for smaller end sizes and/or cans having a significant magnitude of necking such that a 200 diameter end or smaller is preferred.

[0026] Can end 14 in its unseamed state (not shown in the Figures) includes a peripheral curl that upon seaming forms seam 20 with a portion of can body 12. End 14 includes a wall 22 extending inwardly from seam 20. End 14 may also include an annular reinforcing bead 24 ex-

tending inwardly from wall 22. A center panel 26 may extend inwardly from bead 24. Alternatively, the center panel 26 may extend inwardly from wall 22. The ends to which the invention is directed may also have a panel wall between the reinforcing bead and center panel, such as panel walls that form a curve or a chamfer. Reference numeral 26 is used to refer to embodiments of the center panels of the ends, regardless of size, configuration, and type (that is, removable panel or stay-on-tab). Modern lightweight end shells, such as for example shown in United States Patent Numbers 6,877,941 (Brifcani), 8,157,119 (Lockley), 7,819,275 (Stodd), and 6,499,622 (Neiner) and their commercial equivalents and variations, have a reinforcing bead diameter and a panel diameter that are small relative to the seam diameter compared to older or non-lightweight ends, such as an end known as a B64 end. Ends disclosed herein may be used with modern, lightweight end shells (including other modern lightweight ends not referred to above) or the older end shells, such as a b64 end.

[0027] Figure 2 illustrates a full aperture type end 14 shown in its at-rest state in which a tab 40 is approximately horizontal. According to a first embodiment full aperture end 14a, as shown in Figures 5A and 5B, tab 40a includes a nose 42a, a body 44a, a heel 46a, and a rim 48a. Nose 42a is pointed to enable it to impart a force, as explained more fully below. Heel 46a is located opposite nose 42a. Body 44a extends between nose 42a and heel 46a and is elongate. A rim 48a is formed by a portion of body 44a and heel 46a such that rim 48a defines a finger aperture 50a. Rivet 36a is attached to body 44, preferably by conventional means. A moustache score 52a or other vent (not shown in the figures) may be employed. The oval imposed over the end reflects a clearance of 8mm.

[0028] Center panel 26a includes a score 30a, which preferably is continuous such that score 30 defines the boundary of a removable panel 32a. Rivet 36a, which preferably is conventional, is formed on removable panel 32a. Rivet 36a is offset (that is, spaced apart) from the center of center panel 26a such that the tip of nose 42a is located near a contact portion 34a of center panel 26a. Contact portion 34a is the portion of the removable panel 32a that tab nose 42a contacts during the opening process. Contact portion 34a preferably is chosen to be close to a predetermined portion of score 30a.

[0029] Figures 6A and 6B illustrate another embodiment full aperture end 14b, in which a tab 40b includes a nose 42b, a body 44b, a heel 46b, and a rim 48b. Nose 42b is pointed to enable it to impart a force, as explained more fully below. Heel 46b is located opposite nose 42b. Body 44b extends between nose 42b and heel 46b. A rim 48b is formed by a portion of body 44b and heel 46b such that rim 48b defines a finger aperture 50b. Rivet 36b, moustache score 52b, score 30b, and contact portion 34b are as described above for first embodiment end 14a.

[0030] The lengths of tabs 40a and 40b are chosen to provide a 0.32 inch (8mm) clearance between the wall 22 of the seam and the heel 46a and 46b. Accordingly, a length from a distal end of nose 42 to a distal end of the heel 46 is no more than approximately 1.15 inches, more preferably no more than approximately 1.05 inches, and even more preferably no more than approximately 1.00 inches. Other preferred clearance distances (that is, the horizontal distance between the tab heel and the seam 20 or wall 22 are contemplated. Preferably, the clearance distance is greater than 6mm for embodiments relying on a finger access space behind the tab heel.

[0031] Finger aperture 50a, 50b is defined by tab 40a, 40b (respectively) and preferably is configured to restrict complete insertion of an average adult finger up to the knuckle. Rather, finger aperture 50a, 50b preferably is configured to permit insertion only of an average adult finger tip. Preferably, aperture 50a, 50b is sized to permit an adult finger to be inserted over a portion of the finger nail (that is, the distal phalange of the index finger is insertable into the aperture, but not fully to the joint between the distal phalange and the intermediate phalange). As finger apertures 50a and 50b are sized only to accept the distal most portion of the finger tip, the consumer engages the tab by pinching the tab or the aperture between the tip of the index finger and the tip of the thumb.

[0032] In this regard, area of the finger opening 50a, 50b preferably is no more than approximately 0.25 square inches, more preferably no more than approximately 0.20 square inches, and more preferably no more than approximately 0.15 square inches. Also, finger opening 50a, 50b preferably has a length of between of between approximately 0.2 inches and approximately 0.5 inches and a width of between approximately 0.4 inches and approximately 1.0 inches, and more preferably, a length between approximately 0.2 inches and approximately 0.4 inches and a width of between approximately 0.4 inches and approximately 0.8 inches. The length dimension is defined on the centerline of the tab from nose 42a, 42b to heel 46a, 46b along the tab centerline, and the width dimension is defined as perpendicular to the tab centerline and the length dimension. When the direction perpendicular to the tab centerline is not the largest dimension, the dimensions provided for the width can be measured at the largest dimension that is oblique to the length.

[0033] The dimensions of aperture 50a, 50b enable a force to be applied to pull tab 40a, 40b that corresponds to the opening force required for smaller ends and/or for ends formed of an aluminum alloy. Accordingly, end 14 preferably is a 200 size or smaller, preferably, a 180 size or smaller, more preferably a 140 size or smaller, and most preferably a 108 size or smaller. Preferably the end is at least a 100 size.

[0034] The disclosure herein emphasizes ends smaller than or equal to 200 for most embodiments. Another way to define this parameter is by center panel diameter. Accordingly, center panel 26a, 26b preferably has a diameter of no more than approximately 1.7 inches, more pref-

erably no more than approximately 1.6 inches, more preferably no more than approximately 1.5 inches, more preferably no more than approximately 1.25 inches, and preferably no less than approximately 1.0 inches. Removable panel 32a, 32b preferably has a diameter of no more than approximately 1.65 inches, more preferably no more than approximately 1.55 inches, more preferably more than approximately 1.45 inches, more preferably no more than approximately 1.20 inches, and more preferably no more than approximately 1.0 inches. Preferably, the largest diametric or length dimension is greater than that of the pour opening of conventional, easy open, stay-on-tab ends.

[0035] The removable panel preferably is defined by an area that is greater than approximately 60 percent of an area defined by the center panel, more preferably greater than approximately 75 percent of an area defined by the center panel, and more preferably greater than approximately 85 percent of an area defined by the center panel.

