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Frydman(10) **Pub. No.: US 2014/0069280 A1**(43) **Pub. Date: Mar. 13, 2014**(54) **TWO-MATERIAL CAPSULE**(76) Inventor: **Alain Frydman**, Paris (FR)(21) Appl. No.: **13/994,658**(22) PCT Filed: **Jun. 9, 2011**(86) PCT No.: **PCT/FR11/51321**

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(52) **U.S. Cl.**CPC **B65D 85/8043** (2013.01)USPC **99/295; 426/112**(57) **ABSTRACT**

This capsule (1000) comprises a body (1004) in the form of a cup and a seal (1006) delimiting together a chamber (1008) containing a substance for preparing a drink. The body (1004) comprises:

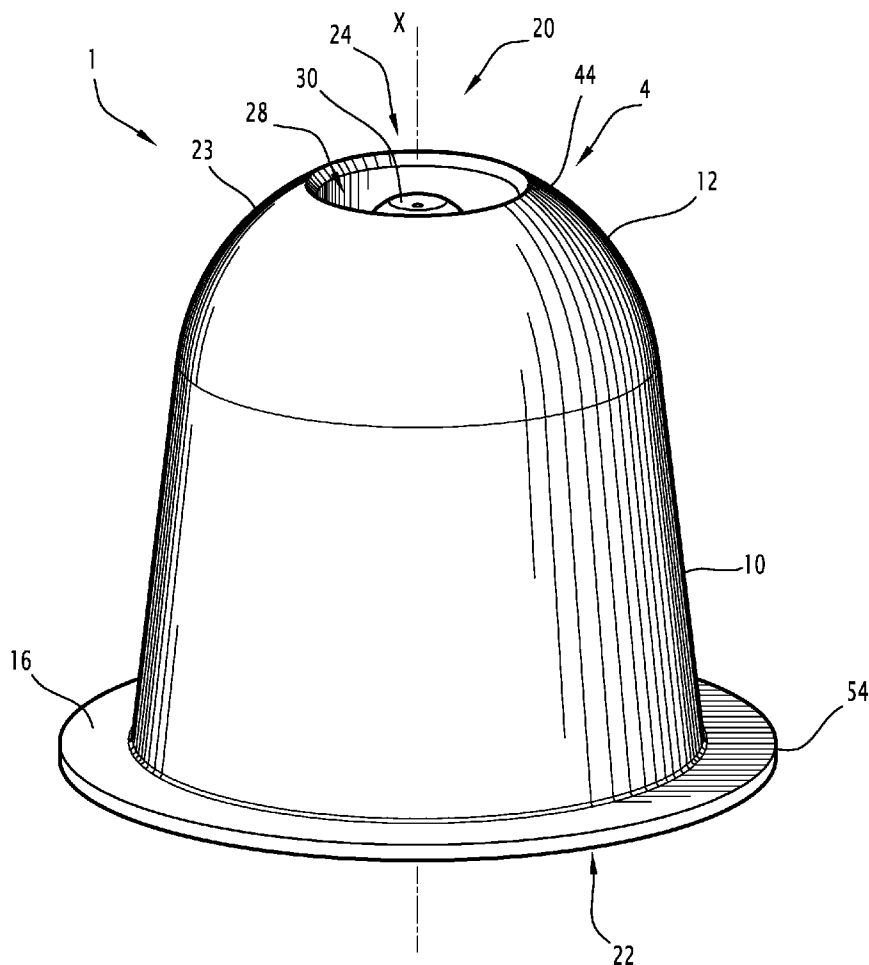
an outer substantially frusto-conical side wall (1010),

a base (1012) made in the same material with the side wall (1010) and closing the side wall (1010) at a rear end (1020) of the body (1004), and

an annular rim (1016) extending radially outwards from the side wall (1010) and delimiting the front end (1022) of the body (1004).

The seal (1006) closes the outer side wall (1010) at the front end (1022).

The base (1012) and the wall (1010) are made in a first plastic material, the annular rim (1016) being formed in a second plastic material different from the first plastic material.



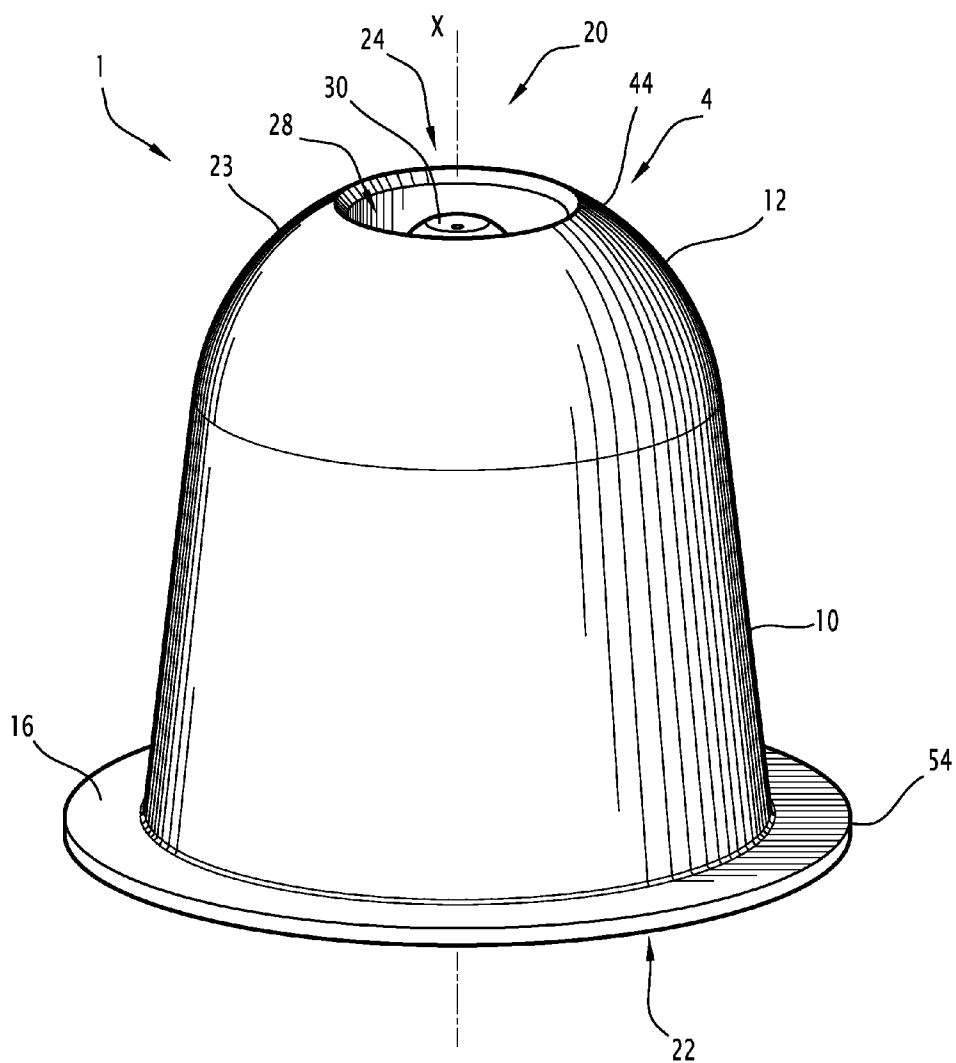
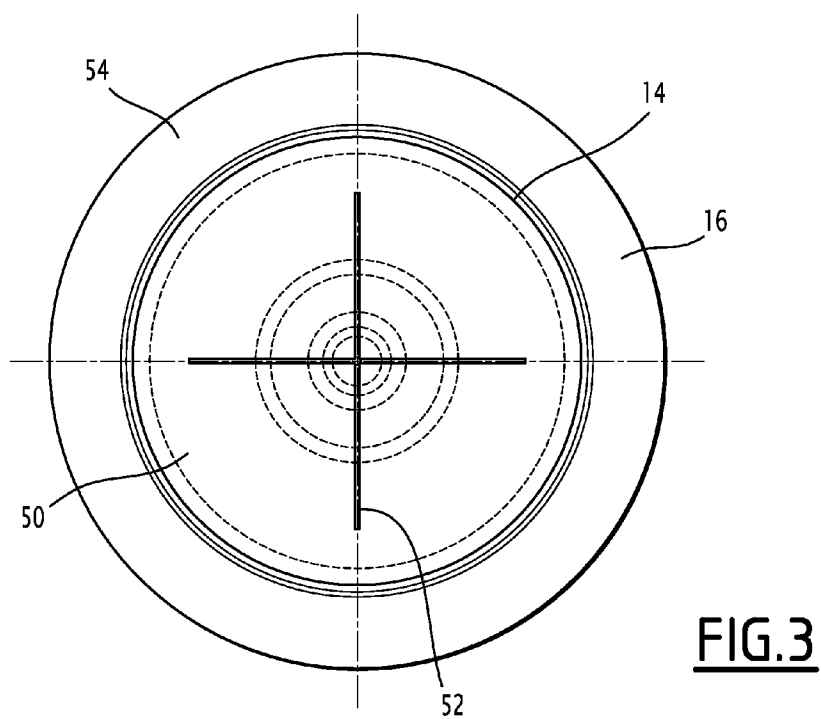
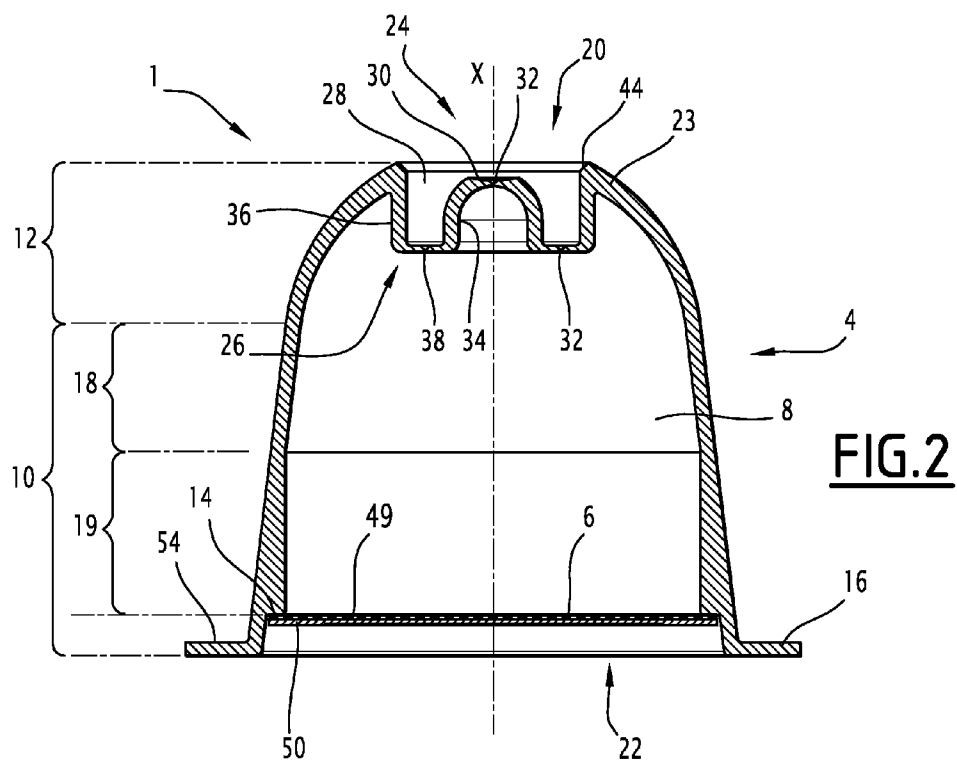


