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(54) CAPSULE FOR USE WITH A BEVERAGE PRODUCTION MACHINE

(57) A capsule body is adapted for containing one or more beverage ingredients for use in a beverage preparation machine. The capsule body includes a base body having side walls defining a cavity for receiving the one or more beverage ingredients, a flange-like rim extending from the side walls and a sealing member adapted to provide a sealed engagement between the capsule body and the beverage preparation machine. The side walls include an inner surface facing the cavity defined by the side walls and an outer surface facing the beverage preparation machine in use. The sealing member is positioned on a surface of the flange like rim that extends from the inner surface of the side walls.

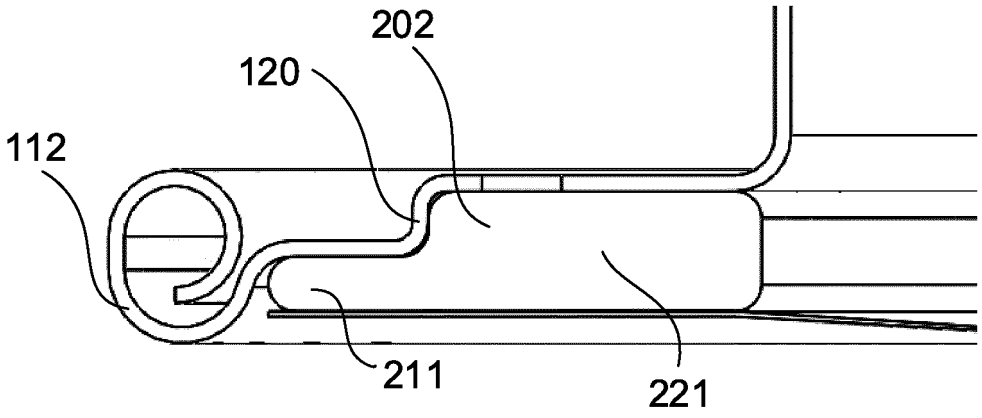

FIG. 9C

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Description

FIELD AND BACKGROUND OF THE INVENTION

[0001] The present invention, in some embodiments thereof, relates to a single use capsule for preparation of a beverage with a beverage production machine and, more particularly, but not exclusively, to a capsule composed of aluminum sheet.

[0002] Single use capsules containing compacted ground coffee, tea and/or other ingredients are known for use in certain coffee preparation machines which are generally termed "espresso" machines. Capsules of this type generally include a capsule body containing the compacted ground coffee and/or other ingredients and a membrane and/or cover such as aluminum foil that seals the capsule body. Typically, the capsule body is shaped as an acute truncated cone with a rim, and the membrane is attached to the rim to seal the capsule. The body of the capsule is typically made from either aluminum or plastic. When aluminum sheet is used, the inside of the capsule is typically coated with a thin layer of a thermoplastic material that is used to thermo-seal the membrane to the rim and to provide a barrier between the aluminum and content of the capsule. Typically, the membrane includes a similar coating and/or lacquer.

[0003] During use in an "espresso" machine, the capsule is placed in a chamber where it is typically pierced on two opposing faces and hot water is passed through the capsule at relatively high pressure and temperature, thereby extracting the aromatic constituents from the ingredients to produce the beverage. Typically, during operation of the "espresso" machine, the rim of the capsule is pressed with a rim of the machine chamber against a capsule holder to form a sealed engagement. The sealed engagement with the capsule holder is typically used to insure that all of the hot water is passed through the capsule for preparation of the coffee beverage and to prevent leakage around the capsule.

[0004] U.S. Patent No. 4,136,202 entitled "Capsule for beverage preparation," the content of which is incorporated herein by reference describes a capsule containing a substance for making up a drink using an apparatus. The capsule includes a body having the general shape of an acute truncated cone with a rim and a membrane positioned over the rim to seal the capsule body. It is described that the body of the capsule is composed of aluminum sheet between 60 and 110 micrometers thick, preferably 80 micrometers with the membrane composed of aluminum, preferably between 30 and 60 micrometers thick.

[0005] European Patent No. 1,654,966 entitled "Capsule with sealing means," the content of which is incorporated herein by reference describes a capsule that contains beverage ingredients such as ground coffee, tea or other ingredients. The capsule is configured for insertion in a beverage production machine (or device) in order to have a liquid under pressure enter the capsule and interact with the ingredients in the capsule. The capsule includes a base body and a foil member closing the base body by being attached to a flange-like rim extending from the side wall of the base body of the capsule. The outer surface of the base body of the capsule includes a resilient sealing member, the sealing member being designed to be in sealing engagement with an enclosing member of the beverage production machine. The sealed engagement assures that all liquid flow is through the interior of the capsule during preparation of the beverage.

SUMMARY OF THE INVENTION

[0006] According to an aspect of some embodiments of the present invention, there is provided a capsule body including a sealing member designed to be in sealing engagement with an enclosing member of the beverage production machine. The capsule body typically includes a base body with side walls into which contents, such as coffee, is introduced, and a flange-like rim extending from the side wall. The flange-like rim is typically not in contact with contents contained in the capsule body and is external to a cavity defined by the side walls, e.g. its extends out from the cavity. A capsule includes the capsule body and a membrane or lid that encloses the capsule body. According to some embodiments of the present invention, the sealing member is mounted on the flange-like rim on a surface of the flange that extends from an inner portion and/or surface of the capsule body. The inner surface of the capsule body is the surface that faces content stored in the capsule while an outer surface faces the beverage production machine. According to some embodiments of the present invention, the flange includes one or more holes and/or slots for exposing the sealing member from an outer portion and/or surface of the flange and/or for improving a seal between the flange and the enclosing member of the beverage production machine. The outer surface of the flange is the surface of the flange that extends from the outer surface of the capsule body that comes in to contact with the rim of the enclosing member of the beverage production machine. Alternatively or additionally, the flange includes one or more cuts and/or slits for weakening a portion of the flange outer surface and thereby improving a seal between the flange (including the sealing member) and the enclosing member of the beverage production machine.

[0007] An aspect of some embodiments of the present invention provides for a capsule body adapted for containing one or more beverage ingredients for use in a beverage preparation machine including: a base body having side walls defining a cavity for receiving the one or more beverage ingredients, wherein the side walls include an inner surface facing the cavity defined by the side walls and an outer surface facing the beverage preparation machine in use, a flange-like rim extending from the side walls; and a sealing member adapted to provide a sealed engagement between the capsule body and the

beverage preparation machine; wherein the sealing member is positioned on a surface of the flange like rim that extends from the inner surface of the side walls.

[0008] Optionally, the side walls are shaped as an acute truncated cone.

[0009] Optionally, the flange-like rim is formed with one or more slots and/or slits.

[0010] Optionally, the one or more slots extend in a circumferential direction around the flange-like rim.

[0011] Optionally, the one or more slots provides an opening that is 0.3 mm - 1 mm wide.

[0012] Optionally, the slots are separated by bridge components formed from material forming the capsule body.

[0013] Optionally, the one or more slits extend in a radial direction of the flange-like rim.

[0014] Optionally, the one or more slits are micro precuts or stamping marks.

[0015] Optionally, a plurality of slits extends from the slots in a radial direction.

[0016] Optionally, the plurality of slits extend from an edge of the slot that is distal to the side walls.

[0017] Optionally, the capsule body is formed from aluminum sheet.

[0018] Optionally, the aluminum sheet on at least a portion of the flange like rim is 50-150 μm.

[0019] Optionally, at least one surface of the aluminum sheet is laminated with a polymer material.

[0020] Optionally, the capsule body includes slots separated by bridge components, wherein the bridge components are from by the polymer material laminated on the aluminum.

[0021] Optionally, the sealing member is ring shaped.

[0022] Optionally, the sealing member has an 'L' shaped cross-section.

[0023] Optionally, the 'L' shaped cross-section includes a first leg and a second leg and wherein the hardness of the first leg is different that of the second leg.

[0024] Optionally, one leg of the sealing member is fitted along the inner surface of the side walls.

[0025] Optionally, the hardness of the one leg fitted along the inner surface of the side walls is more than that of the leg fitted on the flange-like rim.

[0026] Optionally, the sealing member has step shaped cross-section formed with an inner ring portion and an outer ring portion, wherein the inner ring portion is thicker than the outer ring portion.

[0027] Optionally, the sealing member is formed with a first layer overlaid on a second layer, wherein the first layer is formed from material selected to be softer than the second layer.

[0028] Optionally, the inner ring includes both the first layer and the second layer and wherein the outer ring portion is formed from the material of the second layer.

[0029] Optionally, the sealing member extends from an edge between the flange-like rim and the side walls to a curl in on outer edge of the flange.

[0030] Optionally, the sealing member is formed from a polymer material.

[0031] Optionally, the sealing member is applied on the flange-like rim as a liquid and cured in place.

[0032] Optionally, the sealing member is partially exposed through the flange-like rim.

[0033] Optionally, the sealing member is color coded to provide indication regarding the contents of the capsule.

[0034] An aspect of some embodiments of the present invention provides for a capsule for use in a beverage preparation machine, the capsule adapted for containing one or more beverage ingredients, the capsule including: a capsule body as described herein above; a membrane adapted to be positioned over the flange-like rim and thereby enclose the cavity defined by the capsule body; wherein the sealing member is positioned between the flange like rim and the membrane adapted to enclose the cavity defined by the capsule body.

[0035] Optionally, the capsule includes coffee.