[0036] Referring to Figure 2, the at-rest state of can 10 is the condition of the can after filling and as the consumer encounters it. Upon encountering can 10 having tab 40 (employing reference numerals without an appended letter to refer to generally to the inventive removable panels ends described herein) in its at-rest position, a consumer opens can 10 by lifting tab heel 46 to pivot tab 40 about rivet 36 to impart a force from nose 42 onto contact portion 34 of center panel 26 until the score in the region of contact portion 34 is ruptured.

[0037] The present invention encompasses ends that have an annular countersink bead around the center panel, and also encompasses ends that omit or lack the countersink bead, as for example shown in embodiment shown in Figure 4. In embodiments having an annular bead, the center panel is defined as the flat portion that is inside the inner wall of the countersink bead. The transition between the countersink inner wall and flat center panel is typically formed by a small radius, a curved panel wall, or a chamfer. In each case, the outer boundary of the panel is defined where the flat panel meets the transition. The inventors use the term "flat" not to refer to theoretical perfection, but to mean the state in which the end exists as it leaves the shell press or conversion press, including deviations from a perfect plane because of being unwound from a coil, embosses and debosses on the panel for functional reasons, and the like.

[0038] In embodiments that have no countersink bead, the boundary of the center panel may be defined by the transition between the flat portion and the curve or bend that joins the center panel to the wall. Referring to Figure 2, the at-rest state of can 10 is the condition of the can after filling and as the consumer encounters it. Upon encountering can 10 having tab 40 (employing reference numerals without an appended letter to refer to generally to the inventive removable panels ends described herein) in its at-rest position, a consumer opens can 10 by lifting tab heel 46 to pivot tab 40 about rivet 36 to impart a force from nose 42 onto contact portion 34 of center panel 26 until the score in the region of contact portion 34 is ruptured.

[0039] Figure 3 illustrates can 10 upon completion of the first opening operation in which score 30 has been ruptured and thus vented (that is, the can has been "popped"). After initial score rupture, a consumer grasps tab 40 either by partially inserting an index finger tip into aperture 50, pressing an index finger tip and thumb together roughly in the plane of opening 50 (that is, the contact between the consumer's index finger and thumb is roughly in line with the surfaces of rim 48). Alternatively, a user may grasp tab body 44 or heel 46 by pressing between his thumb and a side of an index finger. Upon grasping, the consumer pulls tab 40 either normal to center panel 26 or with a rearward, peeling action to propagate the rupture of score 30 about removable panel 32 until removable panel 32 is fully detached, as shown in the ready state of can 10 of Figure 4.

[0040] Figure 7 illustrates another embodiment can end 14c that includes a center panel 26c, a score 30c, a removable panel 32c, a contact portion 34c, and a rivet 36c that are as described for first and second embodiment can ends 14a and 14b. A tab 40c of end 14c includes a nose 42c, a body 44c, a heel 46c, and a rim 48c. Nose 42c is pointed to enable it to impart a force, as explained more fully below. Heel 46c is located opposite nose 42c. Body 44c extends between nose 42c and heel 46c. Rim 48c is formed by a portion of body 44c and heel 46c such that rim 48c defines a finger aperture 50c. Rivet 36c, moustache score 52c, score 30c, and contact portion 34c are as described above for first embodiment end 14a.

[0041] Tab 40c need not provide a clearance between heel 46c and the seam for figure access, as tab 40c includes a lift feature, such as projection 60c, that provides a lift surface. Projection 60c is a tab that extends from body 44c near rivet 36c rearwardly (that is, in the direction toward heel 46c) to project into or stick into aperture 50c or, in other words, interrupt the smooth curvature of the aperture 50c. In this regard the clearance distance between heel 46c and the seam 20 inner wall preferably is less than 0.5 inches, more preferably less than 0.4 inches, and more preferably less than 0.3 inches. Alternatively, the lift feature may be one or more lateral projections 66c (shown in dashed lines in Figure 7) that extend from body 44. Projection 60c and projections 66c each provide one or more lift surfaces for contact by the consumer's finger.

[0042] To actuate tab 40c, a user first contacts a lift surface 62c of projection 60c or a lift surface 68c of projection 66c to lift tab 40c to the extent that the consumer's finger can be place under heel 46c to complete the first phase of the opening process described above (that is, the reach the "popped" state). The removal of removable panel is completed by the consumer upon insertion of the user's finger into aperture 50c and pulling to fully propagate the rupture of score 30c.

[0043] Figures 8 and 9 illustrate another embodiment

end 14d that lacks a finger aperture for pulling. End 14d includes a score 30d, a contact portion 34d, and a rivet 36d that are as described for first and second embodiment can ends 14a and 14b.

[0044] A tab 40d of end 14d includes a nose 42d, a body 44d, and a heel 46d. Nose 42d is pointed to enable it to impart a force, as explained more fully below. Heel 46d is located opposite nose 42d. Body 44d extends between nose 42d and heel 46d and preferably is continuous without any apertures or without an aperture in which even a tip of an adult finger can be inserted. A tab according to the present embodiment encompasses through holes, which may be made for aesthetic reasons, providing visual access to the center panel, strengthening reasons, light-weighting reasons, and the like. Any opening in this regard (not shown in the figures) would preferably have its longest dimension less than 0.25 inches, Body 44 may include raised structure, such as channel 70 and island 71, to enhance gripping. Rivet 36d, moustache score 52d, score 30d, and contact portion 34d are as described above for first embodiment end 14a.

[0045] Because tab 40d lacks a finger aperture, tab 40d may have a length dimension (that is, from heel to nose) that enables a sufficient finger access between heel 46d and seam 20. Center panel 26d and removable panel 32d may have a recess 70d, shown in relief in Figure 9, underneath or near heel 46d to enhance finger access (that it, to enable a tip of a consumer's finger to access heel 46d or other portion of tab 40d). The offset location of rivet 36d enhances finger access to heel 46d as the pressurized can tends to deform end 14d into a dome shape. Thus, heel 46d may be spaced apart from (that is, there is a vertical cap) from center panel 26d in a seamed-on end even without a recess in the center panel.

[0046] To actuate tab 40d, a consumer's finger first contacts the heel 46d to lift it to complete the first phase of the opening process described above (that is, the reach the "popped" state). Because of the dome shape of end 14d upon pressurization, and because of the location of tab 40d offset from the center of the end, a vertical space (or an increase in the vertical space) may be formed between heel 46d and center panel 26d to enhance the capability of a user's finger to engage heel 46d. In the embodiment having recess 70d, the recess 70d also provides space to enhance finger access.

[0047] The disclosure herein emphasizes ends smaller than 200 for the embodiments having removable panels. Another way to define this parameter is by center panel diameter. Accordingly, center panels 26 of ends 14a through 14d, preferably have a diameter of no more than approximately 1.7 inches, more preferably no more than approximately 1.6 inches, more preferably more than approximately 1.5 inches, more preferably no more than approximately 1.25 inches, and preferably no less than approximately 1.0 inches. Removable panels 32 preferably have a diameter of no more than approximately 1.65 inches, more preferably no more than approximately 1.55 inches, more preferably more than approximately 1.45 inches, more preferably no more than approximately 1.20 inches, and more preferably no more than approximately 1.0 inches. Preferably, the largest diametric or length dimension is greater than that of the pour opening of conventional, easy open, stay-on-tab ends. The tabs employed with ends having a removable panel preferably do not have ha hinge such that panel 32 deforms upon tab actuation.