FIG.1



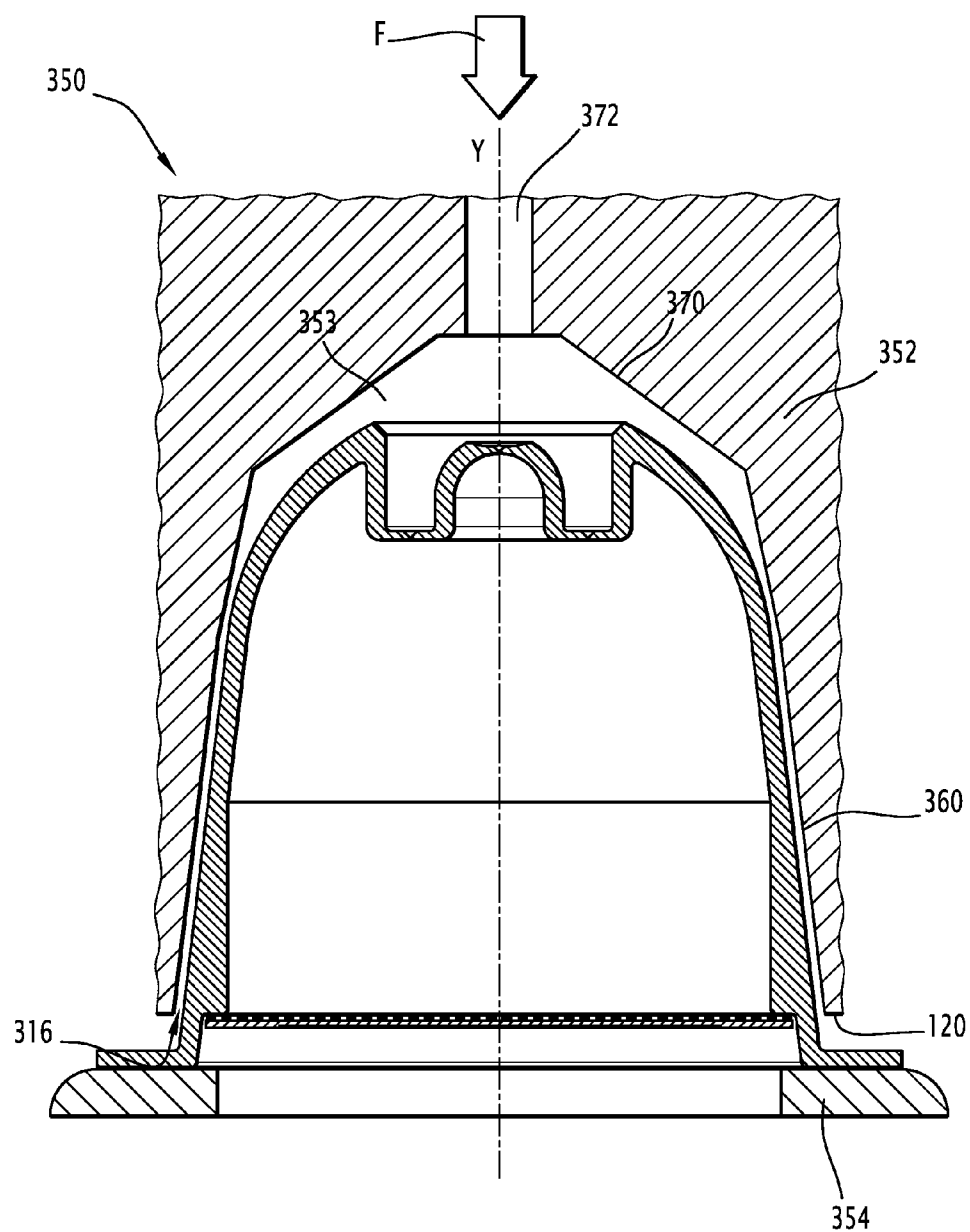


FIG. 4

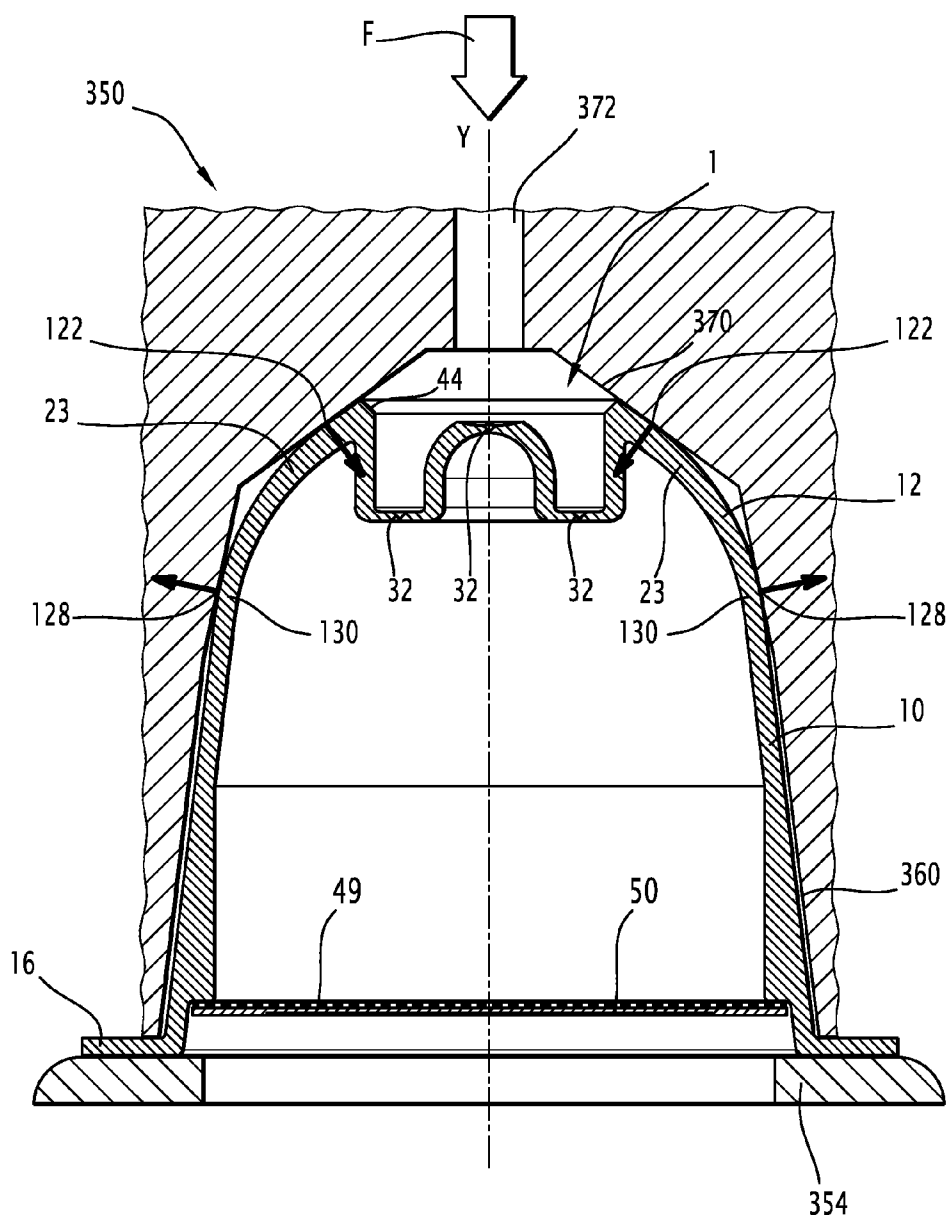


FIG.5

FIG.6

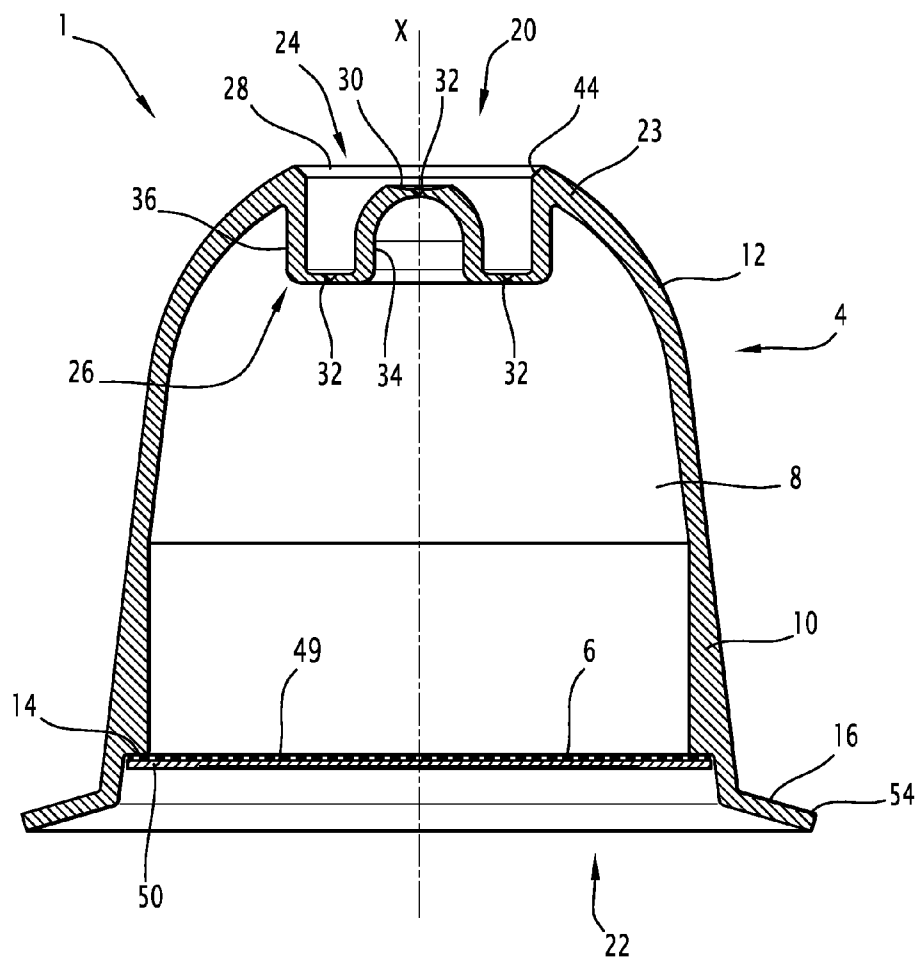


FIG. 7

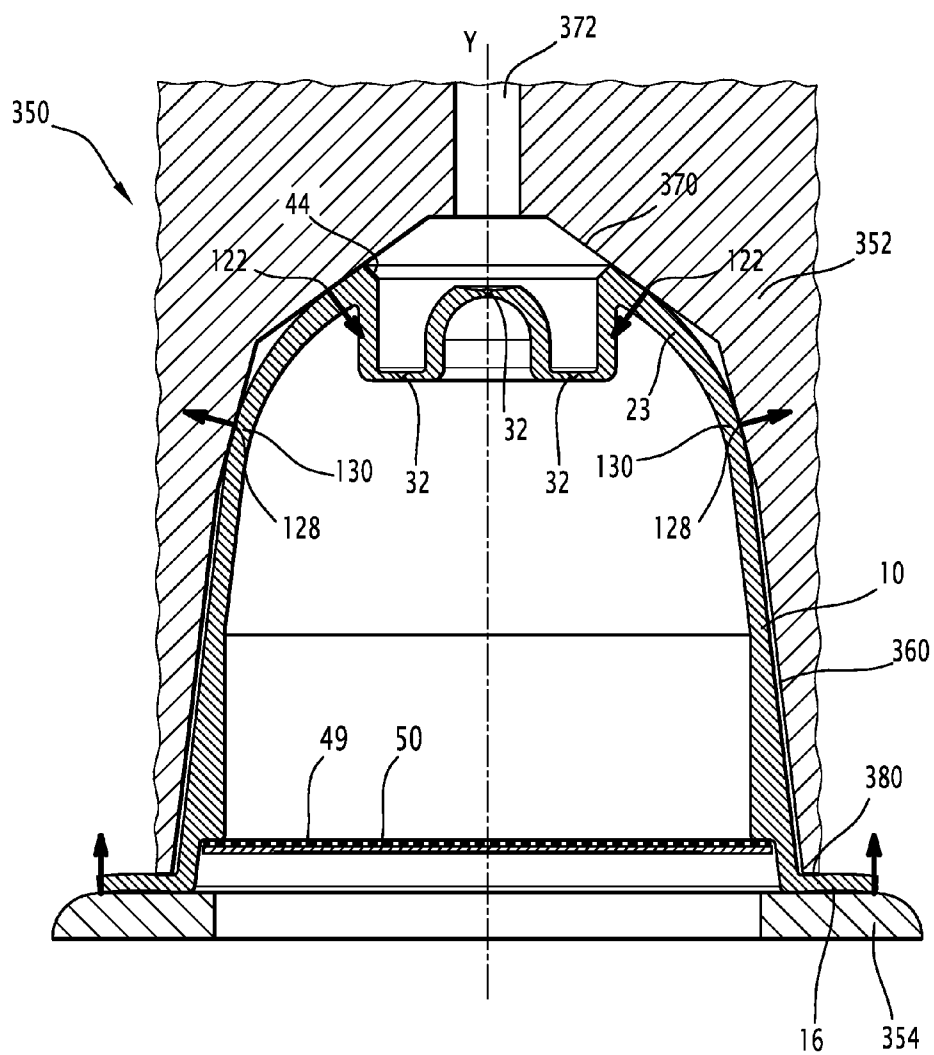
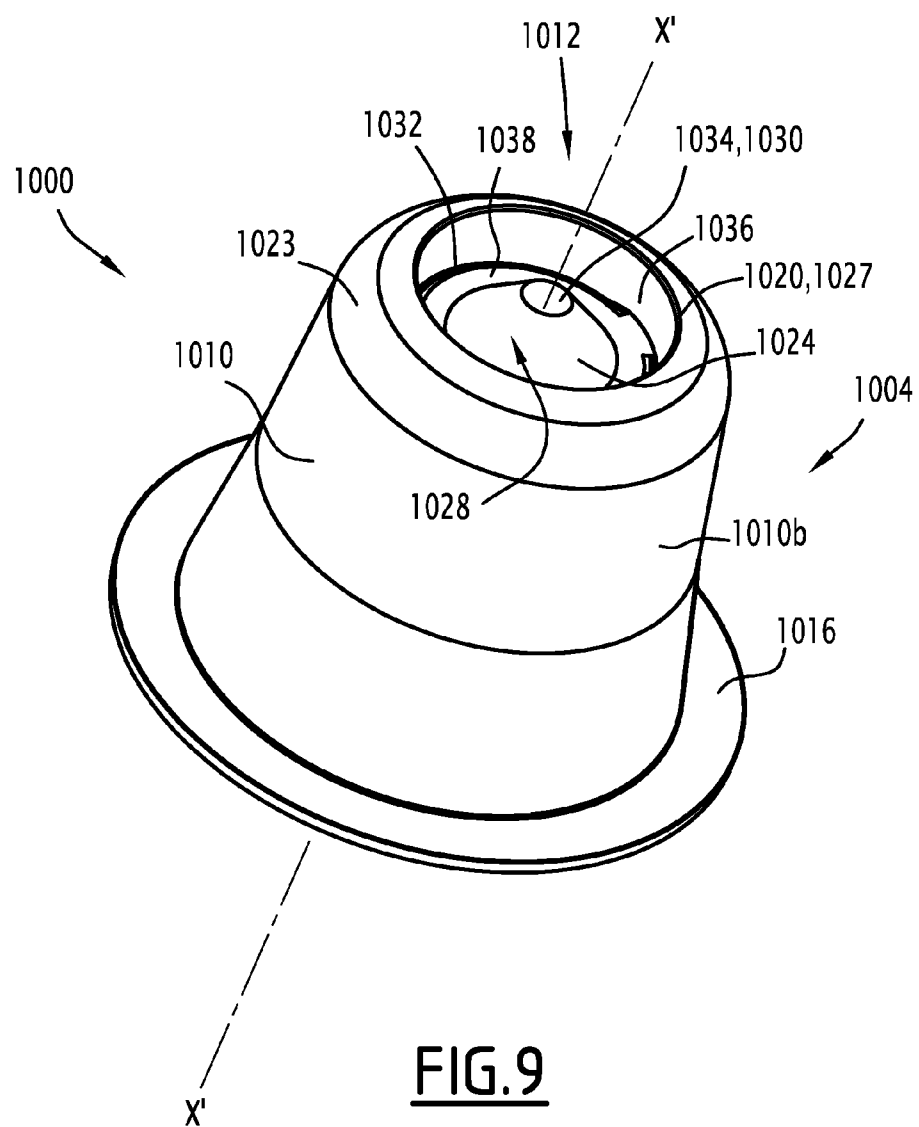


