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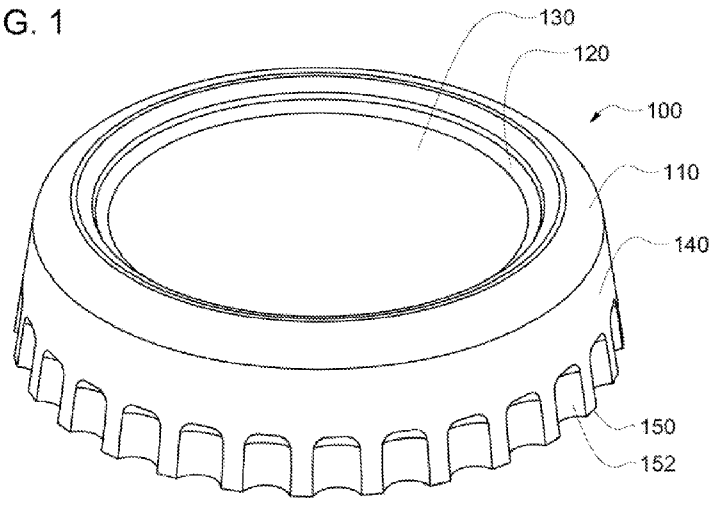
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— *with international search report (Art. 21(3))*

— *with information concerning one or more priority claims considered void (Rule 26bis.2(d))*

(54) **Title**: REDUCED GAUGE BOTTLE CAP

FIG. 1



(57) **Abstract**: A reduced gauged crown for a container opening includes a corrugated panel portion such that the corrugation strengthens the crown material and allows less material to be used for the crown than would be used for an uncorrugated bottle cap.

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REDUCED GAUGE BOTTLE CAP

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present disclosure is related to, incorporates by reference, and claims priority from United states patent application entitled "Easy-Pull Bottle Cap" filed October 6, 2011 and assigned Serial No. 13/267,264, and United states patent application entitled "Bottle Crown", serial number 12/903,533, filed October 13, 2010, which in turn claims priority from the United States patent application Serial Number 11/698,247 filed January 24, 2007 (issued as US patent no. 8,061,544), which is a is a continuation-in-part of co-pending PCT patent application of the same title, Serial No: PCT/US2006/002421 by the same inventor filed January 24, 2006 and entitled EASY-PULL BOTTLE CAP.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates to caps and crowns for beverage bottles and other containers, and in particular, to a reduced gauge corrugated bottle cap.

BACKGROUND

[0003] Published US patent application ser. No. 12/597,385 to Merino Caballero ("Caballero")discloses a low gauge crown cap in which the top panel exhibits grooves in various shapes, depending on the embodiment,

to achieve corrugation and obtain a crown that has a low gauge of crown material such as steel. Although not prior art due a priority date subsequent to the priority date of the present disclosure, the present inventor acknowledges the Caballero application because it was published prior to the filing date of the present disclosure.

[0004] Related application serial number 12/903,533, and its parent 11/698,247 (issued as US patent no. 8,061,544), referenced above, disclose a bottle crown that has a seat in which rests a pull tab assembly so that the pull tab assembly is flush with the top of the crown. The seat is formed by means of a depression or recess in the top of the crown. A benefit of the recessed top is that the recess functionally acts to corrugate the top of the crown. As is well understood, corrugation has the advantage of stiffening a sheet of material against forces that are perpendicular to the direction of corrugation. That is, a corrugated sheet is harder to bend than a non-corrugated sheet, at least in certain directions. A bottle crown that has corrugation across its top will be stiffer than a non-corrugated crown. Therefore, to achieve the same degree of stiffness of a non-corrugated crown, a corrugated crown may be thinner, or have a lower gauge, of crown material such as steel or tinplate. The advantages of corrugation that are

implicitly inherent in the crown of the '533 application are made explicit in the present disclosure. The present disclosure, therefore, describes a corrugated crown and the advantages thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The detailed description that follows, by way of non-limiting examples of embodiments, makes reference to the noted drawings in which reference numerals represent the same parts throughout the several views of the drawings, and in which:

[0006] Figure 1 is an isometric side view illustration of a reduced gauge crown of the present invention.

[0007] Figure 2A is a top view illustration of the crown of Fig. 1.

[0008] Figure 2B is a side cross-section view o fthe crown of Fig. 2A.

[0009] Figure 3A is a top view illustration of an alternative embodiment of a crown of the present disclosure.

[0010] Figure 3B is a side cross-section view of the crown of Fig. 3A.