[0048] According to another aspect of the present invention, a stay-on-tab end 14e shown in Figures 10 and 11, having a size of 200 or smaller, includes a tab 40e that has a nose 42e, a body 44e, a heel 46e, a rim 48e, and an aperture 50e. Nose 42e is rounded and has a contact portion at its distal tip. Heel 46e is located opposite nose 42e. Body 44e extends between nose 42e and heel 46e. A rim 48e is formed by a portion of body 44e and heel 46e such that rim 48e defines an aperture 50e. Rim 48e and aperture 50e are structural, as in conventional stay-on-tabs.

[0049] Tab 40e includes a rivet island 74e that contacts center panel 26e and through which rivet 36e is affixed. Rivet island 74e includes a hinge 76e that is formed upon actuation of tab 40e.

[0050] Rivet 36e is offset from the center of center panel 26e but otherwise may be conventional. The location of rivet 36e and length of tab 40e may be chosen according the distance available on end 14e to provide a clearance distance between the end seam or wall and heel 46e of at least 0.3 inches to enhance finger access.

[0051] Center panel 26e includes a score 30e, which preferably is discontinuous such that opposing ends of score 30e form a hinge 78e. Score 30e and hinge 78e define a tear panel 80e that is openable upon actuation of tab 40e. Score 30e preferably includes a first portion 82 that includes a portion intended to vent upon initial opening and a check slot, a rearwardly projecting bulge 83 that extends to the rearward side of the centerline of rivet 36e, a first side portion 84, a front portion 85, a second side portion 86, and a second end portion 87 that may extend rearward of rivet 36e.

[0052] Preferably, the opening formed when tear panel 80e has been actuated is at least 0.35 inches, more preferably at least 0.4 square inches. Score 30e defines an aspect ratio of panel 80e by dividing length L, which is mostly clearly identified as the length along the centerline of tab 40e, by width W, which is most clearly identified as the maximum distance that is perpendicular to the dimension L between sides 84 and 86. Preferably the aspect ratio of the opening is at least 1.75 and no more than 3.5, more preferably at least 2.0 and no more than 3.0, and more preferably is at least 2.5 and no more than 2.75.

[0053] As described herein, the diminished size of the ends of present invention compared with conventional beverage can end enables changes to the structure of the end. For example, the end 14e may be formed of a less expensive 5000 series alloy or a 3000 series alloy

similar to that of the can body, the end shell may be formed of a thinner shell, or a combination. Moreover, to further enhance openability, the score residual (that is, the metal thickness dimension of the end that remains at the bottom of the score after formation of the score) may be approximately 0.0025 inches.

[0054] To actuate tab 40e, a consumer grips heel 46e in a conventional way for opening ubiquitous stay-on-tab ends. The consumer lifts heel 46e to urge nose 42e against contact portion 34e to rupture score first portion 82. The force applied from nose 82 is applied through initial venting and through the buildup of energy in the panel until the check slot rupture, after which the score may propagate quickly through bulge 83, first side 84, front portion 85, and second side 86 until ceasing at end portion 87.

[0055] Referring now to the inventive ends generally, end 14 is formed of a conventional 5000 series aluminum alloy. The present invention also encompasses ends made of steel or steel alloys, such as conventional tinplate, and any aluminum alloys, such as a 3000 series alloy. In this regard, the present invention encompasses any combination of end materials, score configuration, removable panel size, and opening and/or venting technology that can be actuated with a pull force that is enabled by the pull tab described herein to be employed. For example, even though a 5000 series alloy is preferred for a larger end sizes, such as a 202 end size, the inventors surmise that a 3000 alloy would provide acceptable pressure performance for smaller ends.

[0056] Figure 12 shows a beverage can base 11 having an internal diameter that is greater than the outside diameter of seam 20 such that end 14 fits into the opening at the bottom of the can such that can assemblies 10 stack one on another.

[0057] Ends according to the present invention are described herein using particular sizes, configurations, and materials. The present invention is not limited thereto, but rather encompasses ends as defined in the claims.

Claims

1. A beverage can end having a small diameter and a stay-on-tab, the end comprising:

   a peripheral curl, a wall structure extending from the curl, and a center panel extending inwardly relative to the wall structure; the peripheral curl capable of being seamed together with a beverage can flange to produce a seam that defines an end size of no more than 200;
   a discontinuous score formed in the center panel that defines a tear panel, the tear panel being openable to form an opening of at least 0.35 square inches (225.806 square mm) ;
   a rivet that is offset from a center of the center panel; and
   a pull tab coupled to the center panel by the rivet, the pull tab having a nose configured to rupture the score upon actuation of the pull tab and a heel opposite the nose; the pull tab heel being spaced apart from the seam by at least 0.3 inches (7.62 mm) to enhance finger access.

2. The beverage can end of claim 1 wherein the opening has an aspect ratio that is at least 1.75 and no more than 3.5.

3. The beverage can end of claim 1 wherein the opening has an aspect ratio that is at least 2.0 and no more than 3.0.

4. The beverage can end of claim 1 wherein the opening has an aspect ratio that is at least 2.5 and no more than 2.75.

5. The beverage can end of claim 1 wherein the end is formed of a 3000 series aluminum alloy.

6. The beverage can end of claim 1 wherein the end size is no more than 114.

7. The beverage can end of claim 1 wherein the end size is no more than 112.

8. The beverage can end of claim 1 wherein the end size is no more than 110.

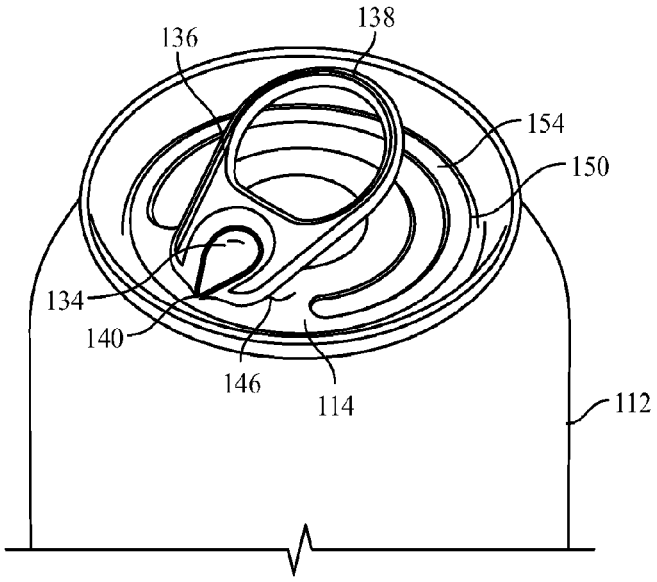

FIG. 1A
(Prior Art)