FIG. 8



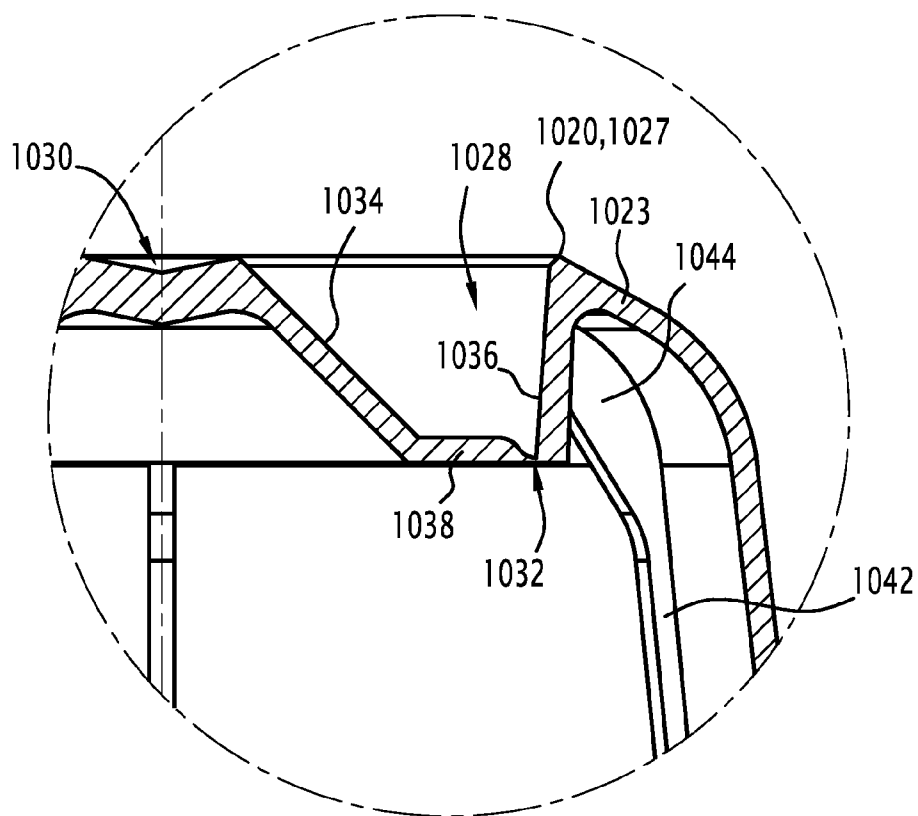


FIG.12

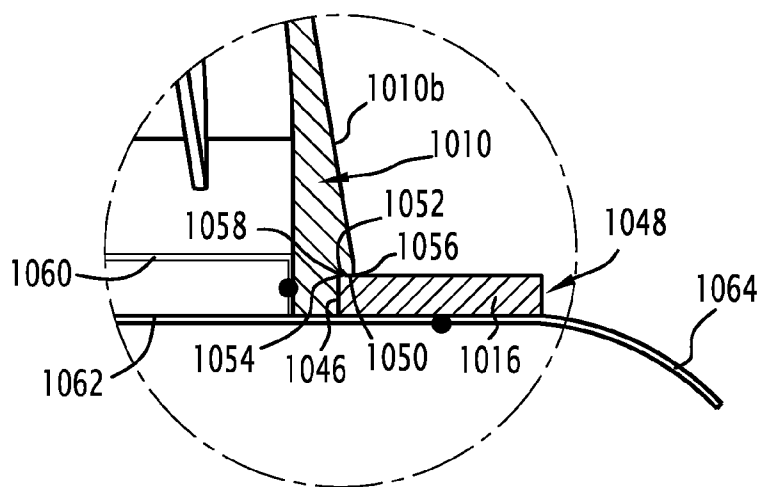


FIG.13

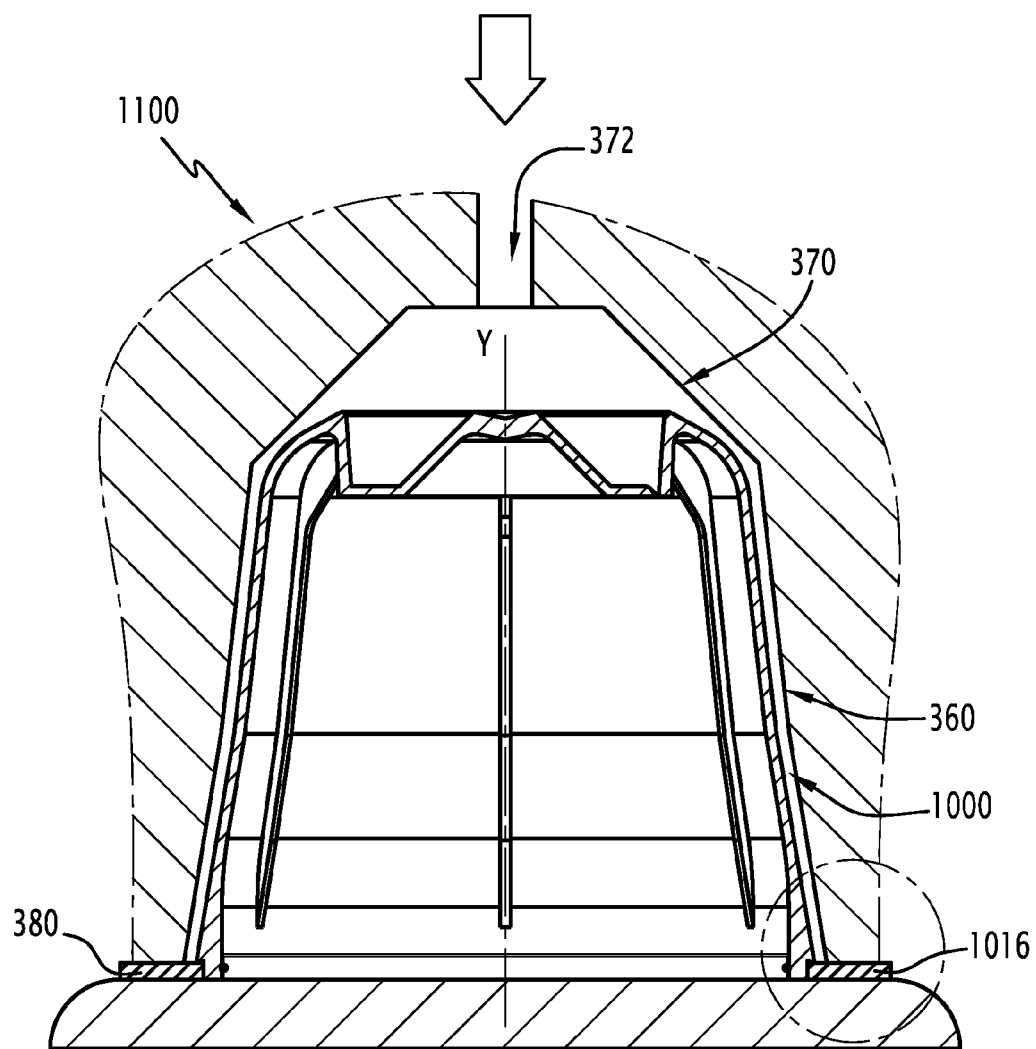


FIG. 14

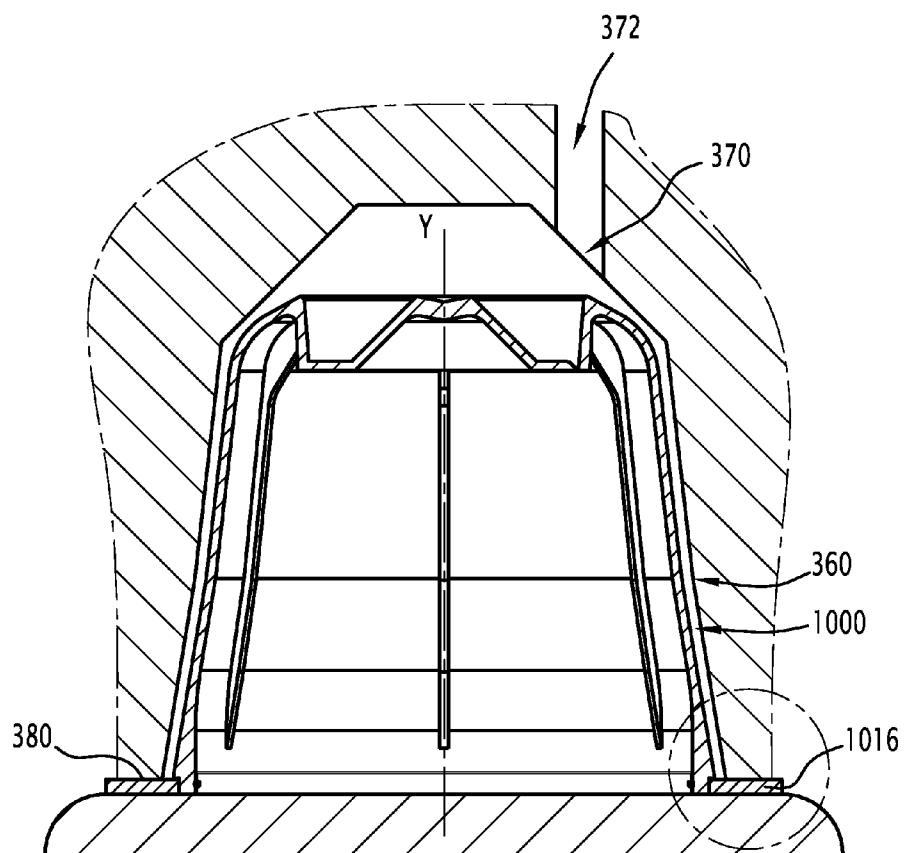


FIG.15

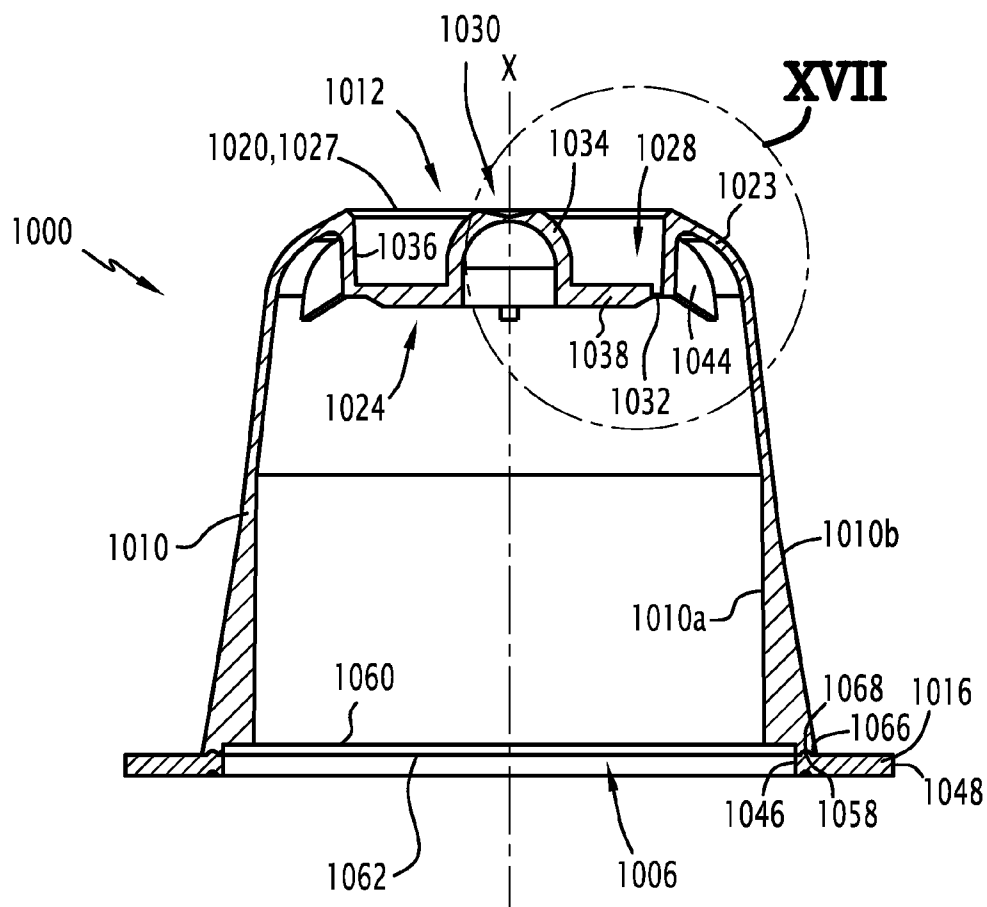


FIG.16

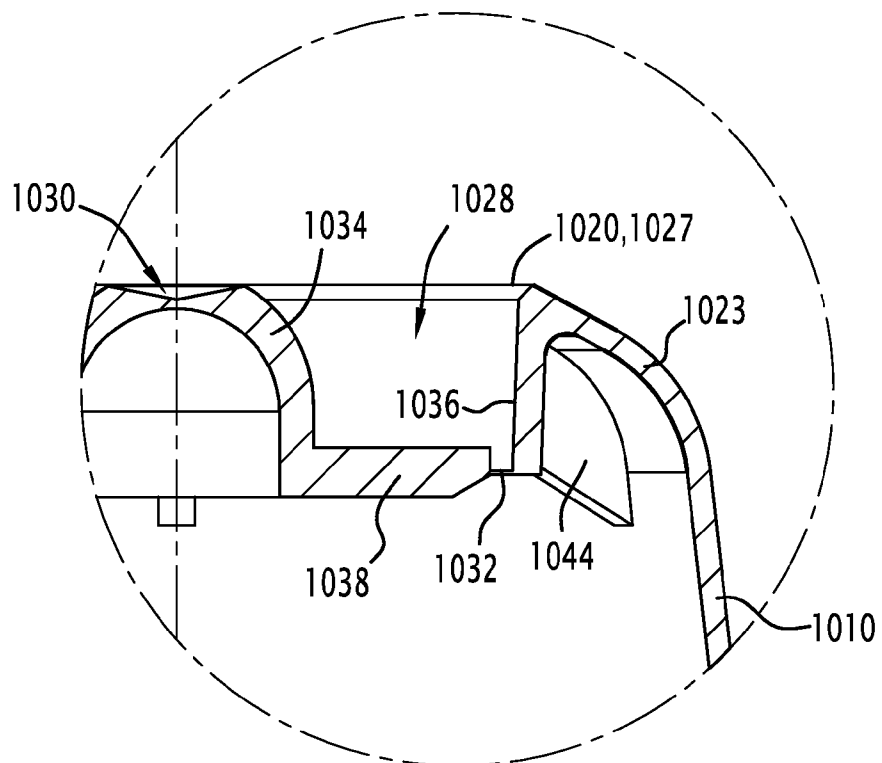


FIG.17

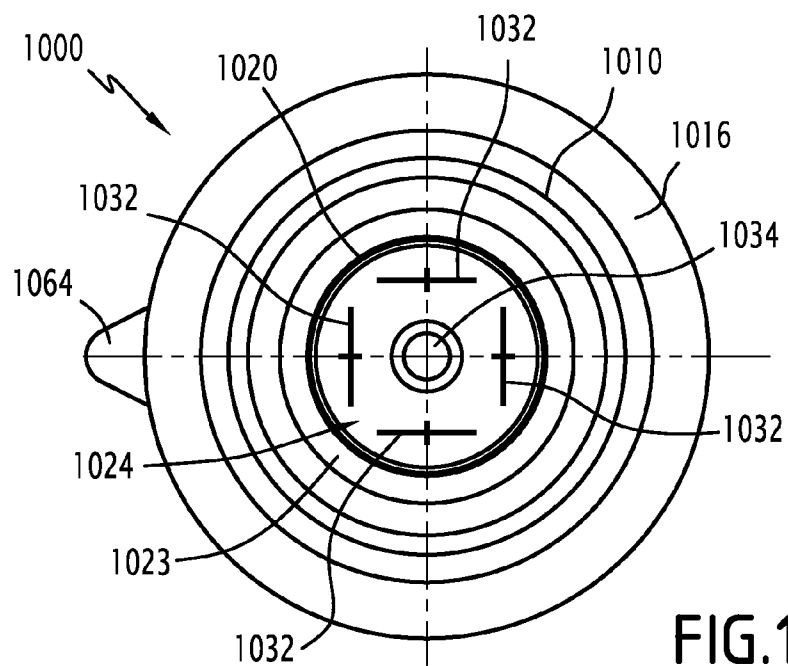


FIG.18

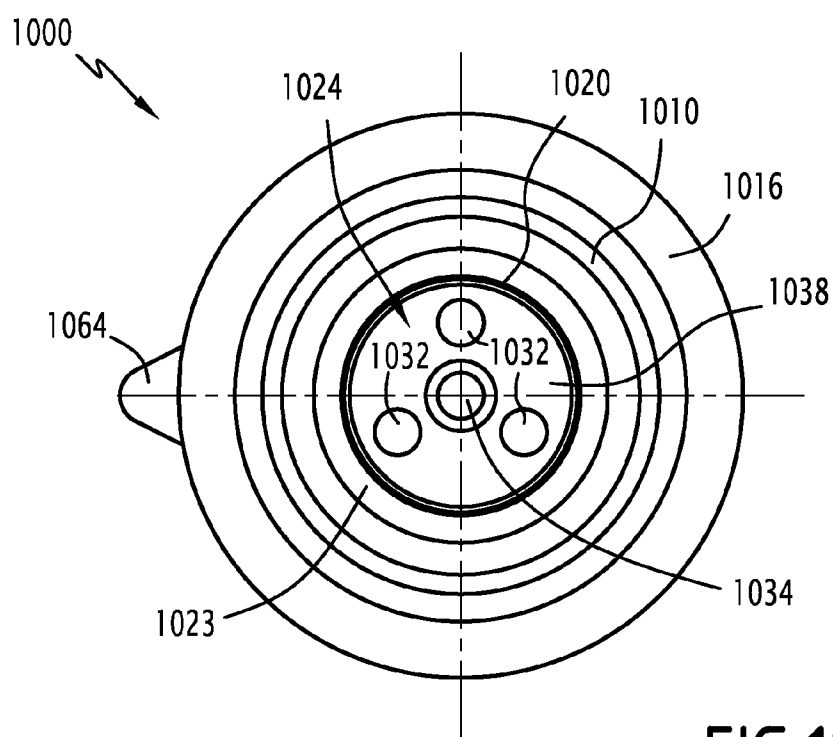


FIG.19

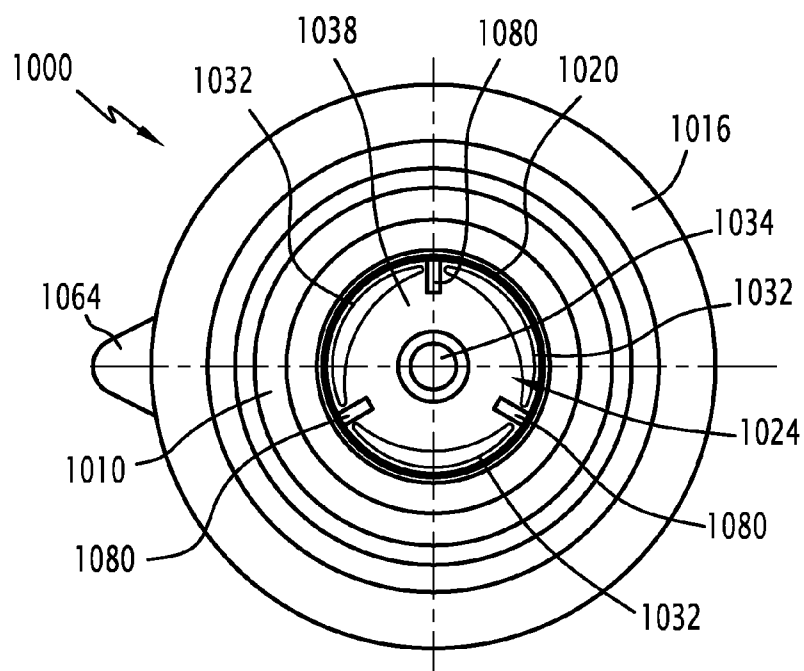
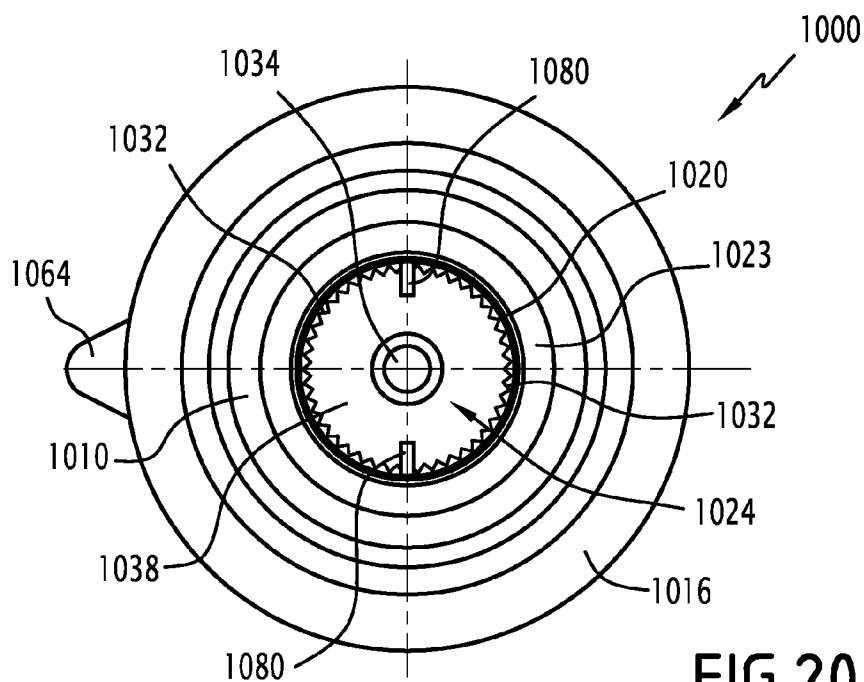




FIG.22

TWO-MATERIAL CAPSULE

[0001] The present relates to a capsule for extracting a pressurized drink, of the type comprising a body in the form of a cup and a seal delimiting together a chamber containing a substance for preparing a drink, the body comprising:

[0002] an external side wall which is substantially frusto-conical,

[0003] a base, made from the same material as the external side wall and closing the external side wall at a rear end of the body, and

[0004] an annular rim extending radially outwards from the external side wall and delimiting the front end of the body,

the seal closing the external side wall at the front end, the capsule being adapted so as to be placed in an extraction device so that a pressurized extraction fluid penetrates into the capsule through the base and exits therefrom through the seal.

[0005] FR 2 373 999 describes such a capsule intended to be used in a device for extracting drinks, in order to produce a drink such as coffee.

[0006] However, there is a risk that such a capsule collapses during the closing of the device for drink extraction and/or for injection of the pressurized liquid.

[0007] Further, such capsules are particularly expensive to produce, in particular when they are produced in large series.

[0008] Further, it is difficult to be able to have both a capsule which is inert towards the substance contained in the chamber and to mark the capsule with a distinctive mark giving the possibility of distinguishing without any ambiguity the substance contained in the chamber.

[0009] Finally, when such a capsule is used in an extraction device including a housing for receiving the capsule and a support against which the capsule is applied, the seal is flattened against the support, which prevents satisfactory flow of the liquid through the capsule.

[0010] An object of the invention is to provide a capsule with reduced cost. Other objects of the invention are to propose a capsule made in a material which is inert towards the substance and bearing a distinctive mark giving the possibility of easily identifying the substance contained in the chamber, of proposing a capsule compatible with many drink extraction devices, and of providing a capsule allowing limitation of the risk of collapse while allowing extraction of a drink.

[0011] For this purpose, a first aspect of the invention relates to a capsule of the aforementioned type, wherein the base and the wall are made in a first plastic material, the annular rim being formed in a second plastic material different from the first plastic material.