[0011] Figure 4A is a top view illustration of another alternative embodiment of a crown of the present disclosure.

[0012] Figure 4B is a side cross-section view of the crown of Fig. 4A.

Detailed Description of Exemplary Embodiments

[0013] Figure 1 is an isometric side view illustration of a reduced gauge crown of the present invention. Crown 100 includes top portion 110 contiguous with recess 120 which terminates in panel 130. Skirt 140 downwardly extends from top 110. In some specific embodiments a flange extends obliquely from skirt 140. Alternating flutes 150 and lands 152 are formed on a circumferential portion of skirt 140. Crown 100, and other crowns shown in the figures, is shown as a pry-off type that is opened with a lever. The present invention also encompasses a twist-off type (not shown in the figures) that is opened by twisting, as will be understood by persons familiar with crown cap technology. Finally, crown 100 is suitable for use with pull tab type assemblies mounted to panel 130 with effective score lines embossed on on crown 100.

[0014] Panel 130 is recessed, that is, it is lower than top 110 but is contiguous with top 110 by virtue of transition surface 120, which will be referred to herein for convenience as recess 120. Recess 120 may formed in crown 100 in a variety of suitable way to provide advantageous shapes. For example, in specific exemplary

embodiments concentric tiers, grooves or steps are integrally formed in the crown 100 material until the desired depth of panel 130 is obtained, as illustrated in Fig. 1. In alternative embodiments, recess 120 is formed with a smoothly curved surface from top 110 to panel 130. The form of recess 120 functions as ribs or structural reinforcements that, it is surmised, help to stiffen panel 130 against deflection or deformation.

[0015] Skirt 140 descends from top 110 along the external perimeter of crown 100 and in specific exemplary embodiments smoothly merges into downwardly and radially outwardly extending flange. The skirt 140 is preferably adapted to be crimped onto the neck of a bottle for sealing. Specific exemplary embodiments of skirt 140 are divided into undulating, repeating portions that define the flutes 150 and lands 152. Preferably, the repeating portions are circumferentially evenly spaced apart such that each flute 150 is identical to all other flutes 150 around the circumference of the crown cap 100, and each land 152 is identical to all other lands 152 around the circumference of the crown cap 100. It should be understood that the crown cap 100 may include any number of flutes 150 and lands 152.

[0016] Referring to now to Figs 2A and 2B, 3A and 3B and 4A and 4B, the "B" figure of each depicted embodiment is the horizontal cross section of its "A" counterpart

through line B-B. Each embodiment, designated 2A/B, 3A/B and 4A/B, is characterized by a particular diameter of its panel 130, as represented by width B 210, 310 and 410 of each embodiment, respectively, and depth A of recess 120 represented by depths 220, 320 and 420, respectively.

[0017] A specific amount of material strengthening from corrugation is achieved by selecting an embodiment with a particular combination of panel diameter 210, 310 or 410, for example, and recess depth 220, 320 or 420, for example. Exemplary embodiment 2A/B, for instance, has panel diameter 210, which is relative wide, and recess depth 220, which is intermediately deep. Exemplary embodiment 3A/B has panel width 310, which of intermediate width, and recess depth 320, which is the deepest of the three exemplary embodiments. Exemplary embodiment 4A/B has panel diameter 410, which is the narrowest of the embodiments, and r3ecess depth 420, which is the shallowest depth of the three embodiments. To obtain a desired amount of material strengthening from corrugation, a combination of panel width 210, 310, or 410, for example, and recess depth 220, 320 or 420, for example, is selected to achieve a specific embodiment.

[0018] Corrugation strengthens materials. This is particularly true of laminar materials formed into a sheet or plane. A laminar product can use less of a material if the material is corrugated to provide lateral

strength. A bottle cap is a laminar product in which the sheet material, often steel or tin plate, is shaped to be affixed to the top of a bottle or other container. A standard pry-off or twist off cap has a thickness of material that is predominantly determined by considerations of leak prevention and the secureness of the attachment of the cap to the container.

[0019] Billions of bottle caps are used worldwide and the cost of the caps is largely determined by the amount of material required for the caps. Corrugation allows caps that use less material to have the equivalent strength of a standard thick crown. A corrugated crown is thinner, that is, it has a reduced gauge, in comparison to a standard bottle cap. An advantage of a reduced gauge cap is the money savings obtained by using less material.