[0036] Optionally, the capsule includes an additional layer between the sealing member and the flange-like rim.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0037] Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description taken with the drawings makes apparent to those skilled in the art how embodiments of the invention may be practiced.

[0038] In the drawings:

FIG. 1 is a schematic perspective view of an exemplary capsule body including an internal sealing member in accordance with some embodiments of the present invention;

FIGs. 2A and 2B are schematic top and bottom perspective views respectively of an exemplary sealing member in accordance with some embodiments of the present invention;

FIGs. 3A and 3B are a schematic perspective view and a detailed cross-sectional view respectively of an exemplary capsule body including a first pattern of slots in accordance with some embodiments of the present invention;

FIGs. 4A and 4B are a schematic perspective view and detailed cross-sectional view respectively of an exemplary capsule body including a second pattern of slits in accordance with some embodiments of the present invention;

FIGs. 5A and 5B are a schematic cross sectional view of an exemplary capsule placed in an enclosing member of a beverage production machine and a

detailed schematic cross-sectional view of enclosing member engaging the sealing member of the capsule in accordance with some embodiments of the present invention;

FIGs. 6A and 6B are a schematic cross-sectional view of an exemplary capsule body including an internal sealing member and a detailed schematic cross-sectional view of the sealing member in accordance with some embodiments of the present invention;

FIGs. 7A and 7B are a perspective view and top view of another exemplary capsule body in accordance with some embodiments of the present invention;

FIGs. 7C and 7D are a top view and detailed view of another exemplary capsule body in accordance with some embodiments of the present invention;

FIG. 8 is a schematic cross-sectional view of a bridge formed between slots on a rim of an exemplary capsule body shown in accordance with some embodiments of the present invention;

FIGs. 9A, 9B, 9C and 9D are simplified schematic cross-sectional views of exemplary rim and sealing member arrangements in accordance with some embodiments of the present invention;

FIGs. 10A and 10B illustrate a sealing member formed from a single material and a sealing member formed with two different materials respectively in accordance with some other embodiments of the present invention; and

FIG. 11 is a simplified flow chart of an exemplary method for forming sheet material with slots or slits for use in producing a capsule body in accordance with some embodiments of the present invention.

DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

[0039] The present invention, in some embodiments thereof, relates to a single use capsule for preparation of a beverage with a beverage production machine and, more particularly, but not exclusively, to a capsule composed of aluminum sheet.

[0040] According to some embodiments of the present invention, the capsule is formed of a body into which contents, such as coffee, is introduced and a flange-like rim extending from a side wall of the body. The surface of the capsule or side walls facing the contents is referred herein as an inner surface and the surface facing a beverage production machine (in use) is referred herein as an outer surface of the capsule body or side walls. Likewise, the surface of the flange-like rim extending from the inner surface of the capsule body is referred herein as an inner surface of the flange and the surface of the flange-like rim extending from the outer surface of the side walls is referred herein as an outer surface of the flange.

[0041] According to some embodiments of the present invention, a capsule includes a sealing member positioned on an inner surface of a wall and flange-like rim, e.g. rim and/or flange of the capsule. According to some embodiments of the present invention, the sealing member provides a sealed engagement between the capsule body and an enclosing member of a beverage production machine.

[0042] According to some embodiments of the present invention, the sealing member is held and/or positioned on an inner surface of the flange-like rim, optionally between the flange-like rim of the capsule body and the membrane for enclosing the capsule body. According to some embodiments of the present invention, the flange-like rim includes a pattern of slits for weakening the flange-like rim and/or slots for exposing the sealing member through the rim. Optionally, the slots are at least partially formed while drawing a shape of the capsule body.

[0043] In some exemplary embodiments, the sealing member is shaped as a flat ring. Optionally, the sealing member has an 'L' shaped cross-section and fits on an edge between the flange and inner wall of the capsule body. In some exemplary embodiments, a diameter of the capsule side walls around the sealing member is extended forming a step-like protrusion in the side walls. The step-like protrusion may be smaller or larger than the sealing member filling it. Optionally, the step-like protrusion is filled by the sealing member such that the inner side of the base body does not comprise a step when the sealing member is provided to it. Alternatively, the sealing member is thicker than the extension of the diameter of the step-like protrusion such that the sealing member causes a step-like inner protrusion in the side walls. In some exemplary embodiments, the sealing member is a ring with a step shaped cross-section and the flange includes a corresponding elevated section or bulge for receiving the sealing member thereunder. Typically, the step in the step shaped cross-section that is configured to be positioned on the flange is wider in width and shorter in height as compared to the 'L' shaped cross-section that is configured to fit on an edge between the flange and inner wall of the capsule body. Optionally, a portion of the ring near its inner diameter is thicker than a portion near its outer diameter. According to some embodiments of the present invention, a portion of the flange that overlaps with the sealing member is elevated and/or raised as compare to other portions of flange. Optionally, the sealing member is fitted under the elevated portion of a flange-like rim. Optionally, the elevated section extends to the sidewalls. In some exemplary embodiments, the sealing member may have 'L' shaped cross-section with a step on one leg of the 'L' shape. The 'L' shaped cross-section may fits on an edge between the flange and inner wall of the capsule body and the step may fitted under the elevated portion of a flange-like rim.

[0044] Typically, the sealing member is formed from a polymer material. Optionally, the polymer material is an elastomer, a polymer with elastic properties and/or a polymer that is deformable. Optionally, the polymer material is defined to be soft so that it protrudes through the slots

and/or slits formed on the flange. Alternatively, the polymer material is not deformable. Optionally, for an 'L' shaped cross section, a portion of the ring that sits around the inner side walls of the capsule body is formed from a material that is harder than a material used to form a portion of the ring that sits on the flange. Optionally, the sealing member is formed of a layered material having different properties. Optionally, a first layer overlaid on the flange-like rim is formed from a material that is softer than a material used to form a second layer overlaid on the first layer.

[0045] Reference is now made to FIG. 1 showing a schematic perspective view of an exemplary capsule body including an internal sealing member in accordance with some embodiments of the present invention. Typically, capsule body 100 is shaped as an acute truncated cone. According to some embodiments of the present invention, a capsule body 100 includes a base 105, side walls 110 extending from base 105 and a flange 115 extending from the side walls 110. Capsule body 100 includes an inner surface 111 in contact with the ingredients and an outer surface 113. According to some embodiments of the present invention, sealing member 200 is fitted and/or positioned on an inner surface of the flange, e.g. on the side of flange extending from an inner surface of capsule body 100. Optionally, sealing member 200 does not extend to the edge of flange 115, e.g. the edge that is distal to side walls 110.

[0046] Typically, sealing member 200 is ring shaped and sized to fit on flange 115 and/or around an edge between flange 115 and side walls 110. In some exemplary embodiments, capsule body 100 is made from aluminum. Optionally, capsule body 100 is formed from aluminum sheet, e.g. with about 100 μm thickness. Optionally, the aluminum sheet is formed from a laminated material. According to some embodiments of the present invention, sealing member 200 is a polymer. Typically, the polymer is defined to have properties, e.g. hardness and/or elasticity that are suitable for forming a sealed connection with a rim of the enclosing member of the beverage production machine in response to force and/or pressure. According to some embodiments, sealing member 200 is formed with a material that has a hardness of around SHORE 15A to 70A, e.g. 20A.

[0047] Reference is now made to FIGs. 2A and 2B showing simplified schematic top and bottom perspective views respectively of an exemplary sealing member in accordance with some embodiments of the present invention. In some exemplary embodiments, sealing member 200 includes a first ring section 210 that sits flat against a surface of flange 115 and another ring section 220 that sits flat against inner surface 111 of side walls 110. In some exemplary embodiments, ring 210 is defined to have a 300-800 μm thickness and/or 400-650 μm thickness. Optionally, ring section 210 has a different thickness and/or width than ring section 220. In some exemplary embodiments, sealing member 200 is formed from a single material. In some exemplary embodiments, sealing member 200 is formed from more than one material and/or one or more layers of material. Optionally, ring section 220 is formed with material and/or with properties that is harder than the material and/or properties of ring section 210.

[0048] In some exemplary embodiments, sealing member 200 is formed from a thermoplastic polymer such as polyethylene (PE), polypropylene (PP), polyamide (PA) and Polyethylene terephthalate (PET). Optionally, sealing member 200 is formed from a thermoplastic elastomer (TPE), a blend of thermoplastic polymers and thermoplastic elastomers, or plastomer. Optionally, sealing member 200 formed from a polymer compound that has a high barrier property against oxygen and moisture. Optionally, sealing member 200 is deformable under pressure. Optionally, the deformable and/or elastic properties of sealing member 200 provides for establishing a fluid seal when engaging an enclosing member of a beverage production machine. Optionally, sealing member 200 is colored, e.g. color coated according to the contents of the capsule. According to some embodiments of the present invention, sealing member is sandwiched between flange 115 and a layer of aluminum or other material that seals the capsule body and provides barrier against oxygen and moisture.

[0049] Reference is now made to FIGs. 3A and 3B showing a schematic perspective view and a detailed cross-sectional view respectively of an exemplary capsule body including an exemplary pattern of slots in accordance with some embodiments of the present invention. According to some embodiments of the present invention, capsule body 100 includes one or more slots 151 formed on flange 115 from which sealing member 200 is exposed. Slots 151 are shown more clearly in detailed view 30 (FIG. 3B). According to some embodiments, slots 151 are elongated slots extending along a circumferential direction of flange 115. Optionally, slots 151 are defined to substantially expose sealing member 200. Optionally, 2-6 slots 151 are used in a capsule, e.g. 4 slots 151. Alternatively, slots 151 may be formed from a pattern of round or elongated holes. In some exemplary embodiments, width of slots 151 are defined to fully accommodate a surface with which sealing member is to form a seal, e.g. width of slots 151 are defined to be wide enough to fit within the rim of the beverage production machine that contacts the flange. Optionally, width of slots 151 is between 0.3 mm - 1 mm, e.g. 0.4 mm.