[0012] According to other embodiments, said capsule includes one or more of the following features, taken individually or according to any technically possible combination (s):

[0013] the first plastic material is polyamide,

[0014] the second plastic material is polyurethane,

[0015] the second plastic material is a thermoplastic elastomer,

[0016] the second plastic material is thermoplastic polyurethane,

[0017] the second plastic material is an elastomerized polyamide,

[0018] the external side wall comprises an inner surface, oriented towards the chamber and an external surface,

opposite to the inner surface, the external surface defining a shoulder for connecting the annular rim to the external side wall,

[0019] the external side wall defines a groove for connecting the annular rim to the external side wall, the annular rim including an annular protrusion cooperating with the groove in order to reinforce the connection of the annular rim to the external side wall,

[0020] the first plastic material is not colored in the bulk,

[0021] the second plastic material is colored in the bulk,

[0022] the base is formed by a peripheral region delimiting a rear end of the body, and by a central region entering the inside of the capsule relatively to the rear end while defining a recess outside the body, the central region comprising at least one area with lower strength intended to at least partly break under the pressure of a pressurized liquid,

[0023] said or each area of lower strength is adapted so as to break at a pressure of the pressurized liquid comprised between 1 and 3 bars,

[0024] before breakage of said or each area of lower strength, the base and the external side wall of the body are impervious to air and to liquids,

[0025] the seal comprises a filter and a membrane,

[0026] the filter is set back from the front end of the body, towards the chamber, the membrane extending along the front end,

[0027] the space between the filter and the membrane is filled with nitrogen,

[0028] the membrane is peelable.

[0029] A second aspect of the invention relates to a capsule for extracting a pressurized drink of the type comprising a body in the form of a cup and a seal delimiting a chamber containing a substance for preparing a drink, the body comprising a substantially frusto-conical side wall and a base made in the same material as the side wall and closing the side wall at one end, the seal closing the other end of the side wall, the capsule being adapted so as to be placed in an extraction device so that a pressurized extraction fluid penetrates into the capsule through the seal and exits therefrom through the seal, characterized in that the base includes a central region including an annular rib for reinforcing the base protruding towards the inside of the body and delimiting an annular trench on the outside of the body.

