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DESCRIPTION

[0001] The invention relates to a capsule containing a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of supplying a fluid under pressure into the capsule, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with an enclosing member of a beverage preparation device if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of a closing member of the beverage preparation device, such as an extraction plate of the beverage preparation device, such that the outwardly extending flange of the capsule and at least a portion of the sealing member of the capsule are sealingly engaged between the enclosing member and the closing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radially extending open grooves.

[0002] The invention also relates to a system for preparing a potable beverage from a capsule using a fluid supplied under pressure into the capsule comprising:

a beverage preparation device comprising an enclosing member for receiving the capsule, wherein the enclosing member comprises fluid supply means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member, such as an extraction plate, for closing the enclosing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device further comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radially extending open grooves;

a capsule containing a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of the fluid supplied under pressure into the capsule by the fluid supply means of the beverage preparation device, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with the enclosing member of the beverage preparation device if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of the closing member of the beverage preparation device, such that the outwardly extending flange of the capsule and at least a portion of the sealing member of the capsule are sealingly engaged

between the enclosing member and the closing member of the beverage preparation device.

[0003] Furthermore the invention relates to the use of a capsule in a beverage preparation device comprising an enclosing member for receiving the capsule, wherein the enclosing member comprises fluid supply means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member, such as an extraction plate, for closing the enclosing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device further comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radially extending open grooves; wherein the capsule contains a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of the fluid supplied under pressure into the capsule by the fluid supply means of the beverage preparation device, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with the enclosing member of the beverage preparation device if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of the closing member of the beverage preparation device, such that the outwardly extending flange of the capsule and at least a portion of the sealing member of the capsule are sealingly engaged between the enclosing member and the closing member of the beverage preparation device.

[0004] Such a capsule, system and use are known from WO 2014/184653 or EP-B-1 700 548.

[0005] In the known system the capsule is provided with a sealing member having the shape of a step, i.e. a sudden increase of the diameter of the side wall of the capsule, and the enclosing member of this known system has a sealing surface acting on the sealing member to provide deflection of the sealing member, the sealing surface being inclined so that the deflection of the sealing member is an inwards and downwards deformation of the step. Furthermore in the known system the enclosing member comprises a capsule holder and a manually operated or an automatic mechanism for relative displacement of the enclosing member and the capsule holder. The manually operated or an automatic mechanism applies a force on the sealing member of the capsule when the enclosing member closes on the capsule holder. This force should ensure the fluid tight seal between the enclosing member and the capsule. Because the manually operated or an automatic mechanism is arranged to be moved relative to the base, the sealing capabilities of the system can depend on the pressure of the fluid supplied by the fluid supply means. If the pressure of the fluid increases, the force between the sealing member of the capsule and the free end of the enclosing member increases too and thereby the force between the sealing member of the capsule and the free

end of the enclosing member increases also. Such a system is described further on. The sealing member of the capsule must be arranged such that upon reaching the maximum fluid pressure in the enclosing member the sealing member should still provide a fluid sealing contact between the enclosing member and the capsule. However, the sealing member must also be arranged such that prior to, or at the start of, brewing when the pressure of the fluid in the enclosing member outside the capsule is relatively low, the sealing member also provides a fluid sealing contact between the enclosing member and the capsule. If at the start of brewing, there would not exist a fluid sealing contact between the capsule and the enclosing member, leakage will occur. However, if leakage occurs there is a real chance that the pressure in the enclosing member and outside the capsule will not sufficiently increase for increasing the force on the sealing member by means of the free end of the enclosing member if the manually operated or an automatic mechanism moves the enclosing member towards the capsule holder. Only if there is a sufficient initial sealing, the pressure in the enclosing member will increase whereby also the force of the free end of the enclosing member acting on the sealing member of the capsule will increase for providing a sufficient fluid sealing contact at also the increased fluid pressure. Moreover, this increased fluid pressure outside the capsule also provides an increased fluid pressure inside the capsule which is essential if the capsule is provided with a cover which is arranged to tear open on relief members of the capsule holder (also called an extraction plate) of the beverage preparation device under the influence of fluid pressure in the capsule.

[0006] It follows from the above that the sealing member is a member which is very critical in design. It should be able to provide a fluid sealing contact between the enclosing member and the capsule at a relatively low fluid pressure if only a relatively small force is applied on the sealing member by means of the free end of the enclosing member but it should also provide a fluid sealing contact at a much higher fluid pressure in the enclosing member outside the capsule if a higher force is applied by means of the free end of the enclosing member to the sealing member of the capsule. In particular when the free contact end of the enclosing member is provided with radially extending open grooves which act as air inlet passage once the force between the enclosing member and the capsule holder is released so that it is easier for a user to take out the capsule, the sealing member must also be able to 'close' the radially extending open grooves to provide an effective seal.

[0007] It is an object of the invention to provide an alternative sealing member which is relatively easy to manufacture, which is environmentally friendly if the capsule is disposed of after use and/or which provides a satisfactory sealing both at a relatively low fluid pressure if only a relatively small force is applied on the sealing member by means of the free end of the enclosing member (sometimes also called initial seal) and at a much higher fluid pressure if a higher force is applied (e.g. during brewing) by means of the free end of the enclosing member to the sealing member of the capsule, even in case of an enclosing member of which the free contact end is provided with radially extending open grooves.

[0008] The invention has also as an object to provide an alternative system for preparing a potable beverage from a capsule and to provide an alternative use of a capsule in a beverage

preparation device.

[0009] In accordance with the invention there is provided in a first aspect a capsule containing a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of supplying a fluid under pressure into the capsule, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with an enclosing member of a beverage preparation device if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of a closing member of the beverage preparation device, such as an extraction plate of the beverage preparation device, such that the outwardly extending flange of the capsule and at least a portion of the sealing member of the capsule are sealingly engaged between the enclosing member and the closing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radially extending open grooves, characterized in that, the sealing member is formed by the outwardly extending flange of the aluminum capsule body, wherein at least said outwardly extending flange is made of aluminum sponge. Since the sealing member is made of aluminum sponge it is not only relatively easy to manufacture but in addition it appears to be able to provide a satisfactory seal during use. In particular the sealing member can provide a satisfactory sealing with the free contact end provided with radially extending open grooves. In addition it is environmentally friendly if the capsule is disposed of after use. Please note that aluminum sponge is sometimes also called aluminum foam.

[0010] In this application the existence of a fluid sealing contact means that 0-6%, preferably 0-4%, more preferably 0-2.5% of the total fluid supplied to the enclosing member for preparing the beverage may leak away due to leakage between the free contact end and the sealing member of the capsule.