[0020] Another advantage of a reduced gauge corrugated cap comes into play with innovated "pull-off" caps, which have a pull tab assembly attached to the crown as described in the related patent applications. The pull tab breaks the cap material and the crown is torn off the bottle using the pull tab. A reduced gauge cap facilitates the tear off because the cap material is thin and the tearing action is parallel to the direction of material strengthening provided by the corrugation and therefor the tearing force does not have to overcome the material strengthening of the corrugation. Corrugation

affords material strengthening perpendicular to the direction of corrugation.

[0021] In addition to the structures illustrated in the figures herein, it is understood that other structures will imbue a cap of the present disclosure with the advantages of corrugation and provide a reduced gauge crown for a bottle. For instance, concentric rings, which progress from the top of the skirt toward the center of the panel, and decorative shapes such as stars, brand logos, sports team logos, religious insignia, and the like, formed in the plane of the cap, are embraced in the present disclosure. [0022] Corrugation forms may be provided to a bottle cap by a variety means, including without limitation, metal stamping, pressing, embossing and so forth. Non-metal crowns of the present disclosure may be formed by injection molding for plastic crowns, or by other suitable means of production.

[0023] The crown caps 100 preferably are formed with steel of increased hardness compared with conventional crown caps presently in commercial production. For example, conventional crown caps are often formed of single reduced, T4, tinplate having a thickness of from 0.21 mm to 0.23 mm. Such tinplate has an average hardness (that is, the reported hardness value regardless of +/- variations) of approximately 61 on a 30T hardness scale, in accordance with ASTM 623. Crown caps 100 described

herein may be made thinner and lighter weight compared with the prior art, for example, crown caps 100 may be formed of a material having a thickness of about 0.16 mm to 0.18 mm that have the same or roughly equal performance as conventional, thicker caps. These decreases in metal usage are more easily achieved when the structure of crown caps 10 are made with steel having increased hardness. For example, the inventor has demonstrated the effectiveness of low gauge crowns having grooves using DR8 (according to ASTM 623) or DR550 (according to EN 10203). Optionally, the inventor surmises that other materials may be used, such as single reduced tinplate or like material having enhance tempering, tin-free steel having similar properties as those described herein, and the like.

[0024] The crown caps 100 preferably have an average hardness of greater than 62 on the 30T scale (conforming to ASTM 623), more preferably greater than about 65, more preferably greater than about 68, more preferably greater than about 71. The embodiments shown in FIG. 1 and FIG. 3A were demonstrated to be effective using steel having a hardness of 73. The upper limit of hardness is set by the maximum stress acceptable to the glass bottle during the crimping process or the spring back (which may tend to urge the crimped flanges toward an uncrimped state) associated with harder plate.

[0025] The crown caps 100 may be formed with conventional press equipment, with only minor changes to parts of the tooling to form the structure (such as the grooves, crosses, stars, and dimples). And crown caps 100 may be crimped with conventional equipment, only modified to have a smaller throat compared with existing, conventional crimpers.

[0026] Because hardness has a relationship to strength as reflected in the yield point, the aspect of the hardness of the crown may be expressed in yield point on a corresponding scale. For example, DR8 or DR550 tinplate may has a yield point (in a tensile test) of550 MEA. The inventor believes that the most advantageous crown cap has a combination of one or more of the structured described herein and harder plate as described herein. A crown of the present disclosure, however, encompasses crown caps that do not have all of the structure, materials, and/or advantages in this specification.

[0027] According to this description, commercially acceptable crown caps formed according to the present disclosure can be commercially made with up to 25 percent less steel compared with many conventional crown caps, which has corresponding advantages in carbon emissions. The savings in steel weight are approximately proportionate to the reduction in metal thickness. Further, even though energy required to cool an

individual crown is tiny, the energy required to cool the total number of crowns produced each year (approximately 45 billion in North America and approximately 300 billion throughout the world), and the corresponding reduction in that energy, is significant.

[0028] In addition to the various structures described herein, certain advantages over the prior art are bestowed on the present crown by the recommended specifications shown in Table 1.

TABLE 1

Items	Acceptable Range / Target
1. Appearance	Disc properly adhering White liner Complete liner Clean liner Clean crown and ring No rust and scratch for crown and ring Two cut lines on the downward surface of crown Rivet Crown
2. Dimensions	Thickness (mm): 0.24-0.28 Inside diameter (mm): 32.08 - 32.12 Outside diameter (mm): 26.60 - 26.90 Radius of angle (mm): 1.5 - 1.9 Number of angels: 21 Ring Diameter (mm): 21.1 - 21.5 Thickness (mm): 0.28 - 0.32 Liner Diameter (mm): 20.00 - 20.50
3. Rockwell Hardness	T4 on the Rockwell 30T scale
4. Secure Seal	Greater than/equal to 150 PSI for 1 minute
5. Finish Hardness	Should not scratch with "H" pencil