[0030] According to other embodiments, said capsule includes one or more of the following features, taken individually or according to any technically possible combination (s):

[0031] the central region has at least one area of lower strength intended to at least partly break under the pressure of a pressurized liquid;

[0032] the annular rib has a U-section defined by two side portions connected through a base, at least one weakened area being defined in the base;

[0033] the annular rib defines a central stud surrounded by the annular trench, the central stud comprising at least one area of lower strength;

[0034] the base comprises a rounded peripheral region with concavity turned towards the inside of the body;

[0035] the base and the side wall of the body are impervious to air and to water;

[0036] the body includes an annular rim extending radially outwards from the side wall, the rim defining an end of the capsule opposite to the base;

[0037] the seal comprises a filter;

[0038] the seal comprises a membrane impervious to air and to water; and

[0039] the membrane is provided with weakened lines for opening the membrane under the effect of the sole pressure of a pressurized fluid.

[0040] A third aspect of the invention relates to a capsule for extracting a pressurized drink, of the type comprising a body in the form of a cup and an outlet filter delimiting a chamber containing a substance for preparing a drink, the capsule comprising a leakproof outlet membrane, the body comprising a base delimiting a rear end of the body and a substantially frusto-conical side wall extending from the base as far as an open front end of the body, the membrane closing the front end, the capsule being adapted so as to be placed in an extraction device so that a pressurized extraction liquid penetrates into the capsule through the base and exits therefrom through the outlet membrane, characterized in that the filter and the membrane are set back relatively to the front end of the body.

[0041] According to other embodiments, said capsule includes one or more of the following characteristics, taken individually or according to any technically possible combination(s):

[0042] the side wall includes an internal shoulder set back relatively to the front end of the body, the filter and the membrane being attached on the internal shoulder.

[0043] the set-back distance of the outlet membrane relatively to the front end is greater than 1 mm;

[0044] the outlet membrane is impervious to air and to water;

[0045] the outlet membrane is capable of tearing under the effect of the sole pressure of a liquid, so as to allow outflow of a liquid crossing the capsule;

[0046] the outlet membrane includes at least one breakage line;

[0047] the outlet filter is placed between the chamber and the outlet membrane;

[0048] the filter and the outlet membrane are placed side by side;

[0049] the outlet filter is in a woven or perforated plastic material; and

[0050] the membrane is a film in a plastic or metal material, in particular in aluminum.