[0011] The invention is in particular advantageous when in an embodiment of a capsule the capsule contains an extractable product as substance for the preparation of a potable beverage, said extractable product preferably being 5-20 grams, preferably 5-10 grams, more preferably 5-7 grams of roasted and ground coffee.

[0012] In an embodiment of a capsule according to the invention which is in particular easy to manufacture the outer diameter of the outwardly extending flange of the capsule is larger than the diameter of the bottom of the capsule. Preferably, the outer diameter of the outwardly extending flange is approximately 37.1 mm and the diameter of the bottom of the capsule is about 23.3 mm.

[0013] The invention is in particular advantageous when in an embodiment of a capsule the thickness of the aluminum capsule body is such that it is deformed easily if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of a closing member of the beverage preparation device, preferably the thickness of the aluminum capsule body is 20 to 200 micrometer, preferably 100 micrometer.

[0014] The invention is in particular advantageous when in an embodiment of a capsule the thickness of the aluminum cover is 15 to 65 micrometer, preferably 30 to 45 micrometer, and most preferred 39 micrometer.

[0015] In an embodiment of a capsule according to the invention the wall thickness of the aluminum cover is smaller than the wall thickness of the aluminum capsule body.

[0016] In a further embodiment of a capsule according to the invention the aluminum cover is arranged to tear open on a closing member of the beverage preparation device, such as an extraction plate of the beverage preparation device under the influence of fluid pressure in the capsule.

[0017] In an embodiment of a capsule according to the invention which is in particular easy to manufacture the side wall of the aluminum capsule body has a free end opposite the bottom, the outwardly extending flange extending from said free end of the side wall in a direction at least substantially transverse to the central capsule body axis. Preferably, the outwardly extending flange comprises a curled outer edge, which is beneficial in obtaining for a satisfactory sealing with the free contact end provided with radially extending open grooves.

[0018] The radius about the central capsule body axis of an inner edge of the curled outer edge of the outwardly extending flange is preferably at least 32 mm, so that clearance from the annular end surface of the enclosure member is ensured. It is then preferred that the sealing member is positioned between the free end of the side wall of the aluminum capsule body and an inner edge of the curled outer edge of the outwardly extending flange to obtain a still further satisfactory sealing.

[0019] To ensure that the curled outer edge does not interfere with operation of a wide variety of commercially available and future beverage preparation apparatuses, the curled outer edge of the outwardly extending flange has a largest dimension of about 1.2 millimeter.

[0020] The invention is in particular beneficial for capsules of which the inner diameter of the free end of the side wall of the aluminum capsule body is about 29.5 mm. The distance between the free end of the side wall of the aluminum capsule body and an outermost edge of the outwardly extending flange can be about 3.8 millimeter. The preferred height of the aluminum capsule body is about 28.4 mm.

[0021] In an embodiment of a capsule according to the invention which after use is easier for

a user to take out of a beverage preparation device the aluminum capsule body is truncated, wherein preferably the side wall of the aluminum capsule body encloses an angle with a line transverse to the central capsule body axis of about 97.5°.

[0022] In an advantageous embodiment of a capsule according to the invention the bottom of the aluminum capsule body has a largest inner diameter of about 23.3 mm. It is preferred that the bottom of the aluminum capsule body is truncated, preferably having a bottom height of about 4.0 mm and that the bottom further has a generally flat central portion opposite the cover having a diameter of about 8.3 mm.

[0023] In a preferred embodiment of a capsule according to the invention the capsule comprises an inner surface, and wherein on the inner surface of at least the side wall of the capsule an inner coating is provided. In particular when the capsule is manufactured by deep drawing the inner coating facilitates the deep drawing process. In case the aluminum cover of the capsule is attached to the outwardly extending flange by means of a sealing lacquer it is then in particular advantageous when said inner coating being composed of the same material as the sealing lacquer. Alternatively, in order to improve the sealing during use on the outer surface of the sealing member an outer coating is provided, whereas the outer surface of the sealing member is free from a color lacquer.

[0024] In a further embodiment of a capsule according to the invention the capsule comprises an outer surface, wherein on the outer surface of the capsule a color lacquer is provided. In order to facilitate in deep drawing it is preferred to provide on an outer surface of the color lacquer an outer coating. In dependence of the color lacquer and outer coating used it is preferred that the sealing member is free from a color lacquer (and consequently the outer coating) in order to prevent crumbling off of the color lacquer/outer coating from the sealing member.

[0025] Although it is possible that only the sealing member is made of aluminum sponge, from a manufacturing point of view it is easier when the aluminum capsule body is made of aluminum sponge. Preferably the aluminum sponge comprises a porosity in the range of 75 - 95%, preferably a porosity of 80 - 85%, meaning that 75 -95%, or preferably 80 - 85% of the volume of the aluminum sponge is empty space. An aluminum sponge particularly suitable for a capsule containing a substance for the preparation of a potable beverage is obtained when the aluminum sponge is produced by mixing TiH_2 as a foaming agent into molten aluminum.

[0026] In a preferred embodiment of a capsule according to the invention the sealing member is formed by aluminum. Please note that with aluminum also aluminum alloys are meant.

[0027] In a further embodiment of a capsule according to the invention only the outwardly extending flange is made of aluminum sponge, comprising air pockets.

[0028] In accordance with the invention there is provided in a second aspect a system for preparing a potable beverage from a capsule using a fluid supplied under pressure into the

capsule comprising:

a beverage preparation device comprising an enclosing member for receiving the capsule, wherein the enclosing member comprises fluid supply means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member, such as an extraction plate, for closing the enclosing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device further comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radially extending open grooves;

a capsule containing a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of the fluid supplied under pressure into the capsule by the fluid supply means of the beverage preparation device, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with the enclosing member of the beverage preparation device if the closed capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of the closing member of the beverage preparation device, such that the outwardly extending flange of the closed capsule and at least a portion of the sealing member of the closed capsule are sealingly engaged between the enclosing member and the closing member of the beverage preparation device, characterized in that, the sealing member is formed by the outwardly extending flange of the aluminum capsule body, wherein at least said outwardly extending flange is made of aluminum sponge. Since the sealing member is formed of aluminum sponge it is not only relatively easy to manufacture but in addition it appears to be able to provide a satisfactory seal during use. In particular the sealing member can provide a satisfactory sealing with the free contact end provided with radially extending open grooves. In addition it is environmentally friendly if the capsule is disposed of after use.