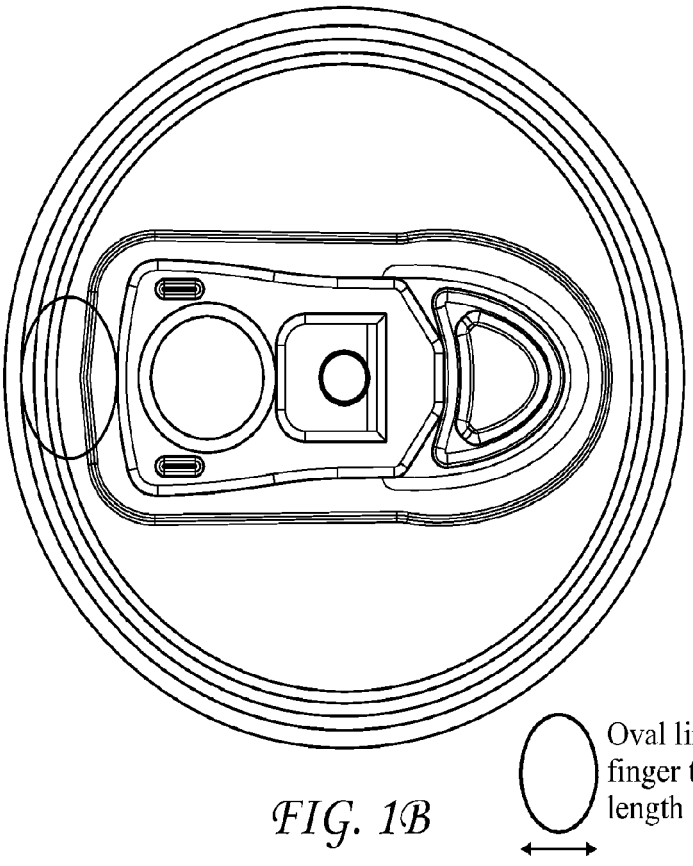

FIG. 1B

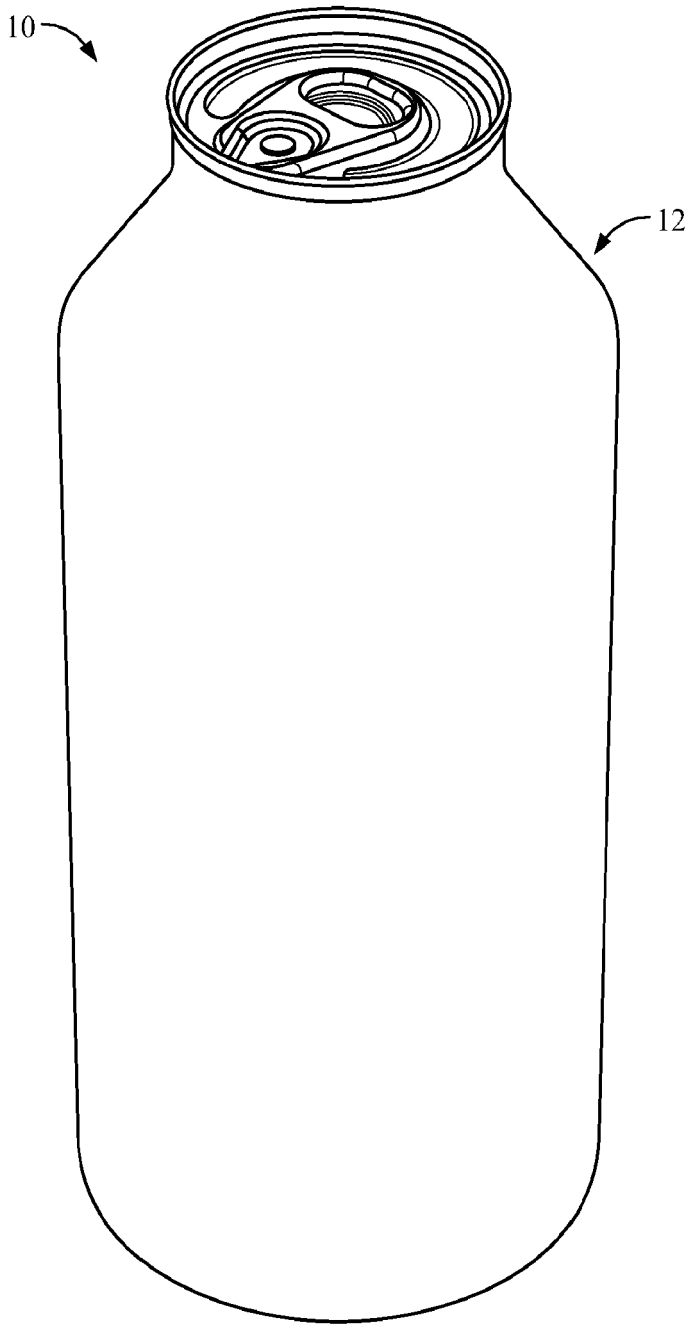

FIG. 2

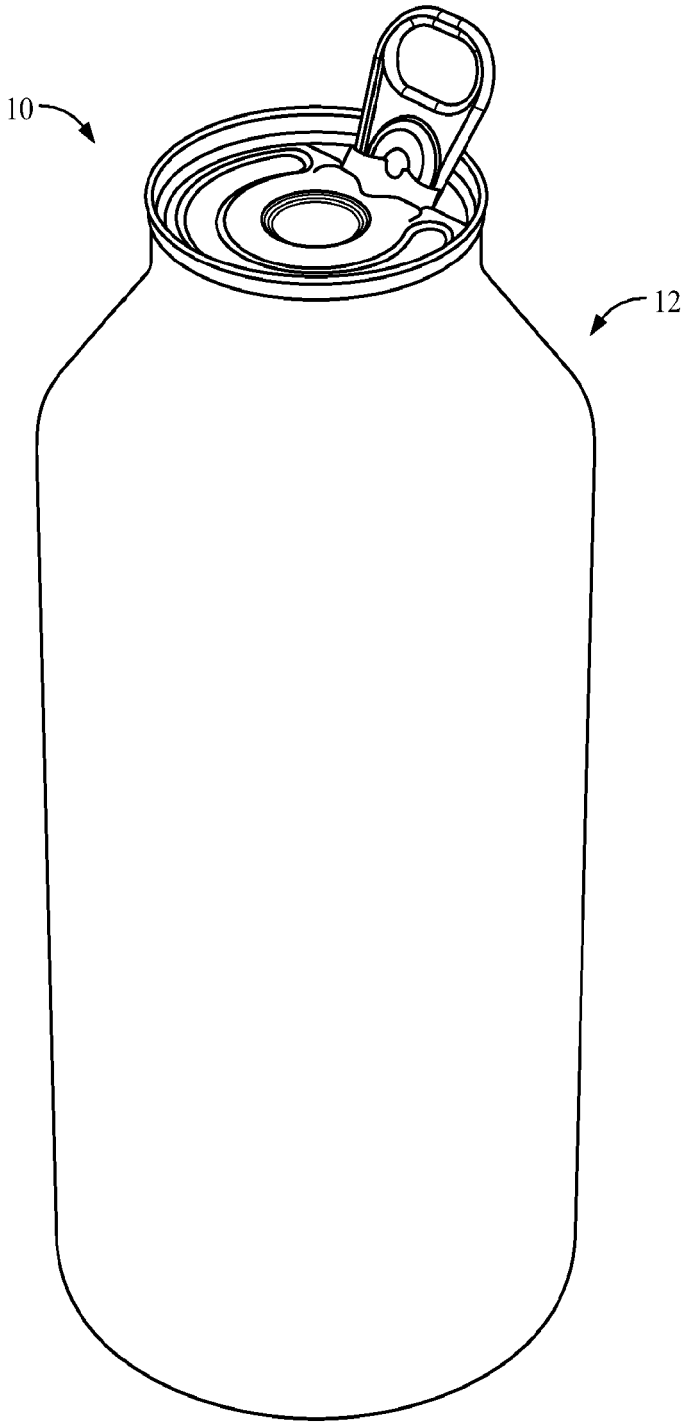

FIG. 3