[0051] A fourth aspect of the invention relates to the system comprising a capsule according to the first, second or third aspect of the invention, and an extraction device including a housing intended for receiving the capsule, a support and a conduit for supplying an extraction liquid.

[0052] A fifth aspect of the invention relates to a system, of the type comprising a drink extraction device and a capsule for extracting a pressurized drink, the capsule comprising a body in the form of a cup and a seal delimiting a chamber containing a substance for preparing a drink, the body comprising a substantially frusto-conical side wall and a base closing the side wall at one end, the seal closing the other end of the side wall, the capsule being adapted so as to be placed in the extraction device so that a pressurized extraction liquid penetrates into the capsule through the base and exits therefrom through the seal, the drink extraction device including an element for receiving a capsule having an inner side face, characterized in that the capsule is adapted so that the base produces a contact against the receiving element along a closed annular contact line.

[0053] According to other embodiments, said system includes one or more of the following features, taken individually or according to any technically possible combination (s):

[0054] the capsule and the receiving element are configured so that the receiving element exerts a compressive force on the base of the capsule, the base and/or the side wall of the capsule being adapted so as to deform under the effect of this force;

[0055] the side wall and/or the base of the body radially expands under the effect of the force exerted by the receiving element of the extraction device, so as to ensure contact between the side wall of the body of the capsule and the inner side face of the receiving element;

[0056] the base of the body of the capsule comprises a rounded peripheral region with concavity turned towards the inside of the body;

[0057] the base of the capsule comprises an annular peripheral region and a central region comprising an annular trench, the contact line being defined on the peripheral region;

[0058] the contact line is defined by an external edge of the trench at the junction between the trench and the peripheral region;

[0059] the external edge of the trench is angled;

[0060] the body of the capsule includes an annular rim at the end of the side wall opposite to the base, the annular rim being at least partly tilted towards the front of the capsule, on the side opposite to the base;

[0061] the rim of the body of the capsule is frusto-conical, widening towards the front; and

[0062] the rim of the body of the capsule is curved towards the front.

[0063] A sixth aspect of the invention relates to a capsule for extracting a pressurized drink, of the type comprising a body in the form of a cup and a seal delimiting a chamber containing a substance for preparing a drink, the body comprising a substantially frusto-conical side wall and a base closing the side wall at a first end, the seal closing the second end of the side wall, the capsule being adapted so as to be placed in the extraction device so that a pressurized extraction liquid penetrates into the capsule through the base and exits therefrom through the seal, characterized in that the capsule is adapted so that the base produces a contact against a capsule-receiving element of an extraction device, along a closed annular contact line.

[0064] According to other embodiments, said capsule includes one or more of the following features, taken individually or according to any technically possible combination (s):

[0065] the capsule is adapted so that, when an axial force is applied on the base of the body, at least one annular area of the side wall and/or of the base expands radially outwards;

[0066] the base of the body of the capsule comprises a rounded peripheral region with concavity turned towards the inside of the body;

[0067] the base is adapted so as to deform under the effect of an axially exerted force on the latter;

[0068] the base of the capsule comprises an annular peripheral region and a central region comprising an annular trench, the contact line being defined on the peripheral region;

- [0069] the contact line is defined by an external edge of the trench, at the junction between the trench and the peripheral region;
- [0070] the external edge of the trench is angled;
- [0071] the body of the capsule includes an annular rim at the end of the side wall opposite to the base, the annular rim being at least partly tilted towards the front of the capsule, on the side opposite to the base;
- [0072] the rim of the body of the capsule is frusto-conical, widening towards the front;
- [0073] the rim of the body of the capsule is curved towards the front; and
- [0074] the body is made as one piece in a plastic material or derived from plastic, or in metal.
- [0075] Finally, a seventh and last aspect of the invention relates to an extraction method by means of a system according to the fifth aspect of the invention, characterized in that the method includes the following steps:
- [0076] installation of the capsule in the drink extraction device;
- [0077] application by the receiving element of the extraction device, of a force (F) on the base of the capsule;
- [0078] deformation of the base and/or of the side wall of the body of the capsule, a portion of the base and/or of the side wall producing a contact along a closed line with the receiving element of the extraction device; and
- [0079] injection of extraction liquid into the capsule with liquid injection means of the extraction device.
- [0080] The invention will be better understood upon reading the description which follows only given as an example and made with reference to the appended drawings, wherein:
- [0081] FIG. 1 illustrates a perspective view of a first alternative of a capsule according to a first embodiment of the invention;
- [0082] FIG. 2 is a longitudinal sectional view of the capsule of FIG. 1;
- [0083] FIG. 3 is a front view of the capsule of FIG. 1;
- [0084] FIGS. 4 and 5 are views of the capsule of FIG. 1, installed in an extraction device in the partly open and closed configurations, respectively;
- [0085] FIG. 6 is a longitudinal sectional view of a second alternative of the capsule according to the first embodiment;
- [0086] FIG. 7 is a longitudinal sectional view of a third alternative of the capsule according to the first embodiment;
- [0087] FIG. 8 is a view of the capsule of FIG. 6, installed in an extraction device in the closed configuration;
- [0088] FIG. 9 is a perspective view of a first alternative of a capsule according to a second embodiment of the invention;
- [0089] FIG. 10 is a longitudinal sectional view of the capsule of FIG. 9;
- [0090] FIG. 11 is a rear view of the capsule of FIG. 9;
- [0091] FIG. 12 is a view of a detail marked as XII in FIG. 10;
- [0092] FIG. 13 is a view of a detail marked as XIII in FIG. 10;
- [0093] FIG. 14 is a view of the capsule of FIG. 8, installed in a first extraction device in the closed configuration;
- [0094] FIG. 15 is a view similar to FIG. 14, the capsule being installed in a second extraction device in the closed configuration;
- [0095] FIG. 16 is a longitudinal sectional view of a second alternative of a capsule according to the second embodiment;
- [0096] FIG. 17 is a view of a detail marked as XVII in FIG. 16;
- [0097] FIG. 18 is a rear view of a third alternative of a capsule according to the second embodiment;
- [0098] FIG. 19 is a rear view of a fourth alternative of a capsule according to the second embodiment;
- [0099] FIG. 20 is a rear view of a fifth alternative of a capsule according to the second embodiment;
- [0100] FIG. 21 is a rear view of a sixth alternative of a capsule according to the second embodiment; and
- [0101] FIG. 22 is a rear view of a seventh alternative of a capsule according to the second embodiment.
- [0102] The capsule 1 according to a first embodiment of the invention, illustrated in FIGS. 1 to 3, includes a hollow body 4 and an outlet seal 6 delimiting together an inner chamber 8 containing a substance (not shown) for preparing a drink.
- [0103] The body 4 has a general shape of a cup and comprises a side wall 10, a base 12 a closed rear end 20 of the body 4, and an annular rim 16 surrounding an open front end 22 of the body 4.
- [0104] The body 4 is made in one piece. The side wall 10, the base 12 and the annular rim 16 are made in the same material. The body 4 is made in a material impervious to air and water, for example in a plastic material or derived from plastic, or in metal.
- [0105] The side wall 10 extends from the base 12 along a longitudinal axis X as far as the front end 22 of the body 4.
- [0106] The side wall 10 comprises an inner shoulder 14. The shoulder 14 extends in a radial plane and is oriented towards the front.
- [0107] The side wall 10 is substantially frusto-conical and axisymmetrical around the longitudinal axis X. The side wall 10 comprises a relatively flexible rear segment 18 extending from the base 12 and a relatively stiff front segment 19 axially extending the rear segment 18. The front segment 19 has an axially increasing thickness, greater than that of the rear segment 18.
- [0108] The base 12 has a peripheral region 23, extending radially inwards from the side wall 10, and a central region 24.
- [0109] The peripheral region 23 is rounded. It extends radially inwards and axially rearwards from the side wall 10 and has concavity turned towards the inside of the body 4.
- [0110] The central region 24 comprises an annular rib 26 axially protruding towards the inside of the body 4 from the peripheral region 23. The annular rib 26 defines an open annular trench 28 on the outside of the body 4 rearwards. The annular rib 26 defines a hollow central stud 30 axially protruding from the base of the annular trench 28 while defining a recess inside the body 4.
- [0111] The central region 24 has at least one area of lower strength 32 intended to break under the effect of a pressurized fluid. The areas of lower strength 32 are for example provided as areas with smaller thickness of the central region 24, for example defined by indentations made in the central region 24.
- [0112] The areas of lower strength 32 are provided in walls of the annular rib 26 and/or on the central stud 30.
- [0113] In the illustrated example, the annular rib 26 comprises a tubular external portion 36 extending axially towards the inside from the peripheral region 23, a tubular internal portion 34 delimiting a side face of the central stud 30 and a base portion 38 extending radially between the external portion 36 and the internal portion 34 giving the annular rib 26 a substantially U-shaped cross-section.

[0114] As illustrated in FIG. 2, areas of lower strength 32 are provided in the base portion 38 and in the central stud 30 as areas with smaller thickness.

[0115] Alternatively, the central region 24 is without any area of lower strength 32 in the central stud 30. Alternatively or optionally, the annular rib 26 has areas of lower strength 32 in the external portion 36 and/or the internal portion 34.

[0116] In another possible alternative different from the one of the FIG. 2 by the shape of the annular rib 26, the external portion 36 and the internal portion 34 converge while giving the annular rib 26 a substantially V-shaped cross section. In this case, areas of lower strength 32 may be provided in the external portion 36, the internal portion 34 and/or the central stud 30.

[0117] As illustrated in FIG. 2, the annular trench 28 has an angled outer edge 44, preferably beveled, at the junction between the annular rib 26 and the peripheral region 23. The outer edge 44 delimits the rear end 20 of the capsule 1. The central stud 30 is axially set back towards the inside of the body 4 relatively to the outer edge 44.

[0118] Preferably, the peripheral region 23 has an over-thickness along the outer edge 44, so as to reinforce the outer edge 44. The peripheral region 23 for example has increasing thickness from the side wall 10 towards the outer edge 44.

[0119] The internal shoulder 14 is annular and protrudes radially from the side wall 10 towards the inside of the body 4. It is axially set back towards the inside of the body 4 relatively to the front end 22 of the body 4 and to the annular rim 16.

[0120] The seal 6 is attached through its periphery on the internal shoulder 14 so that the seal 6 is placed set back axially towards the inside of the body 4 relatively to a front end 22 of the body 4. Preferably the set-back distance of the seal 6 relatively to the front end 22 of the body 4 is greater than 1 mm.

[0121] The seal 6 closes the front end 22 of the body 4. The seal 6 comprises an outlet filter 49 capable of letting through a pressurized fluid while retaining the substance contained in the chamber 8. The filter 49 is in porous filter paper, in woven plastic material or in a perforated plastic film.

[0122] The seal 6 further comprises a membrane 50 impervious to air and to water, lining the filter 49. The membrane 50 has weakened lines 52 so that the membrane 50 is capable of tearing under the sole effect of the pressure of a liquid. In the example illustrated in FIGS. 1 and 3, the weakened lines 52 form a cross. Alternatively, they form a circle, circular arcs, or any other suitable shape for allowing optimum tearing of the membrane 50.