[0029] Regarding the preferred embodiments of the system as mentioned in the dependent claims which relate to the same features as the features of the dependent claims of the capsule reference is made to the above.

[0030] The invention is particularly suitable in a system according to the invention wherein, in use, the maximum fluid pressure in the enclosing member of the beverage preparation device is in the range of 6-20 bar, preferably between 12 and 18 bar. Even at this high pressures a satisfactory seal between capsule and beverage preparation device can be obtained.

[0031] Preferably the system is arranged such that, in use, during brewing, a free end of the enclosing member of the beverage preparation device exerts a force F_2 on the sealing

member of the capsule to provide a fluid sealing contact between the outwardly extending flange of the capsule and the enclosing member of the beverage preparation device, wherein F_2 is in the range of 500-1500 N preferably in the range of 750-1250 N when the fluid pressure P_2 in the enclosing member of the beverage preparation device outside the capsule is in the range of 6-20 bar, preferably between 12 and 18 bar. In particular the system is arranged such that, in use, prior to or at the start of brewing, a free end of the enclosing member of the beverage preparation device exerts a force F_1 on the sealing member of the capsule to provide a fluid sealing contact between the outwardly extending flange of the capsule and the enclosing member of the beverage preparation device, wherein F_1 is in the range of 30-150 N preferably in the range of 40-150 N, more preferably 50-100 N, when the fluid pressure P_1 in the enclosing member of the beverage preparation device outside the capsule is in the range of 0.1 - 4 bar, preferably between 0.1 - 1 bar.

[0032] In an embodiment of a system according to the invention wherein the plurality of radially extending open grooves are uniformly spaced relative to each other in tangential direction of the free contact end of the annular element of the beverage preparation device so that it is easier for a user to take out the capsule while a satisfactory seal between capsule and beverage preparation device can still be provided.

[0033] In an advantageous embodiment of a system according to the invention the longest tangential width of each groove (top to top, i.e. equal to the groove to groove pitch) is 0.9 - 1.1 mm, preferably 0.95 to 1.05 mm, more preferably 0.98 to 1.02 mm, wherein a maximal height of each groove in an axial direction of the enclosing member of the beverage preparation device is 0.01 - 0.09 mm, preferably 0.03 to 0.07 mm, more preferably 0.045 to 0.055 mm, most preferred 0.05 mm and wherein the number of grooves is 90 to 110, preferably 96. The radial width of the annular end surface at the location of the grooves may for instance be 0.05-0.9 mm, preferably 0.2- 0.7 mm and more preferably 0.3 - 0.55 mm. The invention is in particular suitable when applied to an embodiment of a system according to the invention in which during use when the closing member of the beverage preparation device closes the enclosing member of the beverage preparation device at least the free contact end of the enclosing member of the beverage preparation device can move relative to the closing member of the beverage preparation device under the effect of the pressure of the fluid in the enclosing member of the beverage preparation device towards the closing member of the beverage preparation device for applying the maximum force between the flange of the capsule and the free end of the enclosing member of the beverage preparation device. The enclosing member may comprise a first part and a second part wherein the second part comprises the free contact end of the enclosing member wherein the second part can move relative to the first part between a first and second position. The second part can move from the first position towards the second position in the direction of the closing member under the influence of fluid pressure in the enclosing member. The force F_1 as discussed above may be reached if the second part is in the first position with a fluid pressure P_1 . The force F_2 as discussed above may be reached if the second part is moved towards the second position under the influence of the fluid pressure P_2 in the enclosing member.

[0034] In accordance with the invention there is provided in a third aspect a use of a capsule according to the invention in a beverage preparation device comprising an enclosing member for receiving the capsule, wherein the enclosing member comprises fluid supply means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member, such as an extraction plate, for closing the enclosing member of the beverage preparation device, wherein the enclosing member of the beverage preparation device further comprises an annular element having a central annular element axis and a free contact end, said free contact end of the annular element optionally being provided with a plurality of radial grooves; wherein the capsule contains a substance for the preparation of a potable beverage by extracting and/or dissolving the substance by means of the fluid supplied under pressure into the capsule by the fluid supply means of the beverage preparation device, wherein the capsule comprises an aluminum capsule body having a central capsule body axis, said aluminum capsule body being provided with a bottom, a side wall and an outwardly extending flange, the capsule further comprising an aluminum cover attached to the outwardly extending flange, the cover hermetically closing the capsule, wherein the capsule further comprises a sealing member at the outwardly extending flange for providing a fluid sealing contact with the enclosing member of the beverage preparation device if the closed capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by means of the closing member of the beverage preparation device, such that the outwardly extending flange of the capsule and at least a portion of the sealing member of the closed capsule are sealingly engaged between the enclosing member and the closing member of the beverage preparation device. Regarding the advantage of the inventive use and the preferred embodiments of the use as mentioned in the dependent claims which relate to the same features as the features of the dependent claims of the capsule or the dependent claims of the system reference is made to the above.

[0035] The invention will now be further elucidated by means of, nonlimiting, examples referring to the drawing, in which

Fig. 1 shows a schematic representation of an embodiment of a system according to the invention;

Fig. 2 in a perspective view shows an embodiment of a beverage preparation device of a system according to the invention showing the free contact end of the enclosing member of the beverage preparation device with the plurality of radially extending open grooves;

Fig. 3A in cross section shows an embodiment of a capsule according to the invention before use;

Fig. 3B shows an enlarged detail of a the capsule of Fig. 3A showing the outwardly extending flange and the sealing member;

Fig. 3C shows an enlarged detail of the outwardly extending flange of the capsule in Figures 3A and 3B after use; and

Figure 4 schematically shows an outwardly extending flange of aluminum sponge indicating the

air pockets.

[0036] In the Figures and the following description, like reference numerals refer to like features.

[0037] Fig. 1 shows a schematic representation, in cross sectional view, of an embodiment of a system 1 for preparing a potable beverage from a capsule using a fluid supplied under pressure into the capsule. The system 1 comprises a capsule 2, and a beverage preparation device 4. The device 4 comprises enclosing member 6 for holding the capsule 2. The device 4 further comprises a closing member, such as an extraction plate, 8 for supporting the capsule 2.

[0038] In Fig. 1 a gap is drawn between the capsule 2, the enclosing member 6 and the extraction plate 8 for clarity. It will be appreciated that, in use, the capsule 2 may lie in contact with the enclosing member 6 and the extraction plate member 8. Commonly, the enclosing member 6 has a shape complementary to the shape of the capsule 2. The apparatus 4 further comprises a fluid supply means 10 for supplying an amount of a fluid, such as water, under a pressure in the range of 6-20 bar, preferably between 12 and 18 bar, to the exchangeable capsule 2.