[0050] According to some embodiments of the present invention, sealing member 200 has an 'L' shaped cross-section. Typically, the 'L' shaped cross-section helps prevent leakage through slots 151 near an edge between flange 115 and side walls 110. In some exemplary embodiments, a membrane for sealing contents of capsule body 100 is adhered to the 'L' sealing member 200. Typically, 'L' sealing member 200 also provides for increasing the structural stability of capsule body 100 around an edge between flange 115 and side walls 110.

[0051] Reference is now made to FIGs. 4A and 4B

showing a schematic perspective view and detailed cross-sectional view respectively of an exemplary capsule body including an exemplary pattern of slits in accordance with some embodiments of the present invention. According to some embodiments of the present invention, capsule body 101 includes one or more slits 152 formed on flange 115 through which sealing member 200 is exposed. Slits 152 are shown more clearly in detailed view 32 (FIG. 4B). Optionally slits 152 are arranged on flange 115 in a radial direction. In some exemplary embodiments, slits 152 are relatively narrow slits that are designed to provide substantially a minimum amount of exposure. Optionally slits 152 are elongated slits extending perpendicular to a circumferential direction of flange 115. Optionally, slits 152 instead provide for weakening the aluminum surface for increasing surface deformation when pressure is applied. Optionally, slits 152 are formed from micro precuts and/or stamping marks. Typically, slits 152 serve as a better barrier against oxygen and moisture penetration through capsule body 101 as compared to slots 151. Optionally, a thickness of the material used to form flange 115 is made substantially small, e.g. as thin as possible, to improve a seal with a surface pressing against flange 115. Optionally, the hardness of sealing member 200 is adapted, e.g. made softer to provide an adequate seal via slits 152 in flange 115. Optionally, flange 115 includes both slits 152 and slots 151. Optionally, slits extend in a different direction than shown, for example in a circumferential direction or at an angle.

[0052] Reference is now made to FIGs. 5A and 5B showing a schematic cross sectional view of an exemplary capsule placed in an enclosing member of a beverage production machine and a detailed simplified schematic cross-sectional view of the enclosing member engaging the sealing member of the capsule in accordance with some embodiments of the present invention. According to some embodiments of the present invention, an enclosing member 300 of a beverage machine 390 is operative to press surface 310 of enclosing member 300 against flange 115 to form a sealed engagement. The sealed engagement with enclosing member 300 is typically used to insure that all of the hot water introduced through base 105 of capsule 100 is passed through capsule 100 for preparation of the coffee beverage and to prevent leakage of the hot water around capsule 100. Enclosing member 300 also provides for pressing capsule 100 toward a capsule holder 320. Capsule holder 320, typically includes protruding members 325 that pierce through a membrane 190 for extracting the fluid from capsule 100.

[0053] Typically, membrane or lid 190 is composed of an aluminum foil that is between 30 and 60 micrometers thick. In some exemplary embodiments, an inner surface membrane 190 is coated with a polymer coating or lacquer, e.g. a thermoplastic lacquer. Typically, polymer coating or lacquer provides for thermo-sealing membrane 190 to sealing member 200. Typically, membrane 190 extends toward a flange curl and covers sealing membrane 200. Alternatively, sealing member 200 extends beyond membrane 190 so that sealing member 200 is visible once capsule body 100 is enclosed.

[0054] Typically, a ring shaped surface 310 of enclosing member engages flange 115 of capsule 100. In some exemplary embodiments, a width 70 of slots 151 is defined to accommodate surface 310 and/or to provide substantial and/or adequate engagement of surface 310 with sealing element 200. Typically, sealing member 200 has a width that exceeds width 70. Typically, a thickness 60 of sealing element 200 is also defined to provide adequate sealing between surface 310 and sealing element 200 in response to pressure applied by surface 310. Optionally, sealing member 200 is 300-800 μm thick.

[0055] Reference is now made to FIGs. 6A and 6B showing a schematic cross-sectional view of an exemplary capsule including an internal sealing member and a detailed simplified schematic cross-sectional view of a portion of the capsule around the sealing member in accordance with some embodiments of the present invention. According to some embodiments of the present invention, flange 115 includes a step 120, e.g. an elevated portion accommodating ring 210 of sealing member 200 thereunder. In some exemplary embodiments, step 120 provides for improving the sealed connection with enclosing member 300. Optionally, elevating a portion of flange 115 that is designed to make a seal insures that enclosing member 300 contacts that portion, e.g. sealing member 200 prior to coming in contact with other surrounding surfaces that may obstruct proper engagement with sealing member 200. Optionally, sealing member 200 is fully accommodated under step 120 and does not extend out of step 120.

[0056] In some exemplary embodiments, a diameter of the capsule side walls around the sealing member bulges or is extended to form a step-like protrusion 130 in the side walls. In some exemplary embodiments, step-like protrusion 130 of the side walls improves structural strength of the capsule walls after being weakened by slots 151 or slits 152. Typically, step-like protrusion 130 is useful for providing some extra room from sealing ring 200. The extra diameter may help prevent obstruction of water flow in the cavity of the capsule and also help ease assembly of sealing member 200. In some exemplary embodiments, step-like protrusion 130 is sized and shaped to improve the ease in which the capsule bodies can be unstacked in a production site by avoiding conical locking. Typically, the step-like protrusion reduces contact between capsules to substantially a narrow ring defined by an upper surface of the step-like protrusion. Typically, sealing member fills the volume defined by step-like protrusion 130.

[0057] Reference is now made to FIGs. 7A and 7B showing a perspective view and top view of another exemplary capsule body in accordance with some embodiments of the present invention. Capsule 102 may have a plurality of grooves or indentations 118 each extending longitudinally and the plurality distributed around a cir-

cumference of outer surface 113. Typically, capsules 102 are delivered in stacks after manufacturing. Optionally, 6-15 grooves, e.g. 12 are distributed around side walls 110. In some exemplary embodiments, a slot 153 along flange 115 extends circumferential direction and divides flange 115 into an inner rim section 115B and an outer rim section 115A. Slot 153 optionally includes a plurality of polymer bridges 154 each extending in a radial direction that may hold inner rim 115B and outer rim 115A together until a sealing member is adhered to an inner surface of flange 115. Optionally, flange 115 is 2.5-3.5 mm, e.g. 3.3 mm wide and slot 153 is 0.5-0.1 mm wide. Optionally, bridges 154 are formed from material coated or laminated on the aluminum sheet of capsule body 102. Prior to a drawing process, bridges 154 may include aluminum that may break or separate during the drawing process. The coating or laminated layer on the aluminum may stay intact due to its superior elastic properties. Alternatively, the bridges are also formed of aluminum.

[0058] Optionally, sealing member 200 maintains connection between outer rim section 115A and the capsule body for example after use of the capsule.

[0059] Reference is now made to FIGs. 7C and 7D showing a top view and detailed view of another exemplary capsule body in accordance with some embodiments of the present invention. According to some exemplary embodiments, capsule 103 may be similar to capsule 102 and may include a plurality of slits 152 that extend from slot 153. In some exemplary embodiments, slits 152 extend in radial directions from slot 153. Typically, slits 152 extend out from an outer diameter of slits 152 toward edge of flange 115, e.g. toward curl 112. Optionally, slits 152 are 0.7 mm long and extend from slot 153 with a distance of 2 mm between.

[0060] Reference is now made to FIG. 8 showing a schematic cross-sectional view of a bridge formed between slots on a rim of an exemplary capsule body shown in accordance with some embodiments of the present invention. A bridge 154 may be formed from PP laminated layer or coating on aluminum sheet forming flange 115. Optionally, bridge 154 may have a thickness 154 of about 0.03 mm as compared to a thickness 116 of about 0.12 mm of the aluminum with PP laminate. A sealing member 200 positioned under flange 115 and may have a thickness of 0.7-1.1 mm, e.g. 0.8 mm. Typically, lid 190 is attached to flange 115 via sealing member 200 and has a thickness of between 0.03 and 0.06 mm.

[0061] Reference is now made to FIGs. 9A, 9B, 9C and 9D showing simplified schematic cross-sectional views of exemplary rim and sealing member arrangements in accordance with some embodiments of the present invention. Typically, a width of a sealing member, e.g. sealing membrane 200, 201, 202 or 203 is defined to be significantly larger than a width of slot 153 to avoid or minimize oxygen and moisture permeability through slot 153 due to possible misalignment between the elements. Referring now to FIG. 9A, optionally sealing member 201 is shaped as a flat ring and has a width of about 2 mm. Optionally, sealing member 201 extends from an edge between side wall 110 and flange 115 to a curl 112 of the aluminum sheet and fits into step 120 form of flange 115. Referring now to FIG. 9B, optionally, step 120 is displaced from curl 112 by around 1 mm and slot 153 with sealing member 201 is positioned on step 120. In FIG. 9C, a stepped shape sealing member 202 is used to cover both an area under step 120 and to extend toward curl 112. This embodiment may provide maximum protection against leakage and possible permeation of oxygen and moisture around slot 153. Optionally, and outer section of sealing member 202 is thinner than an inner portion of sealing member 202.