[0123] The filter 49 is placed between the chamber 8 and the membrane 50. The filter 49 and the membrane 50 are placed side by side. The filter 49 and the membrane 50 for example appear in the form of a bilayer complex film.

[0124] The annular rim 16 extends radially outwards from the side wall 10. The annular rim 16 defines the front end 22 of the body 4. The rim 16 has a free marginal region 54. It does not support any added seal element or any deformable seal relief. As illustrated in FIGS. 1 to 3, the annular rim 16 is substantially planar.

[0125] The capsule 1 is intended to be placed in an extraction device 350, illustrated in FIGS. 4 and 5.

[0126] The extraction device 350 includes a hollow receiving element 352 delimiting a housing 353 for receiving the capsule 1, and a support 354. It is capable of being maneuvered in an open configuration in which the receiving element

352 and the support 354 are spaced apart from each other in order to introduce the capsule 1 into the receiving element 352, and a closed position, illustrated in FIG. 5, in which the receiving element 352 and the support 354 are brought closer to each other, in order to inject the extraction liquid into the capsule 1. In FIG. 4, the device 350 is illustrated in an intermediate configuration in which it is partly open, but however not sufficiently open for allowing introduction of the capsule 1.

[0127] The housing 353 has an inner side face 360, a housing base 370 and a conduit 372 for supplying an extraction fluid, opening onto the base of the housing 370, substantially at the center and an aperture 376 for introducing the capsule 1.

[0128] The inner side face 360 is axisymmetrical around a longitudinal axis Y. In the illustrated example, it is substantially frusto-conical. When the capsule 1 is placed in the extraction device 350, the longitudinal axis X of the capsule 1 and Y of the housing 353 substantially coincide.

[0129] The receiving element 352 has an annular edge 380 surrounding the aperture 376.

[0130] The capsule 1 has a sufficient axial length so that, in the closed configuration of the extraction device 350, the capsule 1 through its annular rim 16 bears against the support 354 and through its base 12 against the housing base 370 along a closed annular contact line 122, preferably defined on the peripheral region 23 along the outer edge 44 of the annular trench 28.

[0131] The capsule 1 is advantageously adapted so as to elastically deform under the effect of an axial compressive force F in order to ensure sufficient contact between the base 12 and the housing base 370.

[0132] Optionally, the capsule 1 is adapted so that, under the effect of the axial compressive force F, at least one annular area 130 of the base 12 and/or of the side wall 10 of the capsule 1 radially expands outwards so as to ensure additional contact 128 with the side face 360 of the housing 353, along a closed annular contact line.

[0133] The method for extracting the capsule 1 with the extraction device 350 will now be described.

[0134] The capsule 1 is first placed in the device 350 in the open configuration, and the device 350 is then maneuvered so as to move into the closed configuration.

[0135] During this displacement towards the closed configuration, the capsule 1 will, through its annular rim 16, bear against the support 354 and then the receiving element 352 axially bears upon the base 12 of the capsule 1, so that the contact 122 is created, and the body 4 deforms in its entirety so that the contact 128 is created with the receiving element 352 of the device 350.

[0136] Once the device 350 is in a closed configuration, the extraction fluid is injected under pressure through the conduit 372. Under the effect of the pressure of the extraction fluid, the areas of lower strength 32 of the central region 24 of the base 12 break and the extraction fluid penetrates into the capsule 1.

[0137] The liquid pressure in the capsule 1 then increases and under the effect of this pressure, the outlet membrane 50 is torn. The fluid then escapes out of the capsule 1 crossing the seal 6 while being filtered by the filter 49.

[0138] By means of the invention, the base reinforced by an annular rib gives the possibility of making the body of the capsule in a relatively flexible, deformable material without the base collapsing towards the inside of the capsule under the

effect of the fluid pressure. The convexity of the base allows definition of a resistance and an elastically deformable base, with a large volume of the chamber giving the possibility of loading a larger amount of substance into the capsule. The rib delimiting in the outer face an annular trench allows improvement in the injection of the extraction liquid into the capsule. The presence of an annular rim gives the possibility of increasing the stability of the capsule on the support of the extraction device.

[0139] The capsule has a body in the form of a cup, the base of which is impervious to air and to water, the body being closed by a seal impervious to air and to water. The seal of the capsule gives the possibility of keeping the substance away from air and humidity. The seal has a membrane which tears under the effect of the pressurized fluid allowing suitable opening of the seal from a determined pressure level, with a beneficial delay effect for quality extraction. The seal set back axially towards the inside of the body avoids any interference with the support of the extraction device before opening the membrane, and thus allows controlled opening of the capsule. The membrane associated with a filter gives the possibility of ensuring extraction of the substance under satisfactory pressure conditions with effective retention of the substance inside the capsule. The seal provided as a complex film facilitates the making of the capsule at a low cost.

[0140] The alternative capsules illustrated in FIGS. 6 and 7 differ from those of FIGS. 1 to 3 in that the marginal region 54 of the annular rim 16 is tilted towards the front of the capsule 1. As illustrated in FIG. 6, the annular rim 16 is curved towards the front of the capsule 1. As illustrated in FIG. 7, the annular rim 16 is frusto-conical flaring towards the front.

[0141] As illustrated in FIGS. 8 and 9, during the closing of the extraction device 350 under the effect of the supporting force exerted by the support 354, the annular rim 16 deforms while flattening.

[0142] Such a rim 16 gives the possibility of guaranteeing and reinforcing the contact 122 between the base 12 of the capsule 1 and the housing base 370 upon closing the device 350, while it may deform in order to allow closing of the extraction device 350.

[0143] The capsule 1000 according to a second embodiment of the invention, illustrated in FIGS. 9 to 21, comprises, as visible in FIGS. 9 and 10, a hollow body 1004 and an outlet seal 1006 delimiting together an inner chamber 1008 containing a substance (not shown) for preparing a drink.

[0144] The body 1004 has the general shape of a cup and is impervious to air and to water. It comprises an outer side wall 1010, a base 1012 closing a rear end 1020 of the body 1004, and an annular rim 1016 surrounding an open front end 1022 of the body 1004.

[0145] The outer side wall 1010 and the base 1012 are made in the same material and made in a first plastic material impervious to air and to water. The first plastic material is selected so as to be inert towards the substance contained in the capsule 1000. Preferably, said first material is translucent and is not colored in the bulk so as to avoid diffusion of the coloration into the substance. Typically, the second plastic material is polyamide. Polyamide does not interfere with foodstuffs and is a highly performing barrier to air and to water.

[0146] Preferably, the annular rim 1016 consists of a second plastic material, different from the first plastic material. The second plastic material is preferentially selected so as to be a low cost material. As the latter is not in contact with the

substance, its properties towards the substance are not taken into account in the selection of the second material. Typically, the second plastic material is polyurethane which is an inexpensive material. Preferably, the second plastic material is a thermoplastic elastomer, currently designated as TPE, such as thermoplastic polyurethane, currently designated as TPU. Alternatively, the second material is an elastomerized polyamide, such as polyhexamethylene adipamide, currently designated as PA 6-6. These materials allow better attachment of the seal 1006 on the annular rim 1016.

[0147] Preferably, the first and second plastic materials are compatible materials, i.e. materials adapted for polymerizing with each other.

[0148] Thus, it is possible to produce capsules 1000 at a reduced cost. As these capsules are intended to be produced in very large series, this allows significant savings to be made.

[0149] Preferably, the second material is colored in the bulk. Thus, it is possible to color differently the annular rims 1016 of capsules 1000 containing different substances, so as to easily distinguish a capsule 1000 containing a first substance from another capsule 1000 containing a second substance different from the first.

[0150] The outer side wall 1010 extends from the base 1012 along a longitudinal axis X as far as the front end 1022 of the body 1004.

[0151] The outer side wall 1010 is substantially frusto-conical, axisymmetrical around the longitudinal axis X. It is rigid. It has an inner surface 1010a oriented towards the chamber 1008, and an outer surface 1010b, opposite to the inner surface 1010a.

[0152] The base 1012 comprises a peripheral region 1023 and a central region 1024. The peripheral region 1023 is rigid. It is rounded and extends radially inwards and axially rearwards from the outer side wall 1010 and has concavity turned towards the inside of the body 1004. It thus extends from the outer side wall 1010 as far as the rear end 1020 of the body 1004. The rear end 1020 is typically a closed line, for example a circle.

[0153] The central region 1024 axially enters the inside of the chamber 1008 from the peripheral region. The central region 1024 thus defines in the base 1012 a recess 1028 outside the body 1004.

[0154] The central region 1024 comprises a tubular external portion 1036 axially extending towards the inside of the chamber 1008 from the peripheral region 1023, a base portion 1038 extending radially towards the inside from the inner end of the external portion 1036, and closing the recess 1028, and a central internal portion 1034 protruding outwards from the base portion 1038.

[0155] The internal portion 1034 defines a hollow central stud 1030 in the recess 1028. The latter thus has an annular shape. The external portion 1036, the base portion 1038 and the internal portion 1034 define an annular rib 1026 in the central region 1024.

[0156] The base portion 1038 comprises at least one area of lower strength 1032 intended to break under the effect of a pressurized fluid. Preferably, said or each area of lower strength is provided for breaking at a pressure of the pressurized fluid comprised between 1 and 3 bars.

[0157] Said or each area of lower strength 1032 is for example provided in the form of areas of smaller thickness, as illustrated in FIG. 12. As long as said or each area of lower

strength **1032** is not broken, the base **1012** and by extension the whole of the body **1004**, are impervious to air and to liquid.

[0158] In the example illustrated in FIG. 11, the area of lower strength is defined at the periphery of the base portion **1038**, at the junction between the base portion **1038** and the external portion **1036**. The area of lower strength has the shape of a circular arc. The circular arc preferably extends over at least 270°.

[0159] The shape of the internal portion of **1034** conditions the axial shearing force generated by a pressurized liquid present in the recess **1028**.

[0160] In the embodiment of FIGS. 9 to 15, the internal portion **1034** has a frusto-conical shape, widening from rear to front of the capsule **1000** and protruding outwards.

[0161] Alternatively, the internal portion **1034** extends in a radial plane. At a determined pressure of the fluid present in the recess **1028**, a planar internal portion **1034** induces a higher shearing force than an outward protruding internal portion.

[0162] The body **1004** also comprises longitudinal ribs **1042** for stiffening the outer side wall **1010** and radial ribs **1044** for stiffening the base **1012**.

[0163] Each longitudinal rib **1042** extends longitudinally along the outer side wall **1010**, preferably, as illustrated, along the inner surface **1010a**. Thus, the longitudinal ribs are adapted for promoting the emulsion between the pressurized fluid and the substance contained in the chamber **1008**. Alternatively, each longitudinal rib **1042** extends along the outer surface **1010b**.

[0164] Each radial rib **1044** extends radially between the external portion **1036** and the peripheral region **1023**. The radial ribs **1044** stiffen the base **12** and thus promote the generation of shearing forces induced by the pressure of the pressurized fluid directly on said or each weakened area **1032**. In the example illustrated in FIGS. 10 to 15, each radial rib **1044** extends in the extension of a longitudinal rib **1042**.

[0165] The annular rim **1016** extends radially outwards, from an inner annular edge **1046** as far as an outer annular edge **1048**, from the outer surface **1010b** of the outer side wall **1010**. It defines the front end **1022** of the body **1004**. It does not support any added seal element or any deformable seal relief. Preferably, it is substantially planar. The outer annular edge **1048** is free.