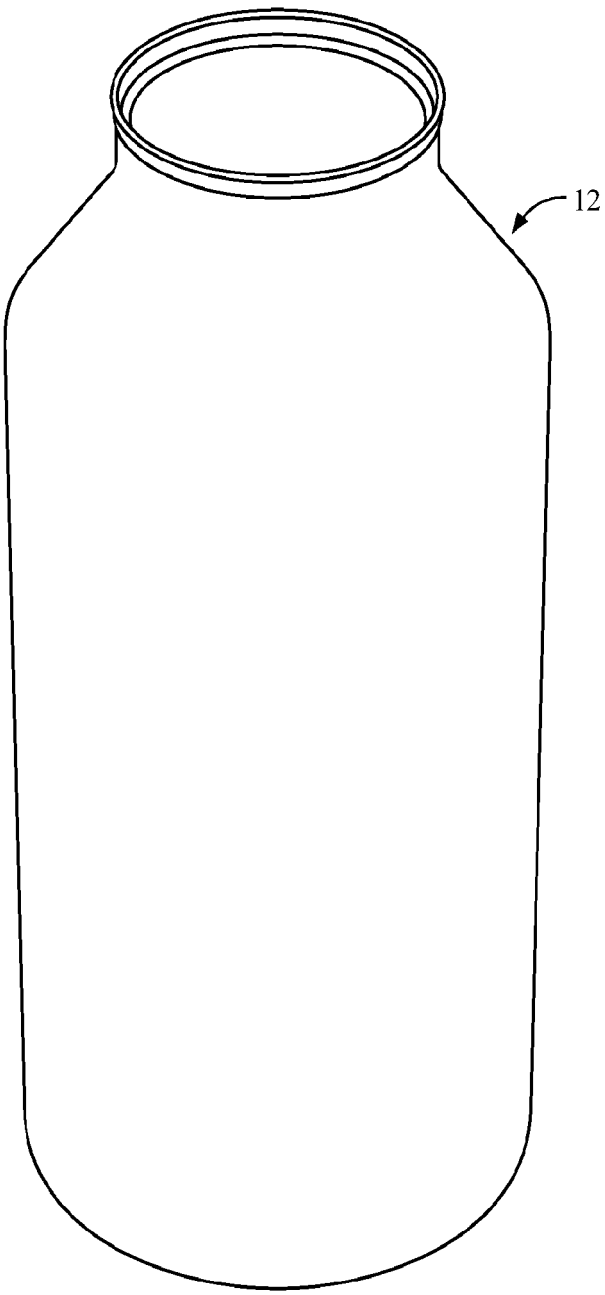

FIG. 4

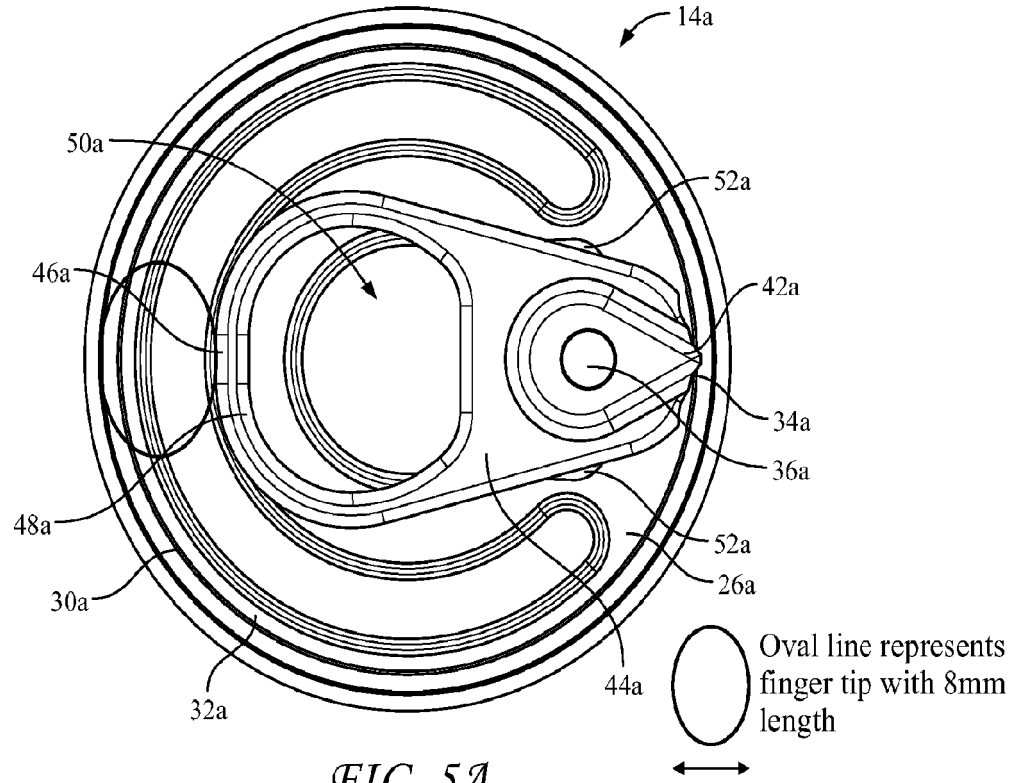
14a
50a
52a
46a
42a
34a
36a
48a
52a
26a
30a
32a
44a
Oval line represents finger tip with 8mm length