[0062] Referring now to FIG. 9D, in some exemplary embodiments, sealing member 203 is formed from two materials 203A and 203B. Material 203A may typically be selected to be harder than material 203B. Optionally, material 203A may be selected to have a hardness of between 50-70 SHORE D while material 203B may be selected to have a hardness of 40-60 SHORE A. Hardness of material 203A may provide adequate rigidity to facilitate assembling the sealing member 203 onto capsule 103. Hardness of material 203A may also provide improved sealing against oxygen and moisture penetration through the seal. Lower density material 203B may be suitable for providing a seal between capsule 103 and enclosing member 300 of a beverage machine 390 (FIG. 5A).

[0063] Reference is now made to FIG. 10A and 10B showing a sealing member formed from a single material and sealing member formed with two different materials respectively in accordance with some other embodiments of the present invention. In some exemplary embodiments, sealing member 202 includes an outer ring 211 that is thinner than an inner ring 221. Optionally, outer ring 211 has a thickness of about 0.4, e.g. 0.2-0.6 mm and inner ring 221 has a thickness of about 0.9 mm, e.g. 0.7-1.1 mm. Optionally, a width of inner ring 221 is greater than a width of outer ring 211. Inner ring 221 may have a width of about 2.5 mm, e.g. 2-3mm and outer ring 211 may have a width of about 1.5 mm, e.g. 1.2-2 mm.

[0064] Referring now to FIG. 10B, in some exemplary embodiments, sealing member 203 is formed from a first material 203A and second material 203B. Sealing member 203 may be formed for example with a 2K injection molding process or with an overmolding process. Typically, inner ring 221 layered with softer material 203B overlaid on harder material 203A while outer ring 211 is predominantly formed with harder material 203A.

[0065] Reference is now made to FIG. 11 showing a simplified flow chart of an exemplary method for forming sheet material with slits and/or slots for use in producing a capsule body in accordance with some embodiments of the present invention. According to some embodiments of the present invention, capsule body is formed from aluminum sheet. Optionally, the aluminum sheet has a thickness of between 50-150 μm, e.g. 100 μm. According to some embodiments of the present inven-

tion, the aluminum sheet is wound out (block 410). Optionally, one or both surfaces of the aluminum sheet that is used is laminated, coated and/or lacquered with a thin coating of polymer and/or lacquer e.g. that has a thickness of 20-50 micrometers, e.g. 30 micrometers. Optionally, a coated surface when provided is used as the inner side walls of the capsule body to provide separation between the contents of the capsule and the aluminum. Optionally, both sides are coated, e.g. the outside is coated for color. According to some embodiments of the present invention, a deep drawing process is used to form the capsule body (block 415). Once the shape is formed, holes are punched out or cuts are made in defined locations to form slots 151, slits 152, or slot 153 respectively (block 420).

[0066] According to some embodiments of the present invention, the sealing member is installed on the capsule body after forming the capsule body shape (block 425). Typically, the sealing member is manufactured separately and then positioned on the capsule body. Optionally, the sealing member is adhered with the capsule body. Alternatively, the sealing member can be applied on the capsule body as a liquid and cured in place.

[0067] According to some embodiments of the present invention, the capsule body is filled with a desired content (block 435) and then the membrane for enclosing the capsule body is adhered to the sealing member (block 440). Typically, the filling and closing of the capsule body is performed separately from the manufacturing of the capsule body.

[0068] It is noted that although only one exemplary slot pattern and one exemplary slit pattern are disclosed, the invention is not limited in this respect and the present invention can be applied to different slots, cuts and/or slit patterns for exposing and/or creating a sealed engagement with an enclosing member of a beverage production machine.

[0069] It is noted that although the one exemplary slot pattern and one exemplary cut pattern is shown to extend in the circumferential direction and one exemplary slit pattern is shown to extend in the radial direction, the invention is not limited in this respect and the slits and/or slots can be directed in different directions and may have different shapes.

[0070] It is noted that although most of the embodiments of the present invention, refer to a capsule that is shaped as an acute truncated cone with a rim, the invention is not limited in this respect and the present invention can be applied for producing capsule bodies that are round, rounded and/or have dome or alternate shapes.

[0071] It is noted that although most of the embodiments of the present invention, refer to a capsule that is formed from aluminum sheet and enclosed with an aluminum membrane, the invention is not limited in this respect and the present invention can be applied for producing capsule bodies from alternate and/or additional material.

[0072] It is noted that although most of the embodiments of the present invention refer to a capsule used for preparation of a hot beverage such as coffee, tea and hot chocolate, the capsule as described herein is not limited in this respect and can also be used and/or adapted for the preparation of cold beverage including carbonated beverages and/or alcoholic beverages.

[0073] The terms "comprises", "comprising", "includes", "including", "having" and their conjugates mean "including but not limited to".

[0074] The term "consisting of' means "including and limited to".

[0075] The term "consisting essentially of' means that the composition, method or structure may include additional ingredients, steps and/or parts, but only if the additional ingredients, steps and/or parts do not materially alter the basic and novel characteristics of the claimed composition, method or structure.

[0076] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination or as suitable in any other described embodiment of the invention. For example, materials and shapes of sealing elements, slots and slits described for one embodiment may be used with other embodiments described. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

Claims

1. A method to manufacture a capsule body adapted for containing one or more beverage ingredients for use in a beverage preparation machine, the method comprising:

   deep drawing a capsule body shape with aluminum sheet material, wherein the capsule body shape includes:

   a base body having side walls defining a cavity for receiving the one or more beverage ingredients, wherein the side walls include an inner surface facing the cavity defined by the side walls and an outer surface facing the beverage preparation machine in use;
   a flange-like rim (115) extending from the side walls;

   punching one or more holes in the flange-like rim (115); and
   covering the holes from a surface of the flange

like rim (115) that extends from the inner surface of the side walls with a sealing member (200), wherein the sealing member (200) is positioned only on the surface of the flange like rim (115) that extends from the inner surface of the side walls and is adapted to provide a sealed engagement between the capsule body and the beverage preparation machine.

2. The method according to claim 1, wherein the holes form one or more slots with an opening that is 0.3 mm - 1 mm wide.

3. The method according claim 1 or claim 2, wherein at least one surface of the aluminum sheet is laminated with a polymer material.

4. The method according to claim 3, wherein the one or more holes are separated by bridge components, wherein the bridge components are formed by the polymer material laminated on the aluminum.

5. The method according to any one of claims 1-4, wherein the sealing member is formed with a polymer, thermoplastic material and/or an elastomer.

6. The method according to any one of claims 1-5, wherein the sealing member is applied on the flange-like rim as a liquid and cured in place.

7. The method according to any one of claims 1-5, comprising adhering the sealing member to the flange-like rim.

8. The method according to any one of claims 1-7, wherein the sealing member is formed with a material that has a hardness of around SHORE 15A to 70A.

9. The method according to any one of claims 1-8, comprising:

filling the cavity with the beverage ingredient; and
closing the cavity with a membrane, wherein the membrane covers the sealing member.

10. A capsule body adapted for containing one or more beverage ingredients for use in a beverage preparation machine comprising:

a base body formed from an aluminum sheet and having side walls defining a cavity for receiving the one or more beverage ingredients, wherein the side walls include an inner surface facing the cavity defined by the side walls and an outer surface facing the beverage preparation machine in use;
a flange-like rim (115) extending from the side walls;
a sealing member (200) adapted to provide a sealed engagement between the capsule body and the beverage preparation machine; and
characterized in that

the sealing member (200) is positioned only on a surface of the flange like rim that extends from the inner surface of the side walls; and
the flange-like rim (115) is formed with one or more slots (151) that extend in a circumferential direction around the flange-like rim, wherein the sealing member is partially exposed through the one or more slots (151).

11. The capsule body according to claim 10, wherein the one or more slots provides an opening that is 0.3 mm - 1 mm wide.

12. The capsule body according claim 10 or claim 11, wherein at least one surface of the aluminum sheet is laminated with a polymer material.

13. The capsule body according to any one of claims 10-12, wherein portion of the flange that overlaps with the sealing member is elevated and/or raised as compare to other portions of the flange.

14. The capsule body according to any one of claims 10-13, wherein the sealing member extends from an edge between the flange-like rim and the side walls to a curl on outer edge of the flange.

15. The capsule body according to any one of claims 10-14, wherein the sealing member is color coded to provide indication regarding the contents of the capsule.