[0166] As visible on the detail illustrated in FIG. 13, the outer surface **1010b** of the outer side wall **1010** defines, in proximity to the front end **1022** of the body **1004**, an annular clearance space **1049** defining a shoulder **1050** and a groove **1052** for connecting the annular rim **1016** to the outer side wall **1010**.

[0167] The shoulder **1050** is set back rearwards relatively to the front end **1022**. It extends radially and parallel to the front end **1022**, between an inner end **1054** and an outer end **1056**.

[0168] The groove **1052** is formed in the shoulder **1050** and protrudes longitudinally rearwards from the inner end **1054** of the shoulder **1050**.

[0169] The annular rim **1016** comprises an annular protrusion **1058** protruding longitudinally from the inner annular edge **1046** in the groove **1052**. The protrusion **1058** cooperates with the groove **1052** in order to reinforce the connection of the annular rim **1016** to the outer side wall **1010**.

[0170] Thus, a portion of the outer side wall **1010** extends between the annular rim **1016** and the chamber **1008**, which avoids that the substance be in contact with the second material.

[0171] Returning to FIG. 1, the seal **1006** is attached through its periphery onto the outer side wall **1010** and onto the annular rim **1016**. The seal **1006** thus closes the front end **1022** of the body **1004**.

[0172] The seal **1006** comprises an outlet filter **1060** capable of letting through a pressurized fluid while retaining the substance contained in the chamber **1008**. The filter **1060** is in a porous filter paper, in a woven plastic material or in a perforated plastic film. Preferably, the filter **1060** is, as illustrated, positioned set back from the front end **1022**, towards the chamber **1008**, and is attached on its periphery to the inner surface **1010a** of the outer side wall **1010**. The filter **1060** is for example positioned between 1 and 1.5 mm set back relatively to the front end **1022**.

[0173] The seal **1006** further comprises a membrane **1062** impervious to air and to water, lining the filter **1060**. Preferably, the membrane **1062** is attached, for example welded on the annular rim **1016**. The membrane **1062** extends along the front end **1022** of the body **1004**. The membrane **1062** gives the possibility of keeping the substance in an inert atmosphere so as to avoid any oxidation of the substance.

[0174] The membrane **1062** is peelable, i.e. it may easily be detached from the body **1004**. For this purpose, it comprises a tab **1064** extending radially outwards from the rim **1016** in order to allow a user to easily remove the membrane **1062** before using the capsule **1000** in an extraction device.

[0175] Optionally, the membrane **1062** has weakened lines (not shown) so that the membrane **1062** is able to tear under the sole effect of the pressure of a liquid. Thus, in the case when a user would have forgotten to remove the membrane **1062** before inserting the capsule **1000** in an extraction device, the extraction may still be performed normally without any risk of damage to the extraction device.

[0176] The filter **1060** is positioned between the chamber **1008** and the membrane **1062**. The space between the filter **1060** and the membrane **1062** is preferably filled with an inert gas, typically with nitrogen.

[0177] The capsule **1000** inserted into a drink extraction device **1100** is illustrated in FIG. 14. This device **1100** is similar to the extraction device **350** described above. Similar elements are designated with the same reference marks. It will be noted that the capsule **1000** is adapted so that the annular edge **380** comes into contact with the annular rim **1016** when the extraction device **1100** is in a closed configuration.

[0178] An alternative of the extraction device **1100** is illustrated in FIG. 15. In this figure, it will be observed that the conduit **372** for supplying an extraction liquid is radially shifted relatively to the longitudinal axis Y. Thus, the capsule **1000** is also adapted so as to be used in drink extraction devices where the arrival of pressurized liquid in the receiving housing **353** is not at the center of the housing **353**.

[0179] An alternative of the capsule **1000** is shown in FIGS. 16 and 17.

[0180] In this alternative, the internal portion **1034** has a hemispherical shape with concavity oriented towards the inside of the body **1004**. This shape is adapted so as to allow breaking of the weakened area **1032** at greater pressures in the case when the internal portion **1034** has a frusto-conical shape.

[0181] The annular rim 1016 is not bound to the outer surface 1010b of the outer side wall 1010, but to an annular front face 1066 of the outer side wall 1010. Said front annular face 1066 defines a groove 1068 protruding longitudinally rearwards and with which the protrusion 1058 of the annular rim 1016 cooperates for reinforcing the connection of the annular rim 1016 with the outer side wall 1010.

[0182] The inner surface 1010a of the outer side wall 1010 defines an annular inner shoulder 1070 extending in a radial plane and being oriented towards the front. The internal shoulder 1070 is axially set back towards the inside of the body 1004 relatively to the front end 1022 of the body 1004 and to the annular rim 1016. This inner shoulder 1070 is adapted for supporting the seal 1006.

[0183] As the inner shoulder 1070 is set back relatively to the front annular face 1066, the substance is thus not in contact with the second material forming the annular rim 1016. In the same way as in the first embodiment, the seal 1006 is formed by a bilayer complex film comprising the filter 1060 and the membrane 1062. This complex film is attached to its periphery onto the internal shoulder 1070 so that the seal 1006 is positioned, axially set back towards the inside of the body 1004 relatively to the front end 1022 of the body 1004. Preferably, the set-back distance of the seal 1006 relatively to the front end 1022 of the body 1004 is greater than 1 mm.

[0184] Other alternatives of the capsule 1000 are shown in FIGS. 18 to 22.

[0185] In the alternative illustrated in FIG. 18, the base portion of 1038 comprises a plurality of areas of lower strength 1032, each being formed by two weakened lines intersecting each other so as to form a cross. In the illustrated example, the areas of lower strength 1032 are four in number. Alternatively, a number of areas of lower strength 1032 is different.

[0186] In the alternative illustrated in FIG. 18, the base portion 1038 comprises a plurality of areas of lower strength 1032, each being formed by a closed circular weakened line, each delimiting a disc not including the internal portion 1034. In the illustrated example, the areas of lower strength 1032 are three in number. Alternatively, the number of areas of lower strength 1032 is different.

[0187] In the alternative illustrated in FIG. 20, the base portion 1038 comprises two areas of lower strength 1032, each having the shape of a serrated semi-circle and extending at the periphery of the base portion 1038, along the junction with the external portion 1036.

[0188] The base 12 further comprises two ribs 1080 for reinforcing the central region 1024. Each rib 1080 extends longitudinally between the tubular portion 1026 and the peripheral edge 1030. Each rib 1080 is interposed between both areas of lower strength 1034. In the illustrated example, the ribs 1080 are thus diametrically opposed to each other.

[0189] These ribs 1080 are intended to concentrate the shearing forces due to the force exerted by the pressurized fluid on the base 1012 in the extraction device 1100 on the areas of lower strength 1034.

[0190] In the alternative illustrated in FIG. 21, the base portion 1038 comprises three areas of lower strength 1032, each being formed by a closed line delimiting a crescent, the large side of which extends along the external portion 1036.

[0191] The base 1012 also comprises ribs 1080 for reinforcing the central region 1024. These ribs 1080 are here three in number and each is inserted between two areas of lower strength 1032.

[0192] Finally, in the alternative shown in FIG. 22, the base portion 1038 comprises a single area of lower strength 1032 formed by a closed circular line extending along the external portion 1036.

[0193] The method for making the capsule 1000 will be briefly described, with reference to FIG. 10.

[0194] In a first phase, the first plastic material is cast, for example injected, into a mold, in order to form the base 1012 and the outer side wall 1010. Next, in a second phase, the second plastic material is in turn cast into the mold so as to form the annular rim 1016.

[0195] As the first and second plastic materials are compatible materials, they bind together chemically. In particular, a portion of the molecules of the first material diffuses into the second material and vice versa. Thus, a thin layer is formed in which both materials are mixed and both materials are thus intimately bound with each other.

[0196] By means of the invention, the portion of the body of the capsule in contact with the substance is formed in material which is inert towards the substance, which gives the possibility of keeping the substance under optimum conditions, without any risks of degrading the substance by oxidation or by toxic elements contained in the material in contact with the substance.

[0197] Further, as the first plastic material is not colored in the bulk, it is possible to reduce the probability of migration of toxic elements from the capsule to the substance.

[0198] Finally, by using a second material for the annular rim, it is possible to reduce the manufacturing costs of the capsule and further allows by coloration of the second material easy identification of the substance contained in the chamber of the capsule, without any risk of migration of the pigments into the substance, the latter not being in contact with the second material.

[0199] It will be noted that the description given above is by no means restrictive, and the features of the different alternatives and of the different embodiments may be combined with each other without departing from the scope of the invention.

1. A capsule for extracting a pressurized drink, the capsule comprising a body in the form of a cup and a seal delimiting together a chamber containing a substance for preparing a drink, the body comprising:

- an outer substantially frusto-conical side wall,
- a base, made in the same material as the outer side wall and closing the outer side wall at a rear end of the body, and
- an annular rim extending radially outwards from the outer side wall and delimiting the front end of the body,
- the seal closing the outer side wall at the front end, the capsule being adapted so as to be positioned in an extraction device so that a pressurized extraction liquid penetrates into the capsule through the base and flows out therefrom through the seal characterized in that the base and the wall are made in a first plastic material, the annular rim being formed in a second plastic material, different from the first plastic material.

2. The capsule according to claim 1, wherein the first plastic material is polyamide.

3. The capsule according to claim 1, wherein the second plastic material is polyurethane.

4. The capsule according to claim 1, wherein the second plastic material is a thermoplastic elastomer.

5. The capsule according to claim 1, wherein the second plastic material is thermoplastic polyurethane.

6. The capsule according to claim 1, the second plastic material is an elastomerized polyamide.

7. The capsule according to claim 1, wherein the outer side wall comprises an inner surface, oriented towards the chamber, and an outer surface opposite to the inner surface, the outer surface defining a shoulder for connecting the annular rim to the outer side wall.

8. The capsule according to claim 1, wherein the outer side wall defines a groove for connecting the annular rim to the outer side wall, the annular rim including an annular protrusion cooperating with the groove for reinforcing the connection of the annular rim to the outer side wall.

9. The capsule according to claim 1, wherein the first plastic material is not colored in the bulk.

10. The capsule according to claim 1, wherein the second plastic material is colored in the bulk.

11. The capsule according to claim 1, wherein the base is formed by a peripheral region delimiting a rear end of the body, and by a central region entering towards the inside of the capsule relatively to the rear end while defining a recess outside the body, the central region comprising at least an area of lower strength intended to at least partly break under the pressure of a pressurized liquid.

12. The capsule according to claim 11, wherein said or each area of lower strength is adapted so as to break at a pressure of the pressurized liquid comprised between 1 and 3 bars.

13. The capsule according to claim 11, wherein before breakage of said or each area of lower strength, the base and the outer side wall of the body are impervious to air and to liquids.

14. The capsule according to claim 1, wherein the seal comprises a filter and a membrane.

15. The capsule according to claim 14, wherein the filter is set back from the front end of the body towards the chamber, the membrane extending along the front end.

16. The capsule according to claim 15, wherein the gap between the filter and the membrane is filled with nitrogen.

17. The capsule according to claim 14, wherein the membrane is peelable.

18. A system comprising a capsule according to claim 1 and an extraction device including a housing intended for receiving the capsule, a support, and a conduit for supplying a pressurized extraction liquid.

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