[0039] In the example shown in Fig. 1, the exchangeable capsule 2 comprises an aluminum capsule body 12 having a central capsule body axis 12A and an aluminum cover 14. In the present context, the meaning of 'aluminum' is understood to also include aluminum alloy. In this example, the aluminum capsule body 12 is made of aluminum sponge and comprises a side wall 16, a bottom 18 closing the side wall 16 at a first end, and an outwardly extending flange 20 extending outwardly of the circumferential wall 16 at a second end opposite the bottom 18. The side wall 16, the bottom 18 and the cover 14 enclose an inner space 22 comprising a substance for the preparation of a potable beverage by extracting and/or dissolving the substance. Preferably the substance contains an extractable product for the preparation of a potable beverage, said extractable product preferably being 5-20 grams, preferably 5-10 grams, more preferably 5-7 grams of roasted and ground coffee for the preparation of a single beverage. The capsule is initially sealed, i.e. is hermetically closed prior to use.

[0040] The system 1 of Fig. 1 comprises bottom piercing means 24 for piercing the bottom 18 of the capsule 2 for creating at least one entrance opening 25 in the bottom 18 for supplying the fluid to the extractable product through the entrance opening 25.

[0041] The system 1 of Fig. 1 further comprises cover piercing means 26, here embodied as protrusions of the closing member 8, for piercing the cover 14 of the capsule 2. The cover piercing means 26 may be arranged to tear the cover 14 once a (fluid) pressure inside the inner space 22 exceeds a threshold pressure and presses the cover 14 against the cover

piercing means 26 with sufficient force. The aluminum cover 14 thus is arranged to tear open on the closing member 8 of the beverage preparation device under the influence of fluid pressure in the capsule.

[0042] The capsule 2 further comprises a sealing member 28, which sealing member 28 is formed by the outwardly extending flange 20 for providing a fluid sealing contact with the enclosing member 6 if the capsule 2 is positioned in the enclosing member 6 and the enclosing member 6 is closed by means of the extraction plate 8, such that the outwardly extending flange 20 of the capsule 2 and at least a portion of the sealing member 28 are sealingly engaged between the enclosing member 6 and the extraction plate 8. According to the invention the sealing member 28 is formed by the outwardly extending flange 20 of the aluminum capsule body 2 which is made of aluminum sponge. In most cases it suffices for a satisfactory sealing to be obtained when only the flange 20 is made of aluminum sponge and is a flat surface which extends transversely to the central axis 12A from the side wall 16 to the curled edge 43. In this case the outwardly extending flange 20 forms the sealing member. In such an embodiment it is beneficial from a manufacturing point of view when the complete aluminum capsule body is made of aluminum sponge. The aluminum sponge material used has a porosity in the range of 75-95%, preferably a porosity of 80-85% and is produced by mixing TiH_2 as a foaming agent into molten aluminum. As schematically represented in Figure 4 the aluminum sponge comprises air pockets 201. This means that a fluid sealing contact between the sealing member and the free contact end is established.

[0043] As shown in Figure 2 the enclosing member 6 of the beverage preparation device comprises an annular element 41 having a central annular element axis 41A and a free contact end 30. The free contact end 30 of the annular element 41 is provided with a plurality of radially extending open grooves 40. The plurality of radially extending open grooves 40 are uniformly spaced relative to each other in tangential direction of the free contact end 30 of the annular element 41. The longest tangential width of each groove 40 is 0.9 - 1.1 mm, preferably 0.95 to 1.05 mm, more preferably 0.98 to 1.02 mm, wherein a maximal height of each groove 40 in an axial direction of the enclosing member 6 is 0.01 - 0.09 mm, preferably 0.03 to 0.07 mm, more preferably 0.045 to 0.055 mm, and most preferred 0.05 mm. The number of grooves 40 lies in the range of 90 to 110, preferably 96. Usually, the radial width of the free end at the location of the grooves is 0.05 - 0.9 mm, more specifically 0.2 - 0.7 mm, more specifically 0.3 - 0.55 mm.

[0044] An embodiment of a capsule according to the invention is shown more detailed in Figures 3A and 3B. In the shown embodiment the outer diameter ODF of the outwardly extending flange 20 is larger than the diameter DB of the bottom 18 of the capsule 2. In the shown embodiment the outer diameter ODF of the outwardly extending flange 20 is approximately 37.1 mm and the diameter DB of the bottom 18 is about 23.3 mm. The thickness of the aluminum capsule body 12 is 100 micrometer, but in other embodiments the thickness can be 20 to 200 micrometer.

[0045] In the shown embodiment the thickness of the aluminum cover 14 is 39 micrometer,

although in other embodiments the thickness can be 15 to 65 micrometer, preferably 30 to 45 micrometer, and is preferably smaller than the thickness of the aluminum capsule body 12.

[0046] The side wall 16 of the aluminum capsule body 12 has a free end 42 opposite the bottom 18. The inner diameter IDF of the free end 42 of the side wall 16 of the aluminum capsule body 12 is about 29.5 mm. The outwardly extending flange 20 extends from that free end 42 in a direction at least substantially transverse to the central capsule body axis 12A. The outwardly extending flange 20 comprises a curled outer edge 43 which is beneficial for obtaining a seal between the capsule and the enclosing member. In the shown embodiment the curled outer edge 43 of the outwardly extending flange 20 has a largest dimension of about 1.2 millimeter. The distance DIF between the free end 42 of the side wall 16 of the aluminum capsule body 12 and an inner edge 43A of the curled outer edge 43 is about 2.7 mm, while the distance DOF between the free end 42 of the side wall 16 of the aluminum capsule body 12 and an outermost edge 43B of the outwardly extending flange 20 is about 3.8 millimeter.

[0047] As can be seen from Figure 3A the aluminum capsule body 12 is truncated. In the embodiment shown, the side wall 16 of the aluminum capsule body 12 encloses an angle A with a line transverse to the central capsule body axis 12A of about 97.5°. The bottom 18 of the aluminum capsule body 12 has a largest inner diameter DB of about 23.3 mm. The bottom 18 of the aluminum capsule body 12 is also truncated, and in the shown embodiment has a bottom height BH of about 4.0 mm. The bottom 18 further has a generally flat central portion 18A opposite the cover 14, which generally flat central portion 18A has a diameter DEE of about 8.3 mm and in which generally flat central portion 18A the entrance opening 25 is to be made. The total height TH of the aluminum capsule body 12 of the capsule is about 28.4 mm.