FIG. 5A

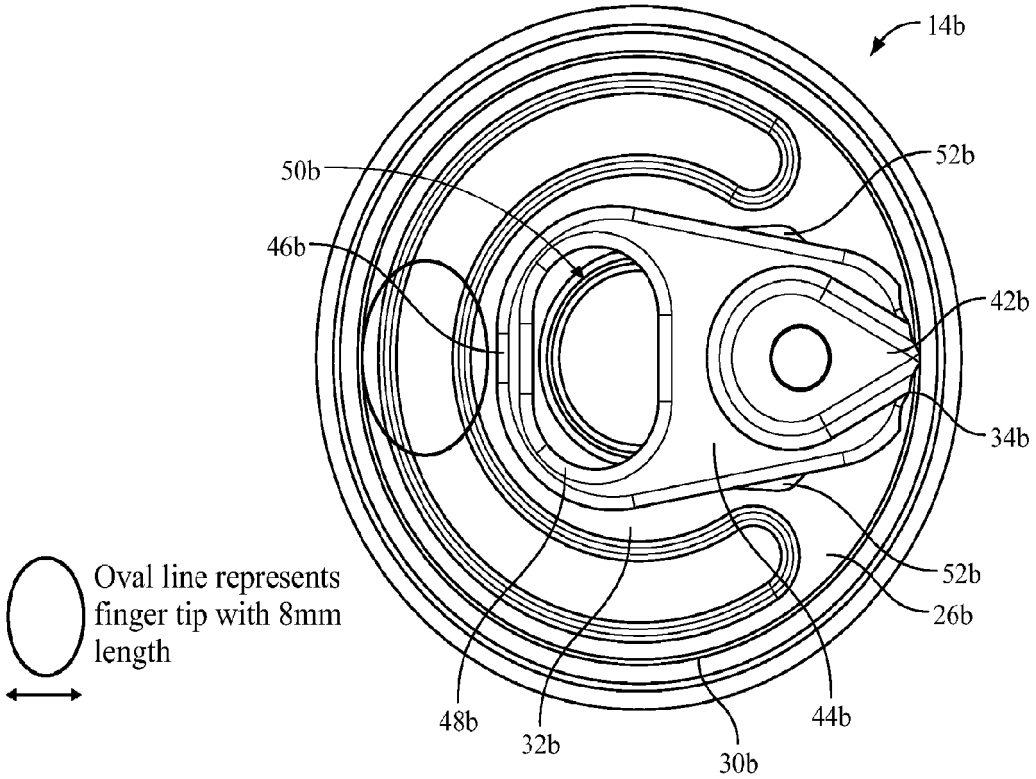
14b
50b
52b
46b
42b
34b
52b
26b
48b
32b
30b
44b
Oval line represents finger tip with 8mm length