6. Sensory	No significant differences with an identified control after 12 weeks at 20 degrees C
7. Lubricant Migration	No particles or lubricant should be present
8.Simulated Palletizing	CO2 loss should not differ against control caps when stored for 1 week with max weight of 45 Kgs over each bottle
9. Corrosion	Maximum corrosion: slight to moderate
10. Odor	No off odors detected
11. Pulling Force of Ring (kg)	2.5kg
12. Composition of Material	Tinplate crown and ring; food class non-PVC for liner
13. Package	5000 Crowns per box
14. Pressure (kg)	10kg
15. Container Loading	1,000 Master Cartons
16. Printing	Logo/other design may be printed on the Easy Pull™ Cap
17. Crown Anti-Oxidation	Material used is "food grade" PET; clear, with no odor, 1.2 UM (micrometers)

[0029] In particular, a tinplate material which demonstrates an approximate hardness of T-4 on the Rockwell 30T Hardness Scale is preferred for the present cap (see item 3 in table 1). This may be contrasted against the prior art which typically uses tinplate having a hardness of K-3 on the Rockwell scale. The preferred softer tinplate material requires less force to

open and tear with the opener assembly of the present crown while still providing sufficient sealing of the container contents. For the purposes of this disclosure, tinplate refers the any material, including tin or tin alloys, from which a crown may be fabricated and does not necessarily mean that the crown is made from tin or a tin alloy.

[0030] The foregoing description is provided for the purpose of explanation and is not to be construed as limiting the invention. While the invention has been described with reference to preferred embodiments or preferred methods, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Furthermore, although the invention has been described herein with reference to particular structure, methods, and embodiments, the invention is not intended to be limited to the particulars disclosed herein, as the invention extends to all structures, methods and uses that are within the scope of the appended claims. Those skilled in the relevant art, having the benefit of the teachings of this specification, may effect numerous modifications to the invention as described herein, and changes may be made without departing from the scope and spirit of the invention as defined by the appended claims. Furthermore, any features of one described

embodiment can be applicable to the other embodiments described herein.

[0031] Such embodiments of the inventive subject matter may be referred to herein, individually and/or collectively, by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept if more than one is in fact disclosed. Thus, although specific embodiments have been illustrated and described herein, it should be appreciated that any arrangement calculated to achieve the same purpose may be substituted for the specific embodiments shown. This disclosure is intended to cover any and all adaptations or variations of various embodiments. Combinations of the above embodiments, and other embodiments not specifically described herein, will be apparent to those of skill in the art upon reviewing the above description.

[0032] In summary, the present disclosure describes a crown for a container opening. The crown has a top portion and an inner portion contiguous with the top portion. The inner is portion formed into a panel. An outer portion contiguous with the top portion is formed into a skirt that descends from the top portion. The crown has corrugation formed in the panel.

[0033] The present disclosure also contemplates methods for making the crown described above. Methods include the steps of shaping a sheet of crown material to provide a top portion and an inner portion contiguous with the top portion and formed into a panel. An outer portion contiguous with the top portion is formed into a skirt that descends from the top portion. The methods also include forming corrugation in the panel.

[0034] In specific embodiments the step of forming corrugation in the panel consists of forming a recess that descends from the top portion to the panel in the inner portion.

[0035] The Abstract of the Disclosure is provided to comply with 37 C.F.R. §1.72(b), requiring an abstract that will allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. In addition, in the foregoing Detailed Description, it can be seen that various features are grouped together in a single embodiment for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed embodiments require more features than are expressly recited in each claim. Rather, as the claims reflect,

inventive subject matter lies in less than all features of a single disclosed embodiment. Thus the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separate embodiment.

[0036] The description has made reference to several exemplary embodiments. It is understood, however, that the words that have been used are words of description and illustration, rather than words of limitation. Changes may be made within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the disclosure in all its aspects. Although description makes reference to particular means, materials and embodiments, the disclosure is not intended to be limited to the particulars disclosed; rather, the disclosure extends to all functionally equivalent technologies, structures, methods and uses such as are within the scope of the appended claims.

I claim:

1. A crown for a container opening, the crown having a top portion, an inner portion contiguous with the top portion and the inner portion being formed into a panel, an outer portion contiguous with the top portion, the outer portion being formed into a skirt that descends from the top portion, the crown comprising corrugation formed in the panel.