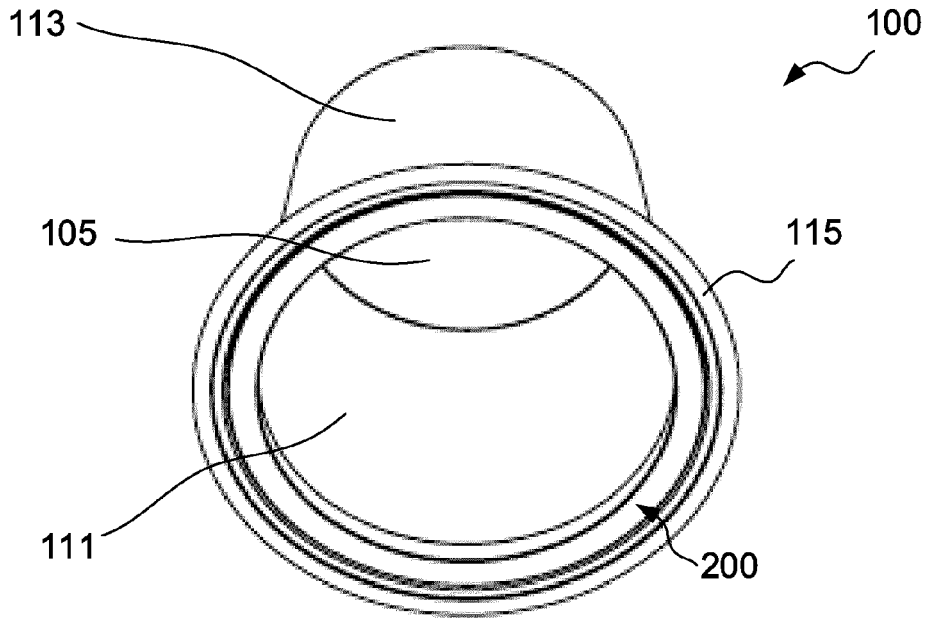


FIG. 1

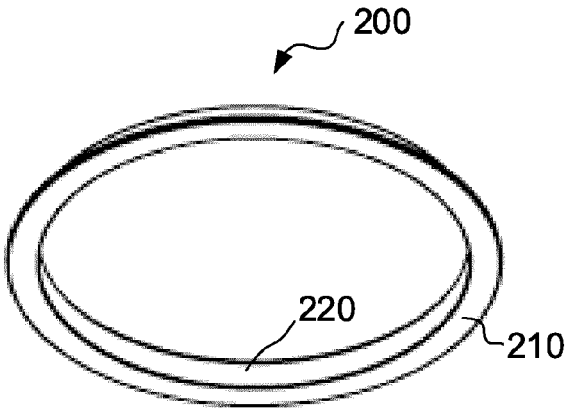


FIG. 2A

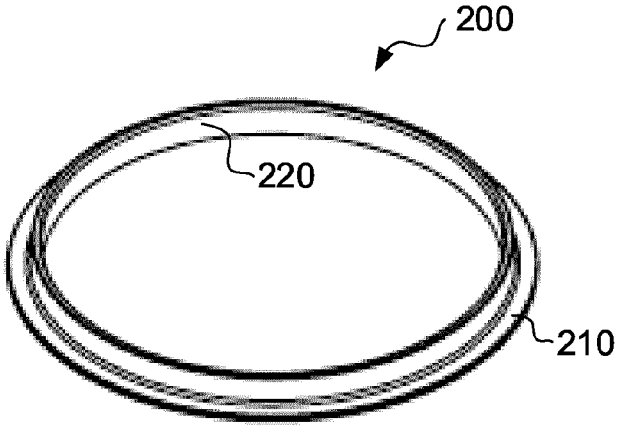


FIG. 2B

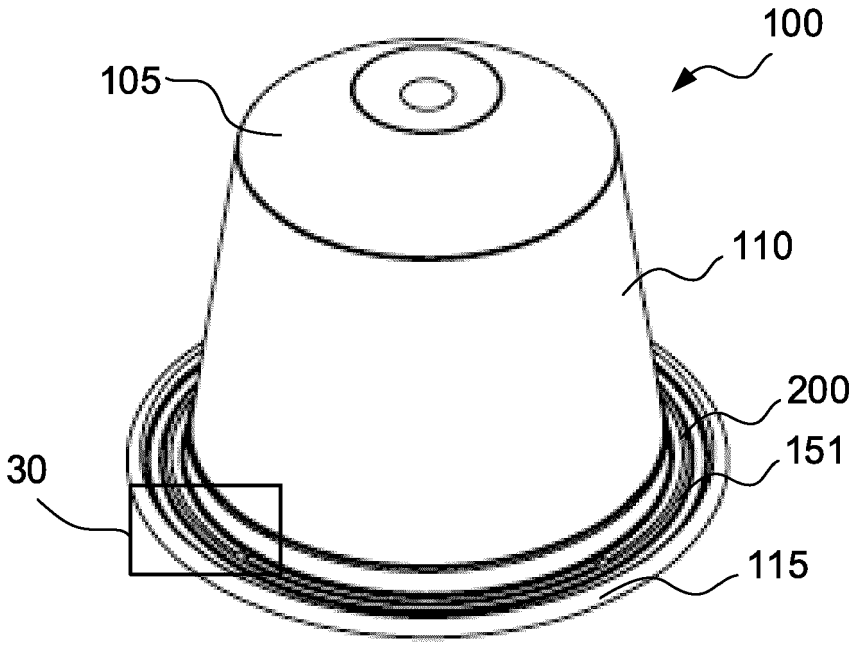


FIG. 3A

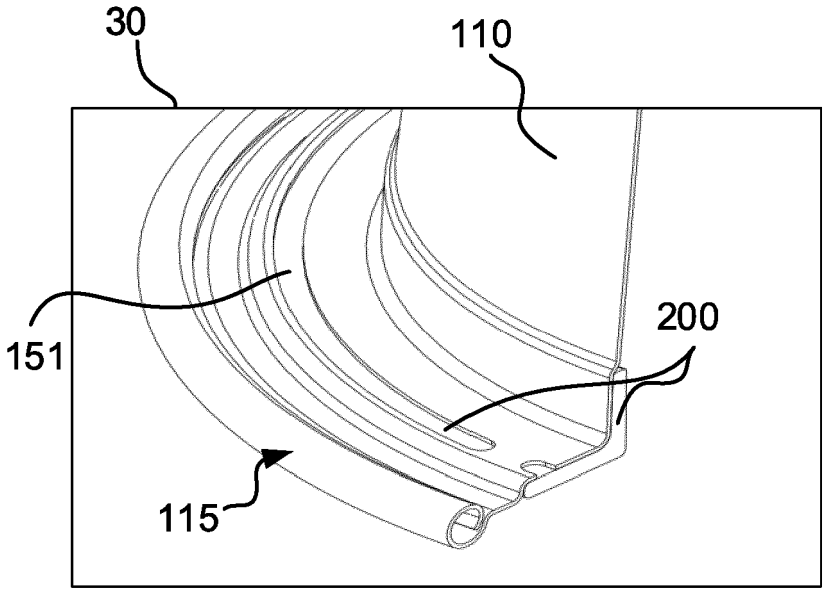


FIG. 3B

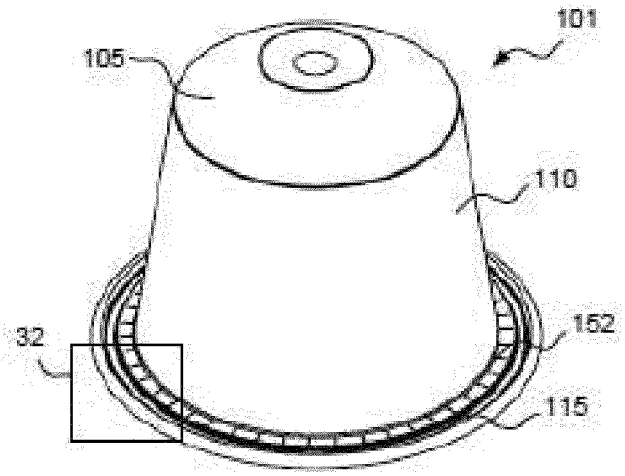


FIG. 4A

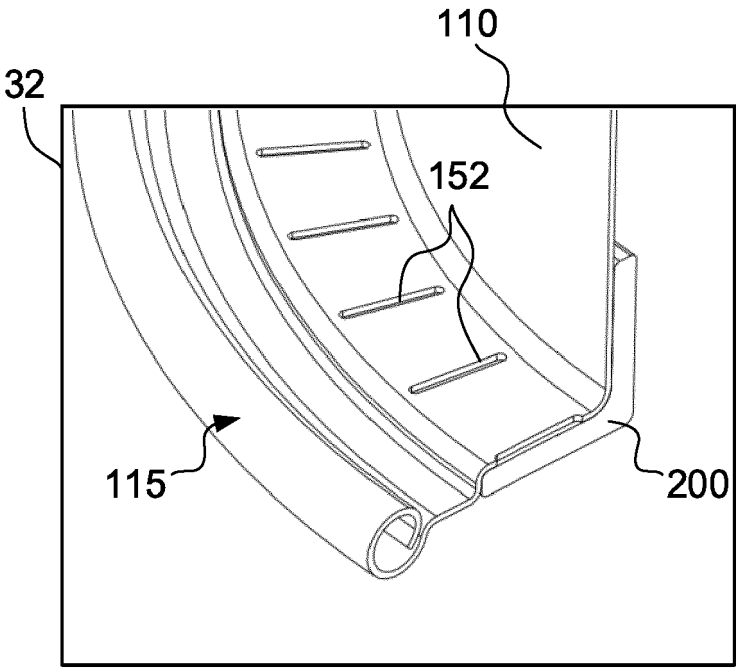
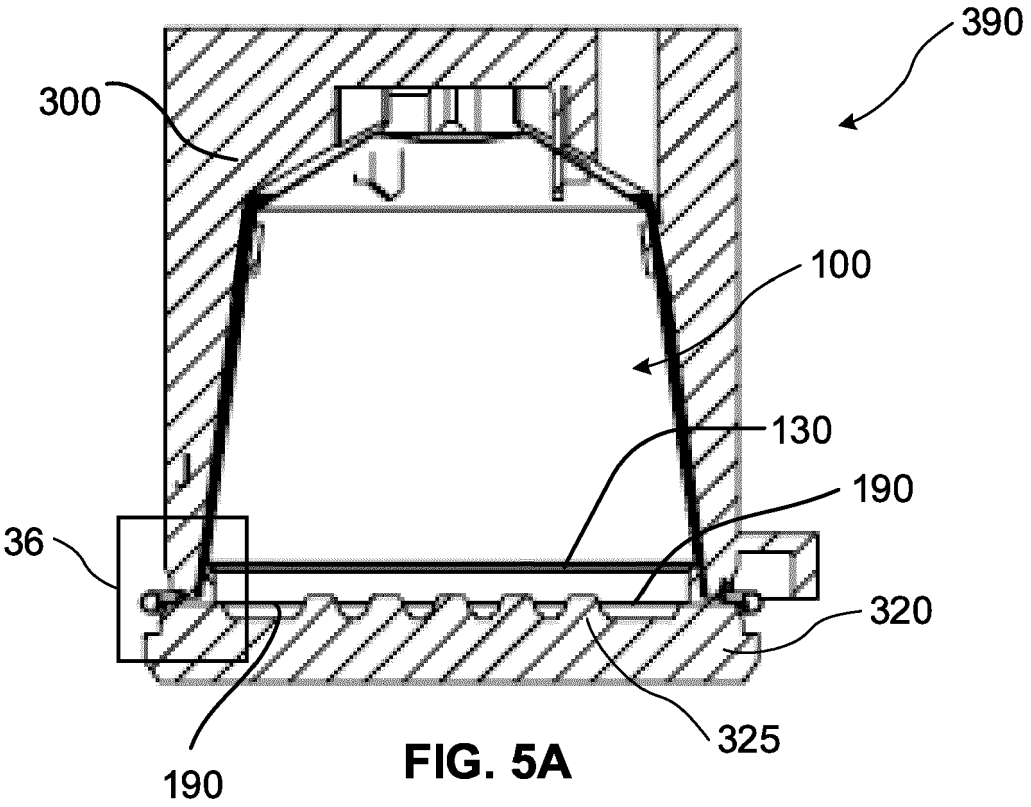