FIG. 6A

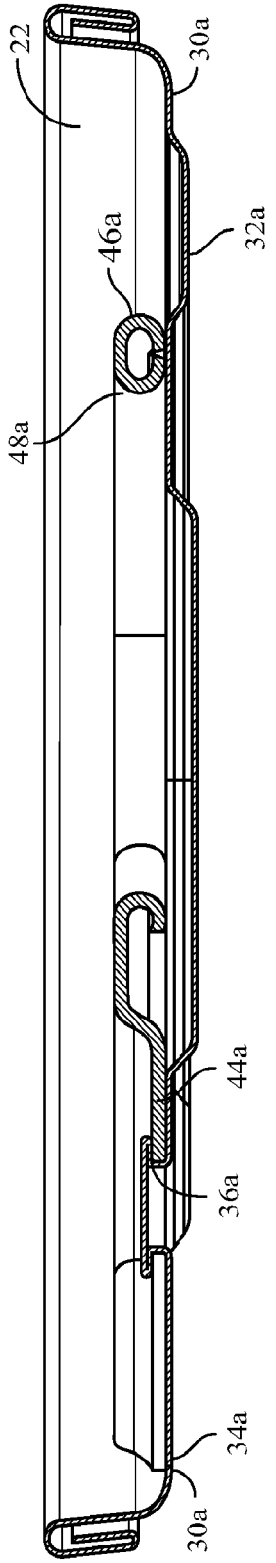
22
30a
46a
32a
48a
44a
36a
34a
30a

FIG. 5B

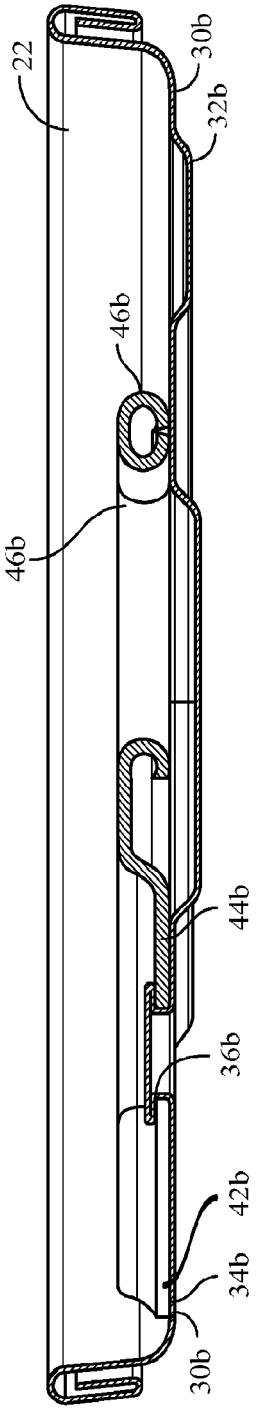
22
30b
32b
46b
46b
44b
36b
42b
34b
30b

FIG. 6B

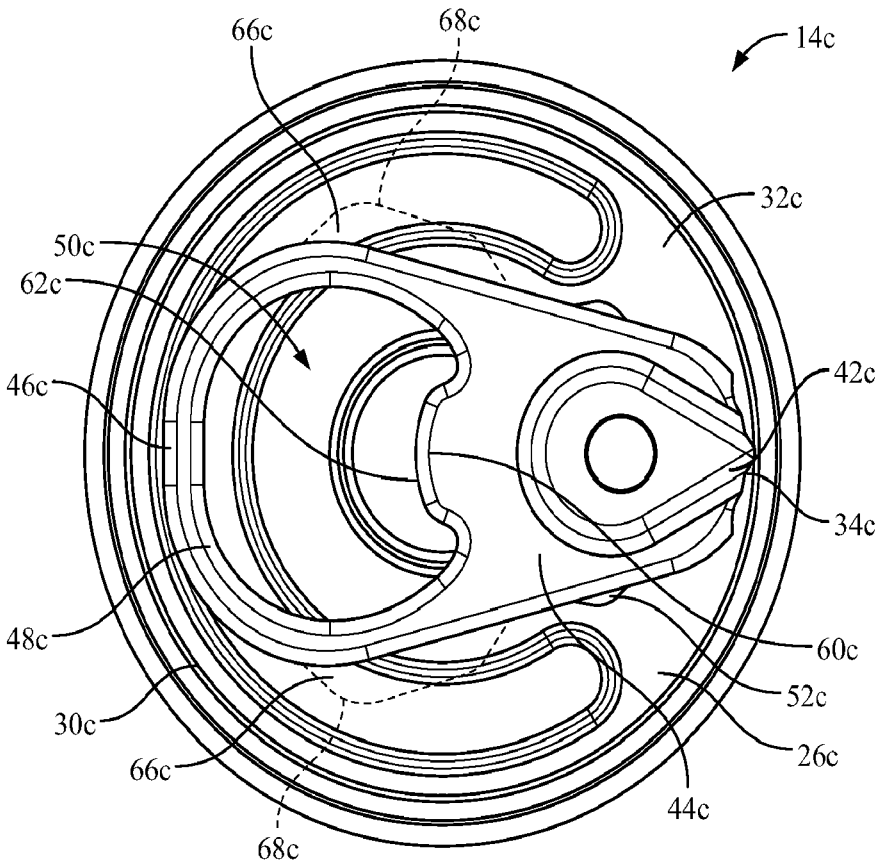
66c
68c
14c
32c
50c
62c
46c
42c
34c
48c
60c
52c
30c
26c
66c
44c
68c

FIG. 7

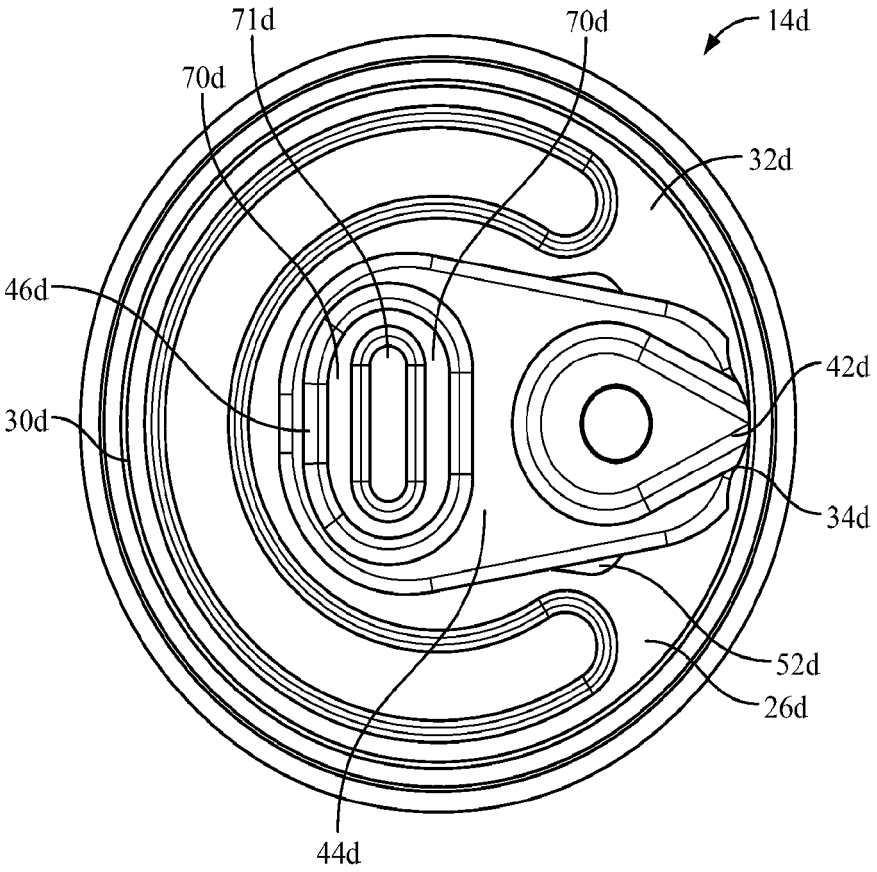
71d
70d
14d
70d
32d
46d
42d
30d
34d
52d
26d
44d

FIG. 8

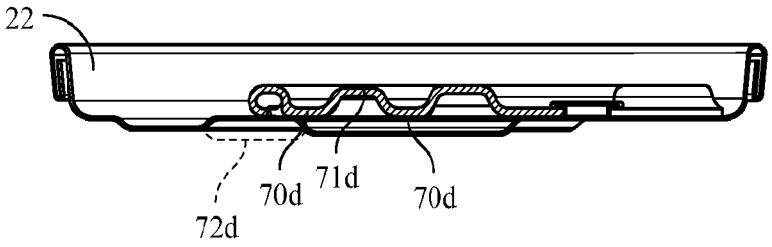
22
72d
70d
71d
70d

FIG. 9

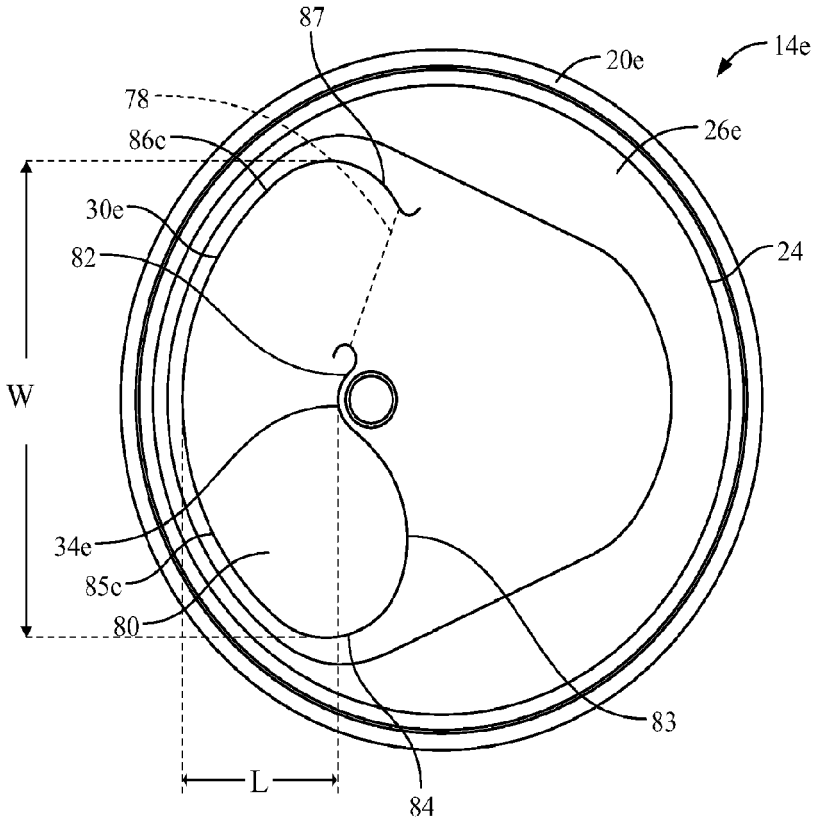
87
20e
14e
78
26e
86c
30e
24
82
W
34e
85c
80
83
L
84