[0048] The system 1 shown in Fig. 1 is operated as follows for preparing a cup of potable coffee, wherein the substance is roasted and ground coffee.

[0049] The capsule 2 is placed in the enclosing member 6. The extraction plate 8 is brought into contact with the capsule 2. The bottom piercing means 24 pierce the bottom 18 of the capsule 2 for creating the entrance openings 25. The fluid, here hot water under pressure, is supplied to the extractable product in the inner space 22 through the entrance openings 25. The water will wet the coffee grounds and extract the desired substances to form the coffee beverage.

[0050] During supplying the water under pressure to the inner space 22, the pressure inside the capsule 2 will rise. The rise in pressure will cause the cover 14 to deform and be pressed against the lid piercing means 26 of the extraction plate. Once the pressure reaches a certain level, the tear strength of the cover 14 will be surpassed and the cover 14 will rupture against the lid piercing means 26, creating exit openings. The prepared coffee will drain from the capsule 2 through the exit openings and outlets 32 (see Fig. 1) of the extraction plate 8, and may be supplied to a container such as a cup (not shown).

[0051] The system 1 is arranged such that prior to or at the start of brewing, the free end 30

of the enclosing member 6 exerts a force F_1 on the sealing member 28 of the capsule 2 to provide a fluid sealing contact between the outwardly extending flange 20 of the capsule 2 and the enclosing member 6 of the beverage preparation device, wherein F_1 is in the range of 30-150 N preferably 40-150 N, more preferably 50-100 N, when the fluid pressure P_1 in the enclosing member of the beverage preparation device outside the capsule is in the range of 0.1-4 bar, preferably 0.1-1 bar. During brewing, the free end 30 of the enclosing member 6 exerts a force F_2 on the sealing member 28 of the capsule 2 to provide a fluid sealing contact between the outwardly extending flange 20 of the capsule 2 and the enclosing member 6, wherein the force F_2 is in the range of 500 -1500 N, preferably in the range of 750-1250 N, when the fluid pressure P_2 in the enclosing member 6 of the beverage preparation device outside the capsule 2 is in the range of 6-20 bar, preferably between 12 and 18 bar. In the shown embodiment the free contact end of enclosing member 6 can move relative to the extracting plate 8 under the effect of the pressure of the fluid in the enclosing member 6 device towards the extraction plate 8 for applying the maximum force F_2 between the outwardly extending flange 20 and the free end 30 of the enclosing member 6. This movement can take place during use, i.e. in particular at the start of brewing and during brewing. The enclosing member 6 has a first part 6A and a second part 6B wherein the second part comprises the free contact end 30. The second part 6B can move relative to the first part 6A between a first and second position. The second part 6B can move from the first position towards the second position in the direction of the closing member 8 under the influence of fluid pressure in the enclosing member 6. The force F_1 as discussed above may be reached if the second part 6B is in the first position with a fluid pressure P_1 . The force F_2 as discussed above may be reached if the second part 6B is moved towards the second position under the influence of the fluid pressure P_2 in the enclosing member 6.

[0052] As a result of the force applied the sealing member 28 of the capsule according to the invention undergoes a plastic deformation and closely conforms to the grooves 40 of the free contact end 30 and thus provides a fluid sealing contact between the enclosing member 6 and the capsule 3 at a relatively low fluid pressure during start up of brewing but also provides a fluid sealing contact at the much higher fluid pressure in the enclosing member outside the capsule during brewing. This close conformation to the grooves 40 of the enclosing member is indicated in Figure 3C which shows the capsule 2 of the invention after use, and which clearly indicates that the outwardly extending flange 20 comprises deformations 40' which conform to the grooves 40 of the enclosing member.

[0053] In the foregoing specification, the invention has been described with reference to specific examples of embodiments of the invention. It will, however, be evident that various modifications and changes may be made therein without departing from the scope of the invention as set forth in the appended claims.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO2014184653A [0004]
- EP1700548B [0004]

PATENTKRAV

1. Kapsel (2), der indeholder en substans til tilberedning af en drikkelig drikkevare ved ekstrahering og/eller opløsning af substansen ved hjælp af tilførsel af en væske under tryk ind i kapslen (2), hvor kapslen (2) omfatter en aluminiumkapselkrop (12) med en central kapselkropakse (12A), hvilken aluminiumkapselkrop (12) er forsynet med en bund (18), en sidevæg (16) og en flange (20), som strækker sig udad, idet kapslen (2) endvidere omfatter et aluminiumdæksel (14), der er fastgjort til flangen (20), som strækker sig udad, idet dækslet (14) lukker kapslen (2) hermetisk, hvor kapslen (2) endvidere omfatter et forseglingselement (28) ved flangen (20), som strækker sig udad, til tilvejebringelse af en væskeforseglingsskontakt med et indkapslingselement (6) i en drikkevaretilberedningsindretning, hvis kapslen (2) placeres i indkapslingselementet (6) i drikkevaretilberedningsindretningen, og indkapslingselementet (6) lukkes ved hjælp af et tillukningselement (8) i drikkevaretilberedningsindretningen, såsom en ekstraktionsplade i drikkevaretilberedningsindretningen, således at kapslens (2) flange (20), som strækker sig udad, og mindst en del af kapslens (2) forseglingselement (28) er i forseglende indgreb mellem indkapslingselementet (6) og tillukningselementet (8) i drikkevaretilberedningsindretningen, hvor indkapslingselementet (6) i drikkevaretilberedningsindretningen omfatter et ringformet element (41) med en central ringformet element-akse (41A) og en fri kontaktende (30), hvilken frie kontaktende (30) i det ringformede element (41) valgfrit er forsynet med en flerhed af åbne riller (40), der strækker sig radialt udad, **kendetegnet ved, at** forseglingselementet (28) er dannet ved hjælp af flangen (20), som strækker sig udad, på aluminiumkapselkroppen (12), hvor mindst flangen (20), som strækker sig udad, er fremstillet af aluminiumsvamp.
2. Kapsel (2) ifølge krav 1, hvor hele aluminiumkapselkroppen (12) er fremstillet af aluminiumsvamp.
3. Kapsel (2) ifølge krav 1 eller 2, hvor aluminiumsvampen omfatter en porøsitet i intervallet 75-95 %, fortrinsvis en porøsitet på 80-85 %.
4. Kapsel (2) ifølge et hvilket som helst af de foregående krav, hvor aluminiumsvampen er fremstillet ved blanding af TiH_2 som et opskumningsmiddel i smeltet aluminium.