FIG. 4B


390
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100
130
190
36
320
325
190

FIG. 5A

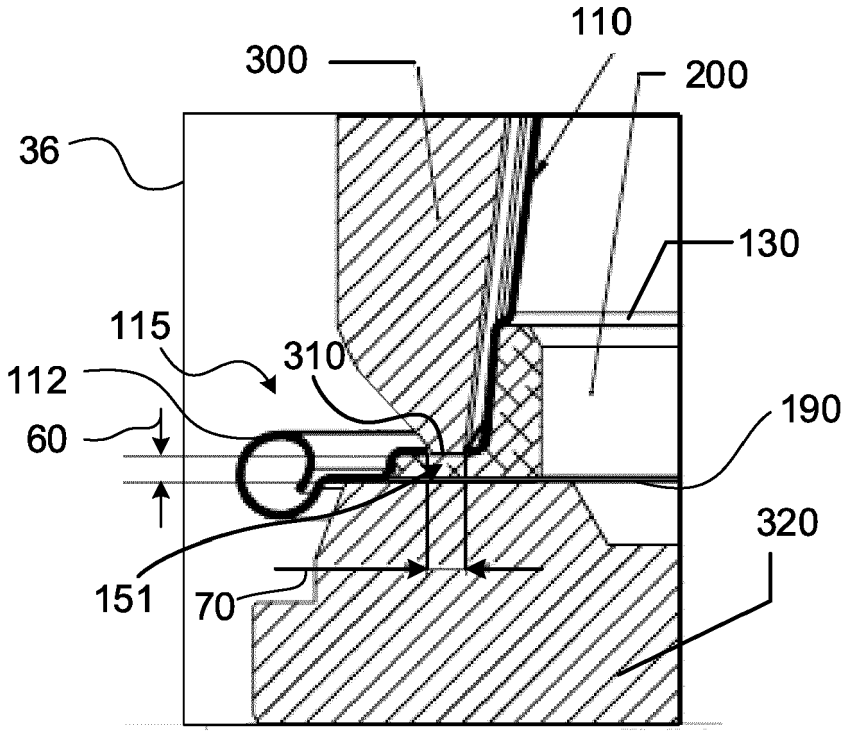

110
300
200
36
130
115
310
112
190
60
320
151
70

FIG. 5B

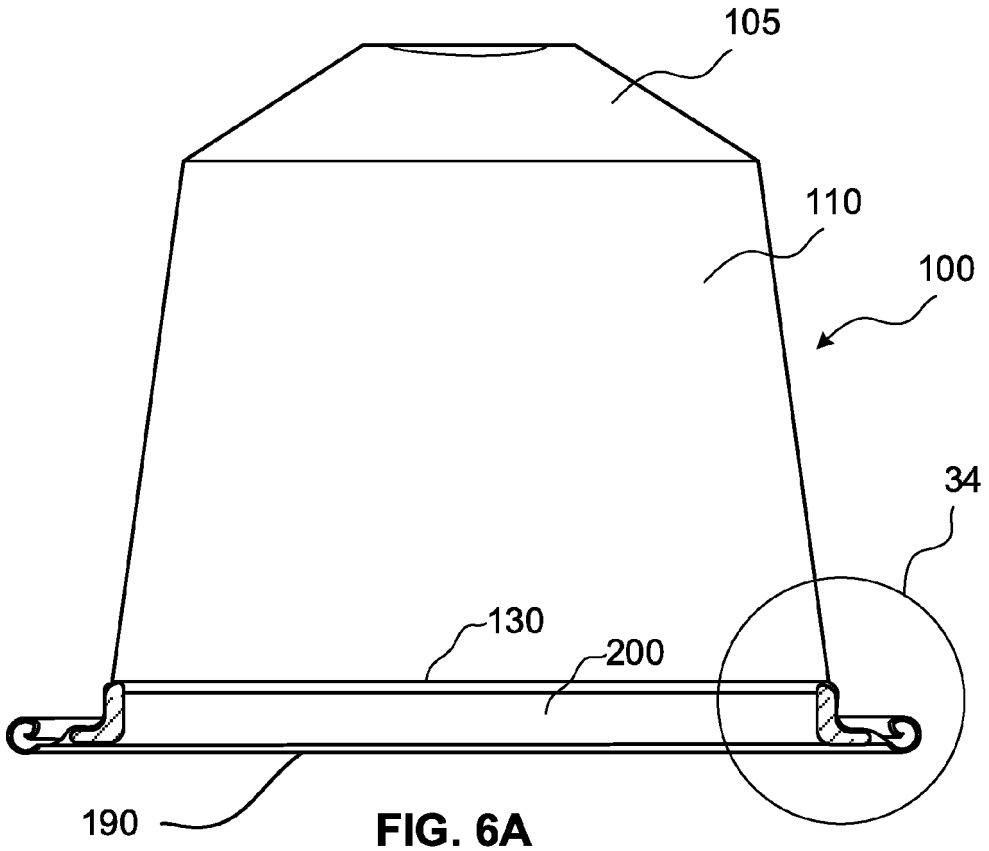


FIG. 6A

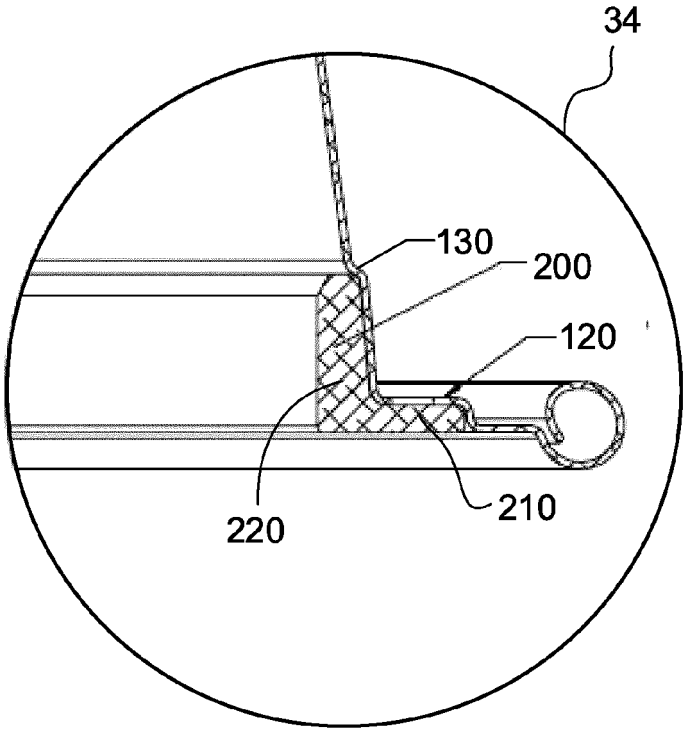


FIG. 6B

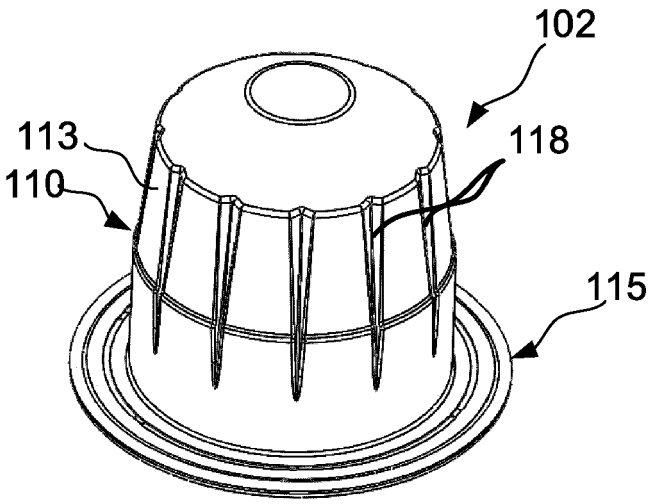


FIG. 7A

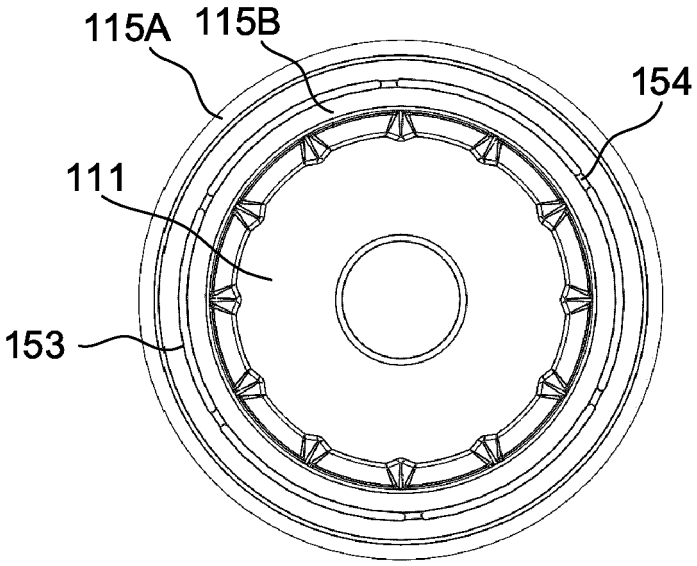


FIG. 7B

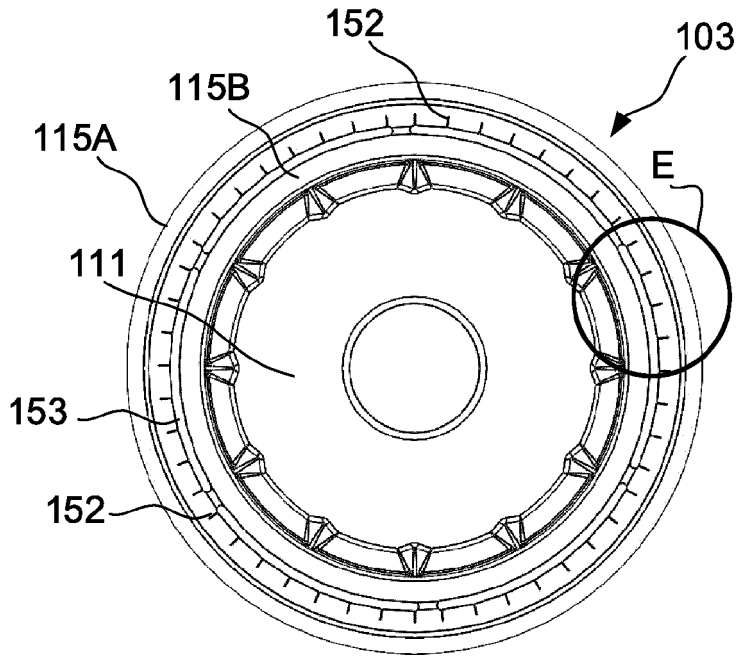
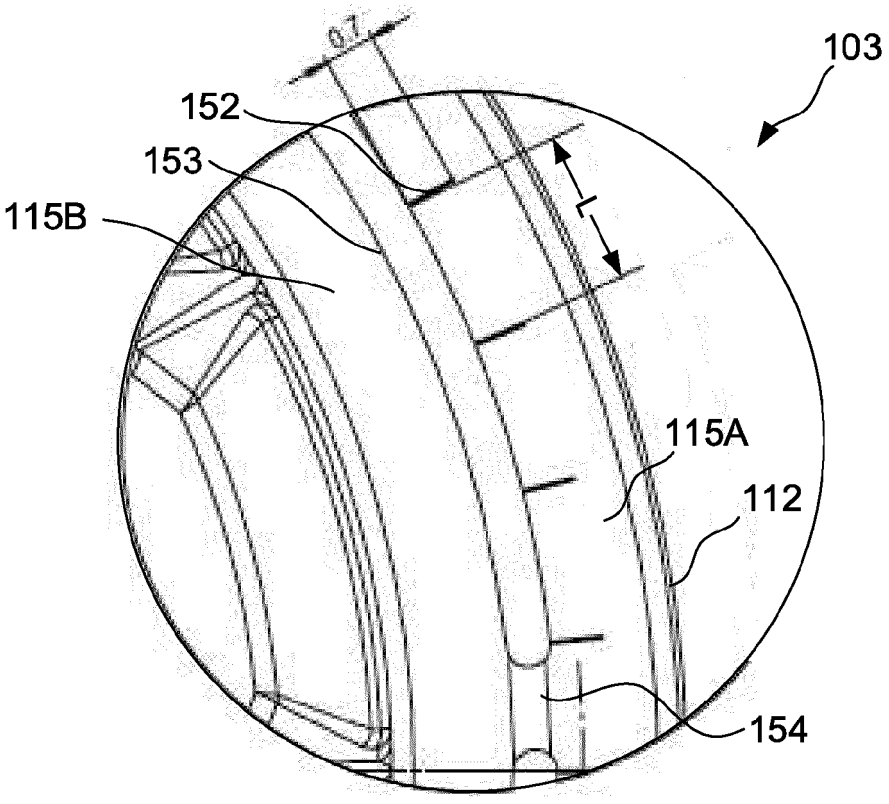