2. The crown of claim 1, wherein the corrugation comprises a recess that descends from the top to the panel.

3. The crown of the claim 1, wherein the corrugation comprises one or more shapes formed in the panel.

4. The crown of claim 1, wherein the crown is lightweight.

5. A method for making a crown for a container, the method comprising:

i. Shaping a sheet of crown material to provide a top portion, an inner portion contiguous with the top portion and formed into a panel, and an outer portion contiguous with the top portion and formed into a skirt that descends from the top portion; and

ii. forming corrugation in the panel.

6. The method of claim 5, wherein the step of forming corrugation in the panel consists of forming a recess that descends from the top portion to the panel in the inner portion.

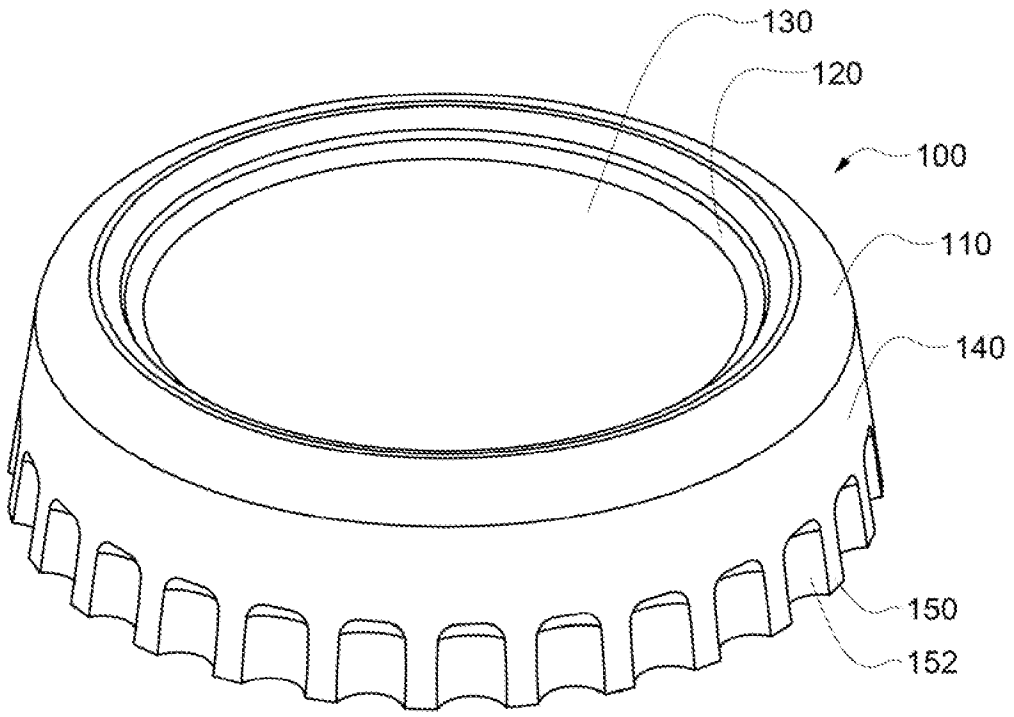


FIG. 1

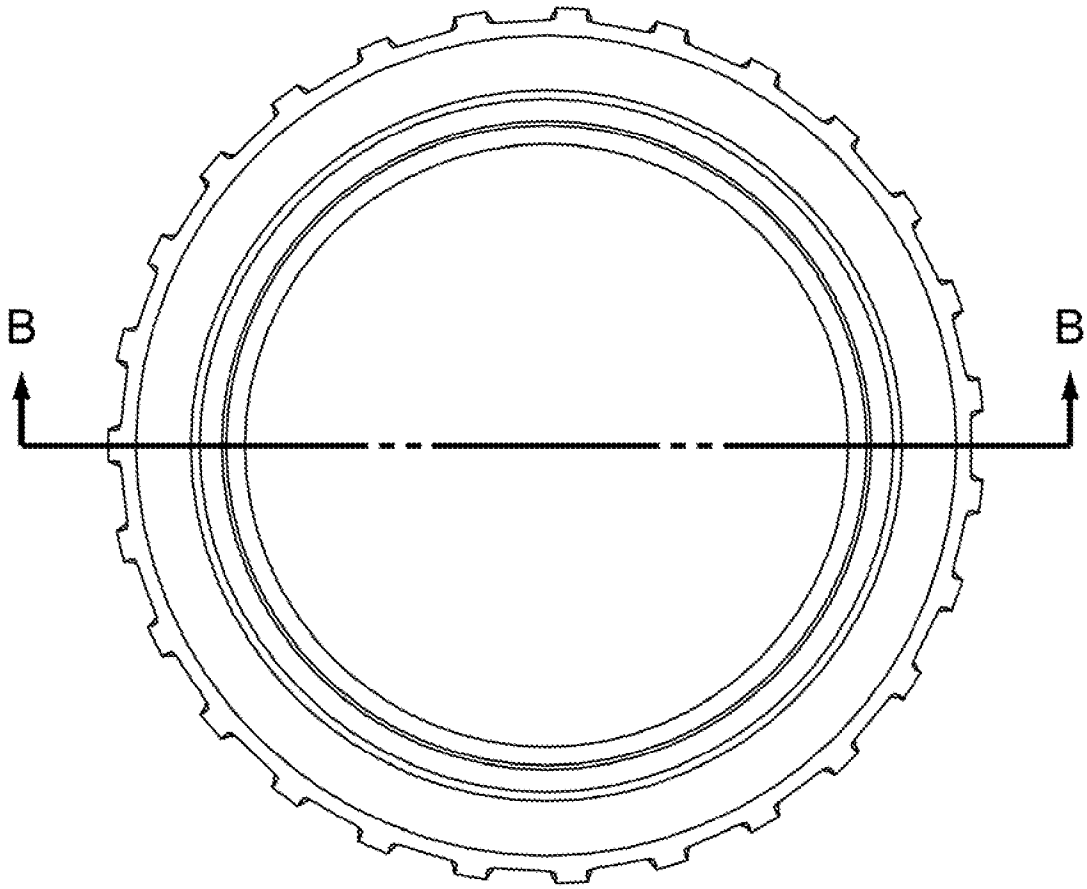


FIG. 2A

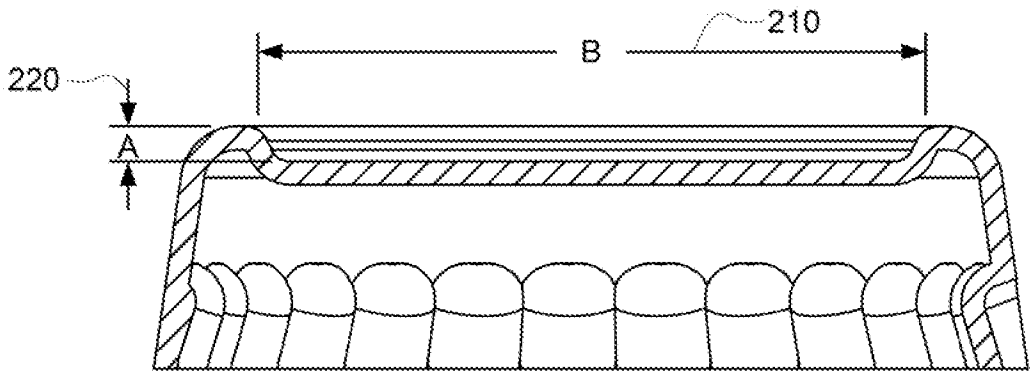


FIG. 2B

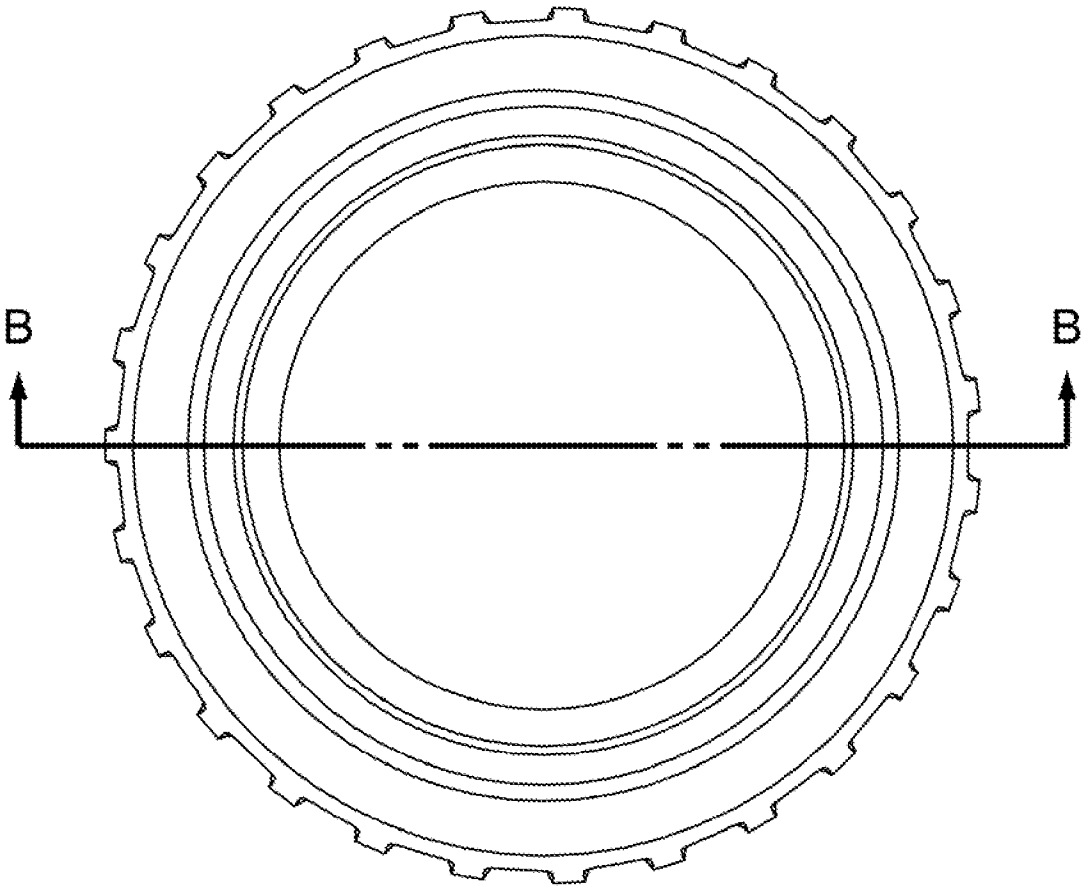


FIG. 3A

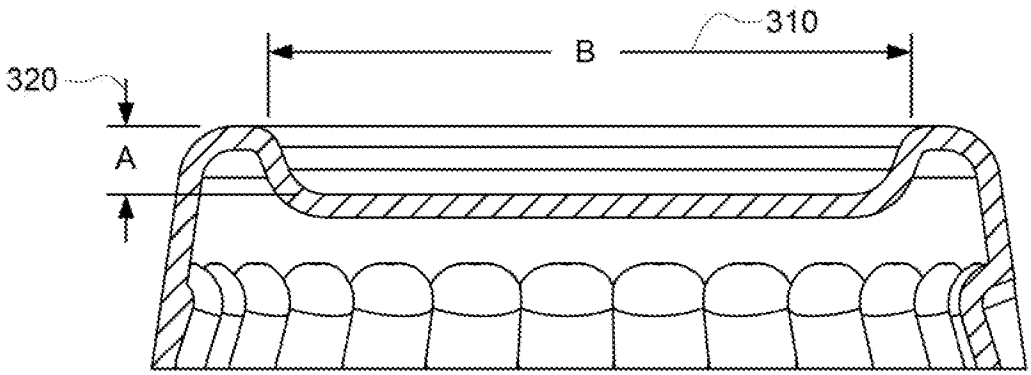


FIG. 3B

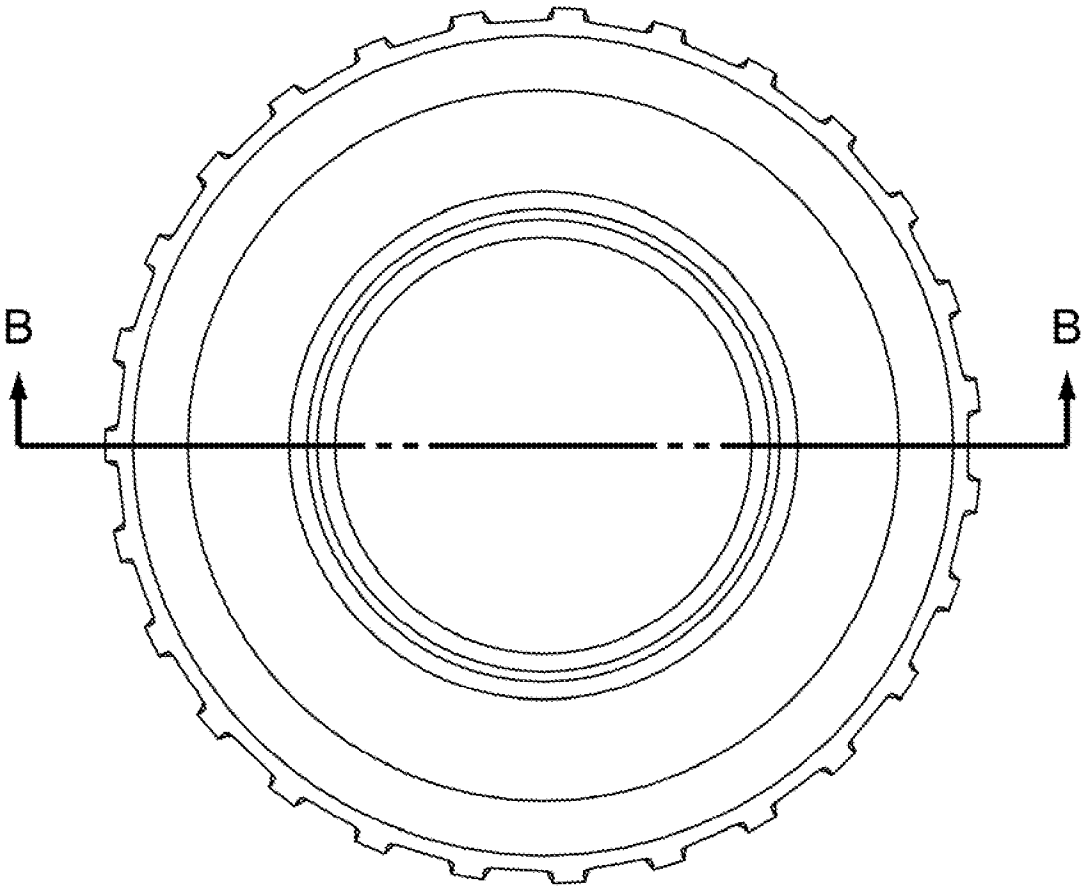


FIG. 4A

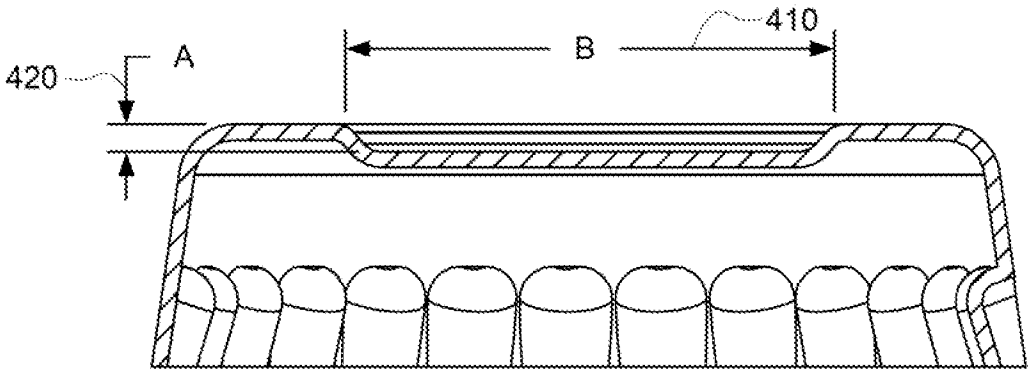


FIG. 4B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/47949

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65D 41/12 (2012.01)
USPC - 215/328
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): B65D 41/12 (2012.01)