FIG. 10

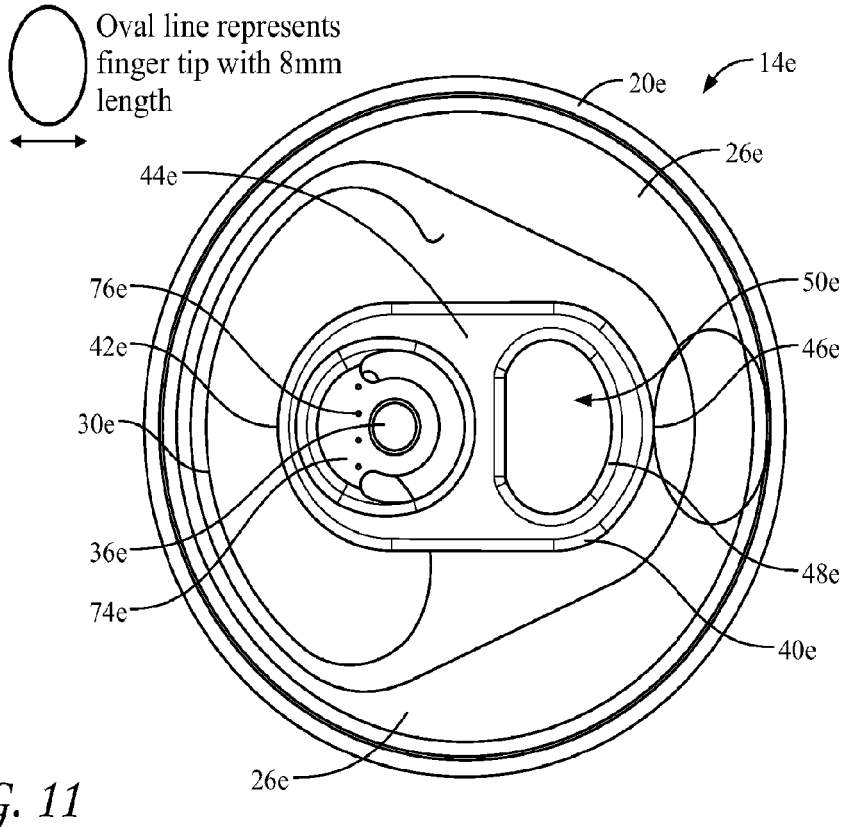
Oval line represents finger tip with 8mm length
20e
14e
26e
44e
50e
76e
46e
42e
30e
36e
48e
74e
40e
26e

FIG. 11

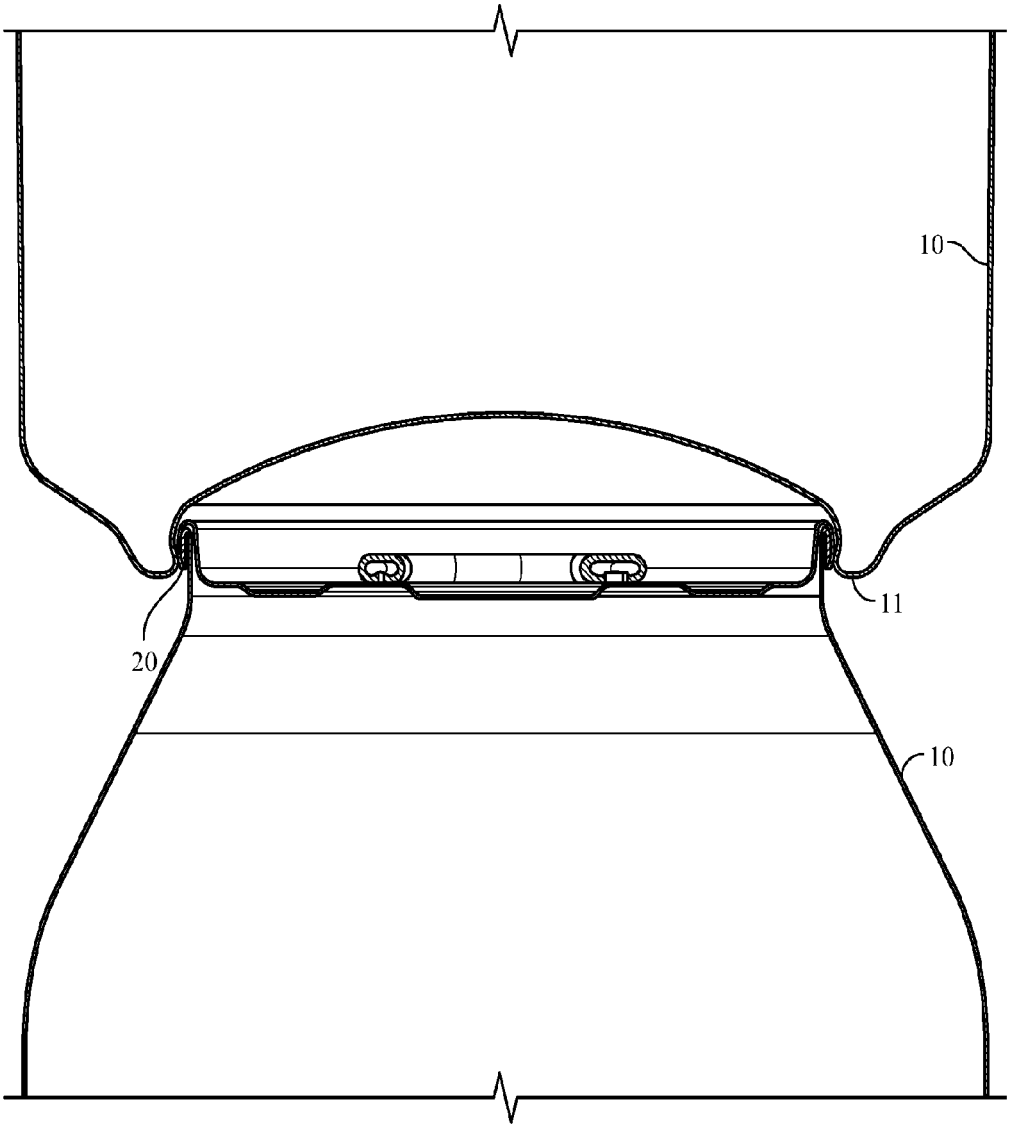

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 2345

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y A	US 2002/046786 A1 (ROBERTS DAVID ANDREW [GB] ET AL) 25 April 2002 (2002-04-25) * the whole document *	5 1-4,6-8	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 March 2016	Pernice, Ciro

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 2345

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03-03-2016

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