FIG. 7C



Detail E

FIG. 7D

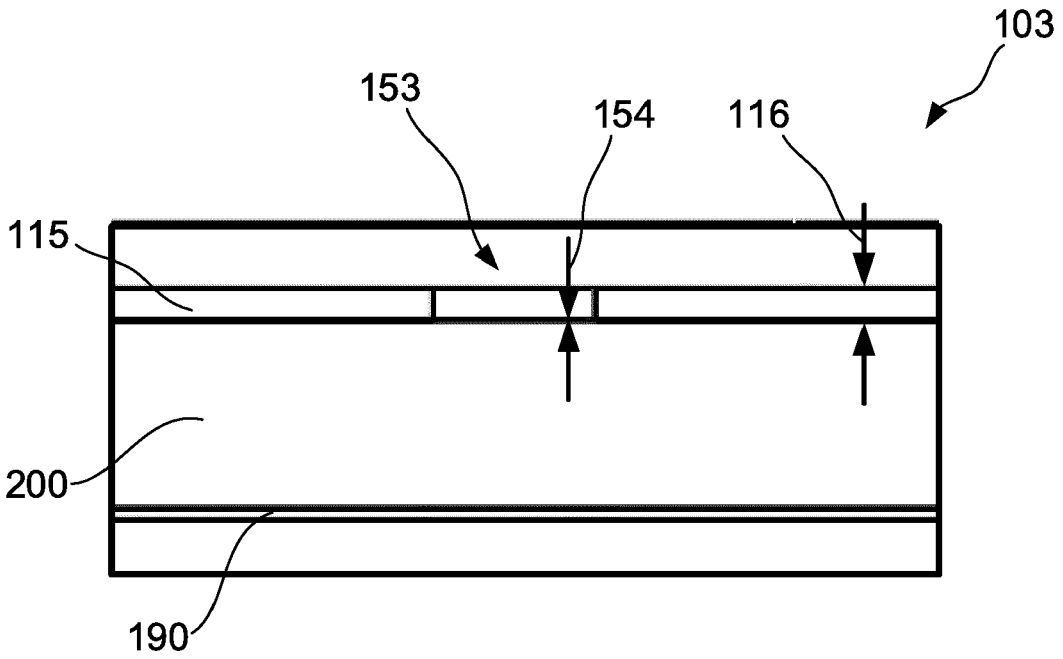


FIG. 8

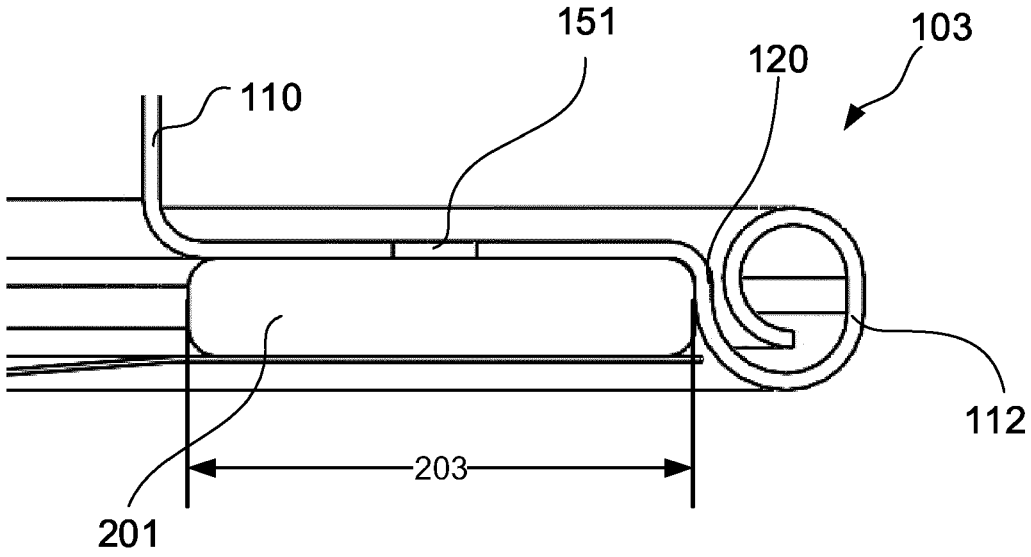


FIG. 9A

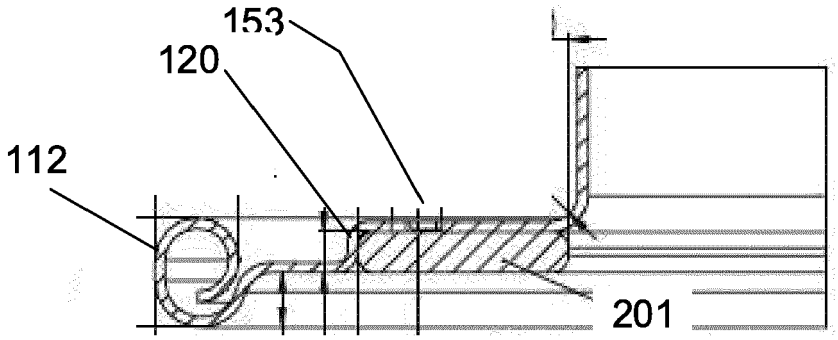


FIG. 9B

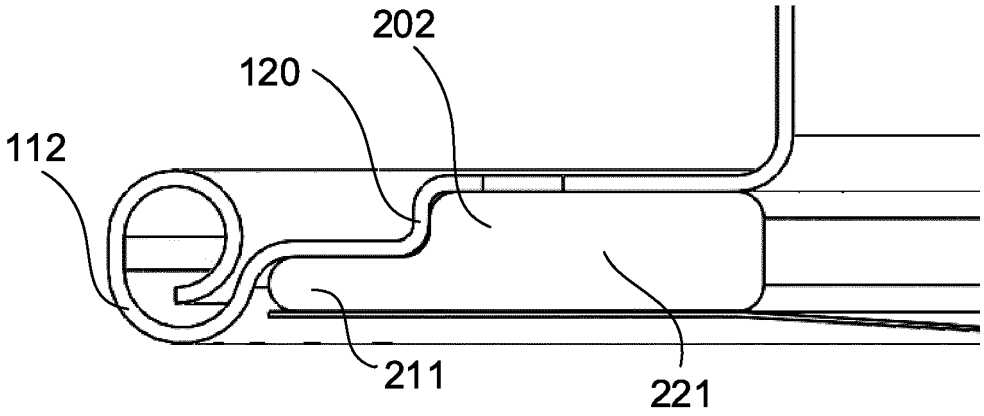


FIG. 9C

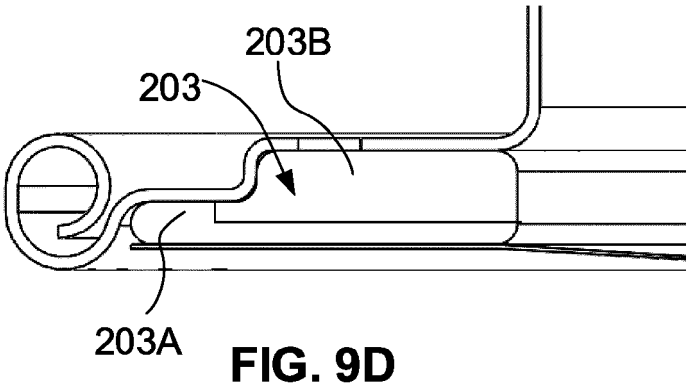


FIG. 9D

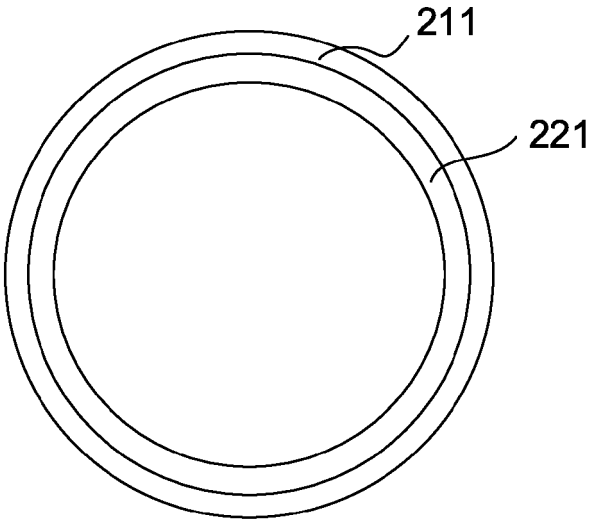


FIG. 10A

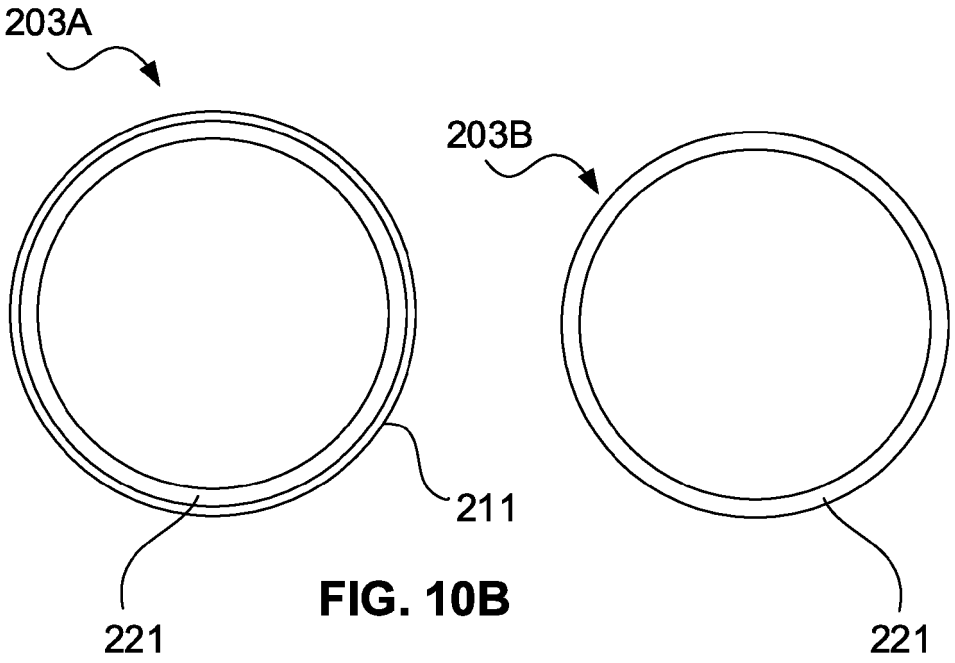


FIG. 10B

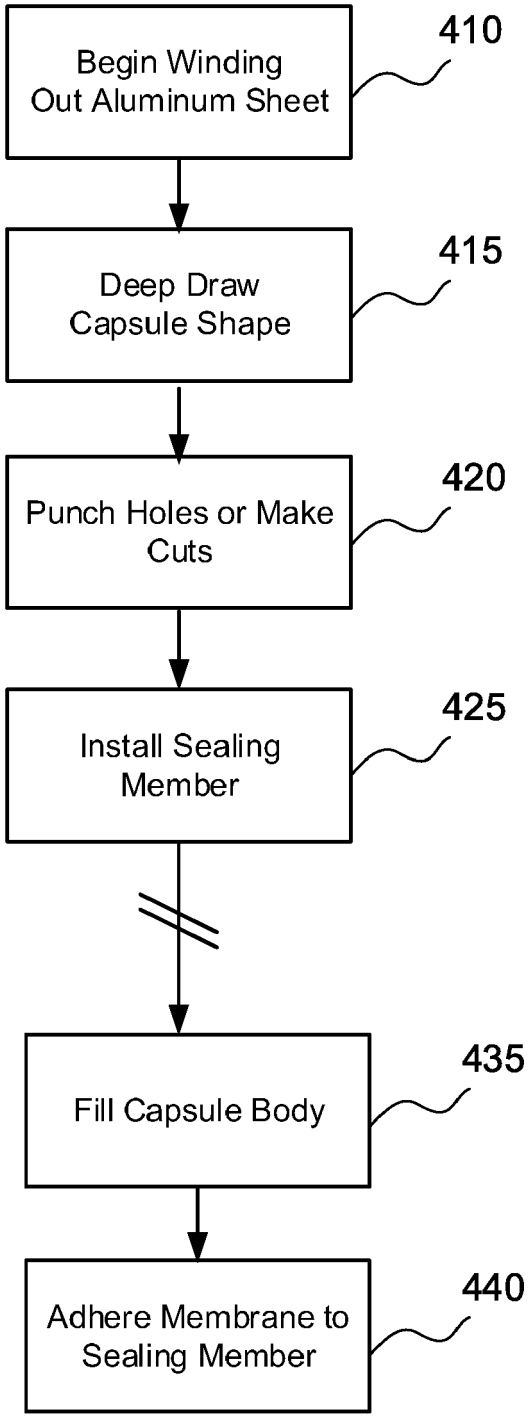

Begin Winding Out Aluminum Sheet
410
Deep Draw Capsule Shape
415
Punch Holes or Make Cuts
420
Install Sealing Member
425
Fill Capsule Body
435
Adhere Membrane to Sealing Member
440

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 4969

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A	ES 1 073 281 U (SIERRA MONTOYA IVAN [ES]) 26 November 2010 (2010-11-26) * claim 2; figures 1,2 *	1-15	
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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
Munich	18 December 2019	Brochado Garganta, M

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REFERENCES CITED IN THE DESCRIPTION

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