USPC: 215/328

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 215/316, 328; 220/200

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; Google/Patents; Google/Web; EPO Espacenet
Search terms: Cap, closure, crown, lid, bottle, jar, container, receptacle, skirt, flange, corrugated, rib, fluted, wavy, wave, undulate, ripple, light, weight, less, reduce, minimize, material, top, topside, covering

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2,327,455 A (PUNTE) 24 August 1943 (24.08.1943), col 1, lns 1-9, 28-33; Figs. 1, 3	1-6
X	US 2,233,904 A (WAGNER) 04 March 1941 (04.03.1941), col 1, lns 1-2; col 2, lns 29-38; Figs. 1, 2	1-3, 5, 6
A	GB 599,704 A (CROWN CORK) 18 March 1948 (18.03.1948), Figs. 18, 19, 21	1-6
A	FR 322,592 A (BATCHELDER) 09 February 1903 (09.02.1903), Figs. 4-6	1-6
A	DE 1,038,934 B (ISELE-AREGGER) 11 September 1958 (11.09.1958), Fig. 1	1-6
A	US 3,207,350 A (HAGMANN et al.) 21 September 1965 (21.09.1965), Fig. 1	1-6
A	US 3,122,253 A (HAGMANN et al.) 25 February 1964 (25.02.1964), Figs. 8a, 13, 14a, 14b	1-6
A	US 1,639,857 A (PLANSKI) 23 August 1927 (23.08.1927), Figs. 1, 2	1-6
A	US 800,867 A (MULVANEY) 03 October 1905 (03.10.1905), Figs. 1-4	1-6

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 October 2012 (16.10.2012)	05 NOV 2012

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774