5. Kapsel (2) ifølge et hvilket som helst af de foregående krav, hvor forseglingselementet (28) og resten af kapselkroppen (12) er fremstillet af det samme plademateriale.

6. System til tilberedning af en drikkelig drikkevare ud fra en kapsel (2) under anvendelse af en væske, der under tryk tilføres kapslen (2), hvilket system omfatter:

en drikkevaretilberedningsindretning, der omfatter et indkapslingselement (6) til modtagelse af kapslen (2), hvor indkapslingselementet (6) omfatter væsketilførselsmidler (10) til tilførsel af væske under tryk ind i kapslen (2), hvor drikkevaretilberedningsindretningen endvidere omfatter et tillukningselement (8), såsom en ekstraktionsplade, til tillukning af indkapslingselementet (6) i drikkevaretilberedningsindretningen, hvor indkapslingselementet (6) i drikkevaretilberedningsindretningen endvidere omfatter et ringformet element (41) med en central ringformet element-akse (41A) og en fri kontaktende (30), hvilken frie kontaktende (30) i det ringformede element (41) valgfrit er forsynet med en flerhed af åbne riller (40), der strækker sig radialt udad;

en kapsel (2), der indeholder en substans til tilberedning af en drikkelig drikkevare ved ekstrahering og/eller opløsning af substansen ved hjælp af den væske, som under tryk tilføres kapslen (2) ved hjælp af væsketilførselsmidlerne (10) i drikkevaretilberedningsindretningen, hvor kapslen (2) omfatter en aluminiumkapselkrop (12) med en central kapselkropakse (12A), hvilken aluminiumkapselkrop (12) er forsynet med en bund (18), en sidevæg (16) og en flange (20), som strækker sig udad, idet kapslen (2) endvidere omfatter et aluminiumdæksel (14), der er fastgjort til flangen (20), som strækker sig udad, idet dækslet (14) lukker kapslen (2) hermetisk, hvor kapslen (2) endvidere omfatter et forseglingselement (28) ved flangen (20), som strækker sig udad, til tilvejebringelse af en væskeforseglingskontakt med indkapslingselementet (6) i drikkevaretilberedningsindretningen, hvis kapslen (2) placeres i indkapslingselementet (6) i drikkevaretilberedningsindretningen, og indkapslingselementet (6) lukkes ved hjælp af tillukningselementet (8) i drikkevaretilberedningsindretningen, således at kapslens (2) flange (20), som strækker sig udad, og mindst en del af kapslens (2) forseglingselement (28) er i forseglende indgreb mellem indkapslingselementet (6) og tillukningselementet (8) i drikkevaretilberedningsindretningen, **kendetegnet ved, at** forseglingselementet (28) er dannet ved hjælp af flangen (20), som strækker sig udad, på aluminiumkapselkroppen (12), hvor mindst flangen (20), som strækker sig udad, er fremstillet af aluminiumsvamp.

7. System ifølge krav 6, hvor kapslen (2) er en kapsel (2) ifølge et hvilket som helst af kravene 2-5.

8. Anvendelse af en kapsel (2) ifølge et hvilket som helst af kravene 1 til 5 i en
5 drikkevaretilberedningsindretning, der omfatter et indkapslingselement (6) til modtagelse af kapslen (2), hvor indkapslingselementet (6) omfatter væsketilførselsmidler (10) til tilførsel af væske under tryk ind i kapslen (2), hvor drikkevaretilberedningsindretningen endvidere omfatter et tillukningselement (8), såsom en ekstraktionsplade, til tillukning af
10 indkapslingselementet (6) i drikkevaretilberedningsindretningen, hvor indkapslingselementet (6) i drikkevaretilberedningsindretningen endvidere omfatter et ringformet element (41) med en central ringformet element-akse (41A) og en fri kontaktende (30), hvilken frie kontaktende (30) i det ringformede element (41) valgfrit er forsynet med en flerhed af radiale riller (40); hvor kapslen (2) indeholder en substans til tilberedning af en drikkelig drikkevarer ved ekstrahering og/eller opløsning af substansen ved hjælp af den væske, som under tryk tilføres
15 kapslen (2) ved hjælp af væsketilførselsmidlerne (10) i drikkevaretilberedningsindretningen, hvor kapslen (2) omfatter en aluminiumkapselkrop (12) med en central kapselkropakse (12A), hvilken aluminiumkapselkrop (12) er forsynet med en bund (18), en sidevæg (16) og en flange (20), som strækker sig udad, idet kapslen (2) endvidere omfatter et aluminiumdæksel (14), der er fastgjort til flangen (20), som strækker sig udad, idet dækslet (14) lukker kapslen (2)
20 hermetisk, hvor kapslen (2) endvidere omfatter et forseglingselement (28) ved flangen (20), som strækker sig udad, til tilvejebringelse af en væskeforseglingsskontakt med indkapslingselementet (6) i drikkevaretilberedningsindretningen, hvis kapslen (2) placeres i indkapslingselementet (6) i drikkevaretilberedningsindretningen, og indkapslingselementet (6) lukkes ved hjælp af tillukningselementet (8) i drikkevaretilberedningsindretningen, således at
25 kapslens (2) flange (20), som strækker sig udad, og mindst en del af kapslens (2) forseglingselement (28) er i forseglende indgreb mellem indkapslingselementet (6) og tillukningselementet (8) i drikkevaretilberedningsindretningen.

DRAWINGS

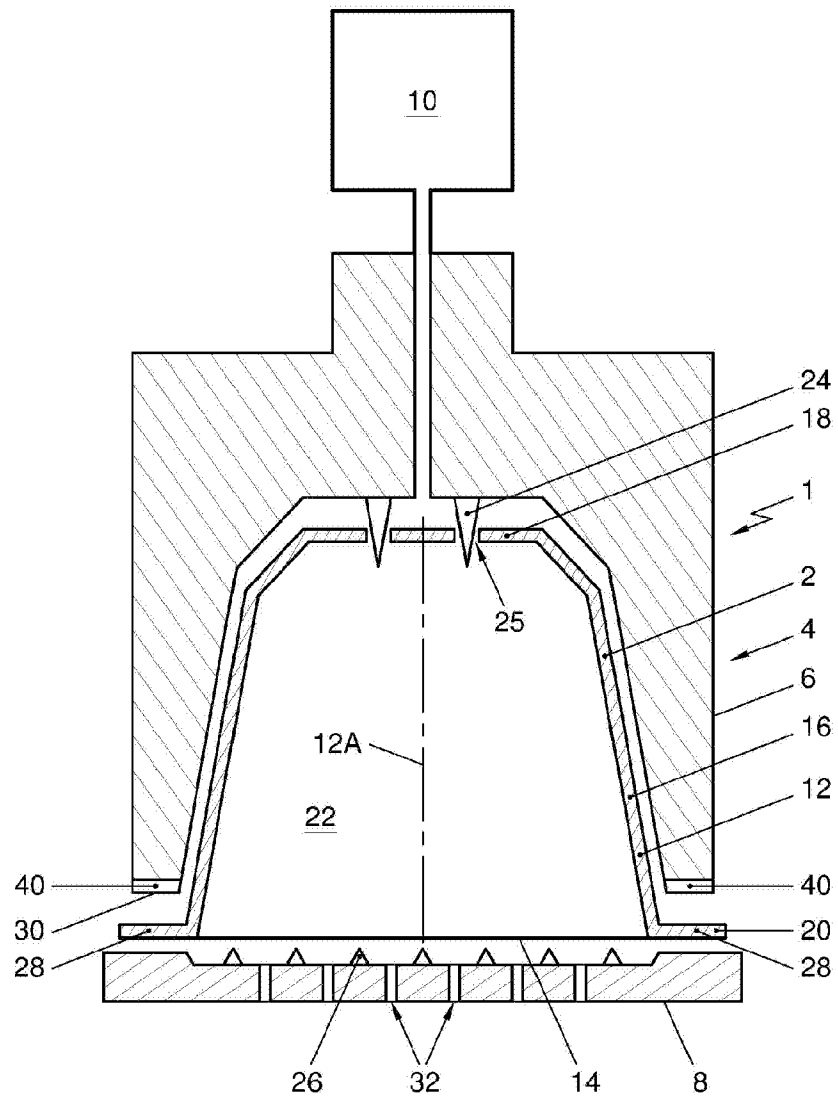


Fig. 1

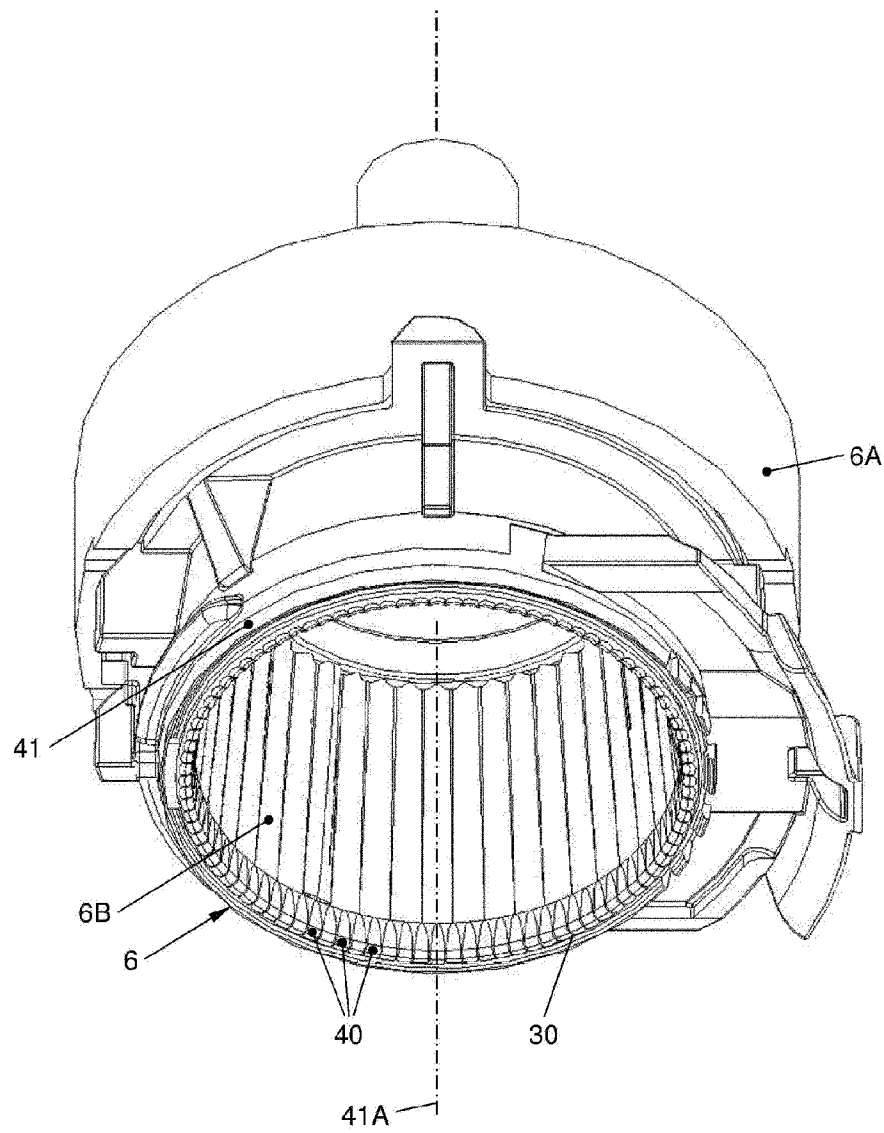


Fig. 2

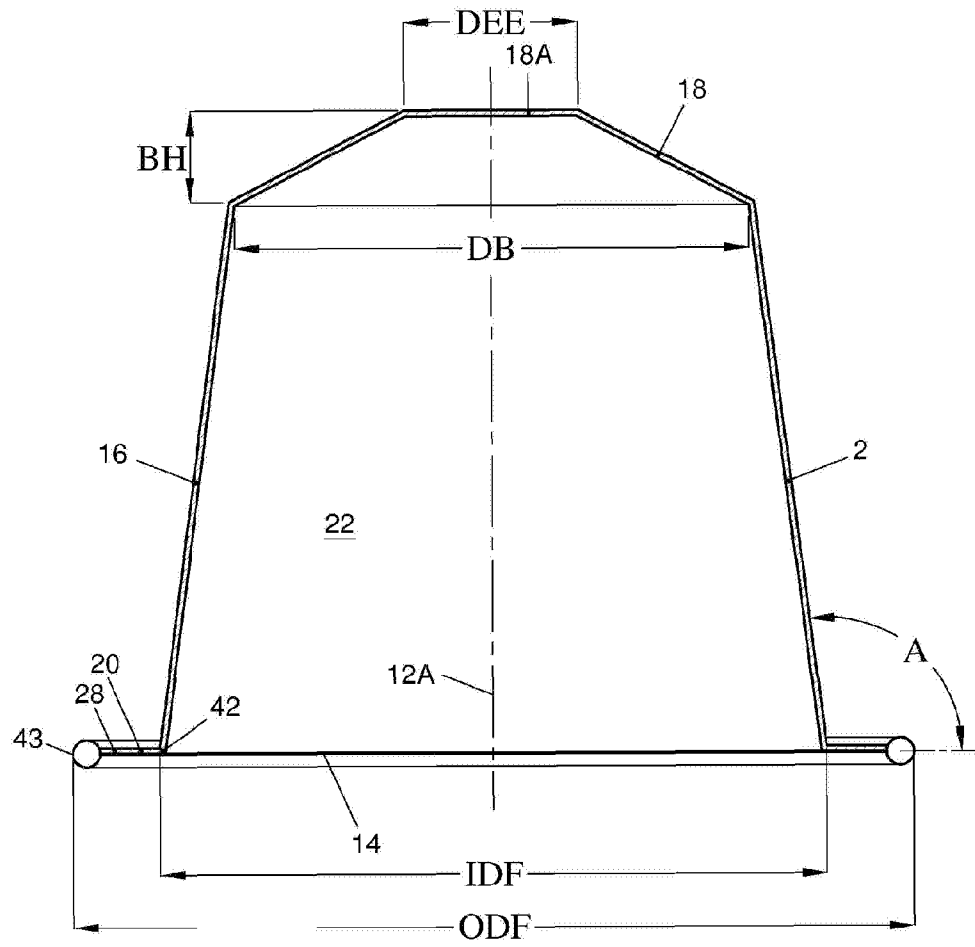


Fig. 3A

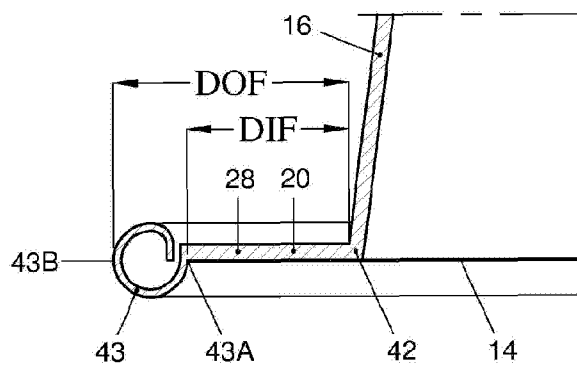


Fig. 3B

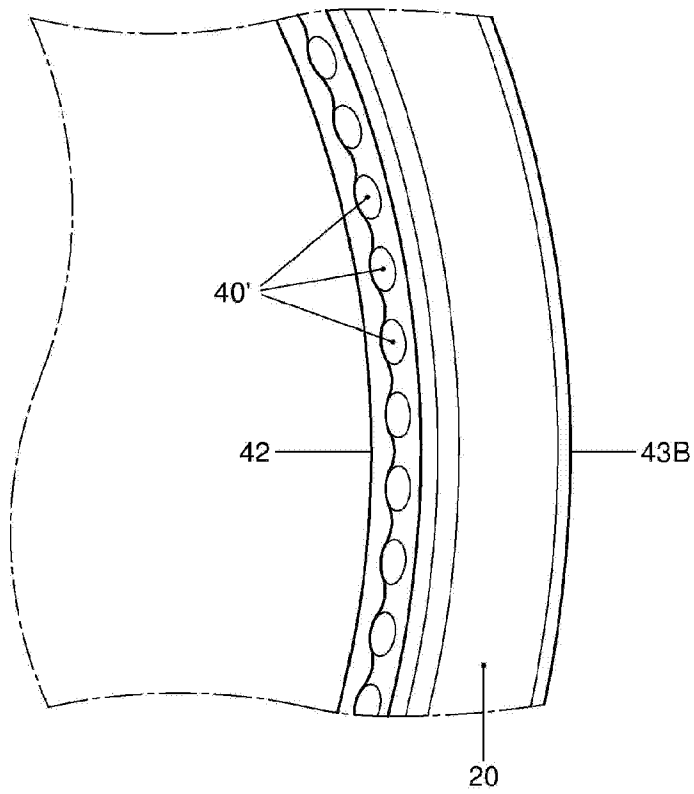


Fig. 3C

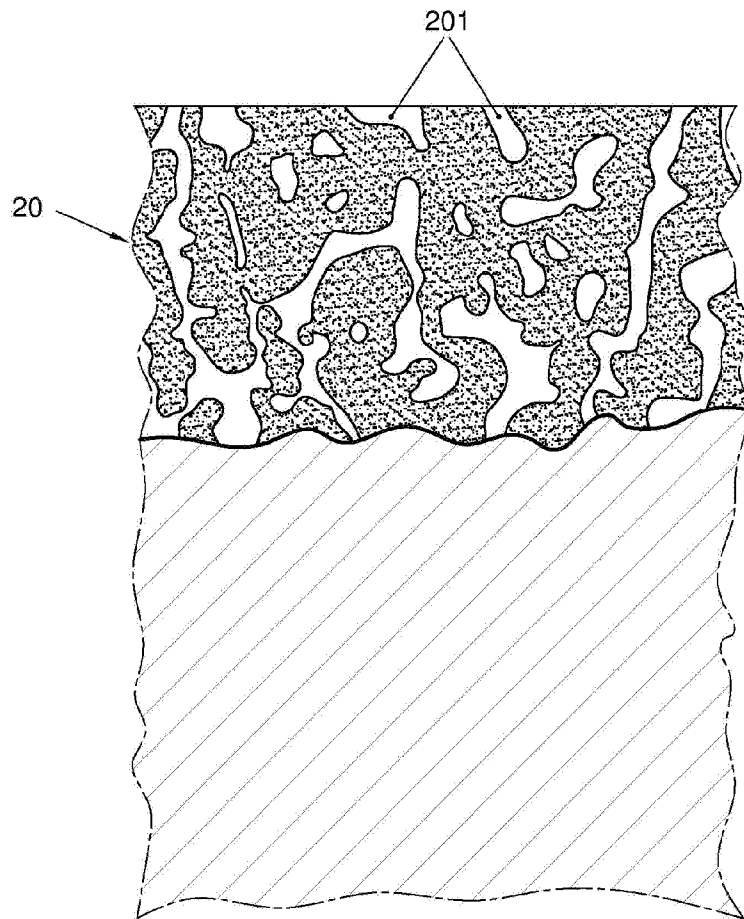


Fig. 4