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(72) Inventeurs/Inventors:
KAMERBEEK, RALF, NL;
GROOTHORNTE, AREND HENDRIK, NL;
DIJKSTRA, HIELKE, NL;
VAN GAASBEEK, ERIK PIETER, NL

(73) Propriétaire/Owner:
KONINKLIJKE DOUWE EGBERTS B.V., NL

(74) Agent: LAVERY, DE BILLY, LLP

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Capsule containing a substance for the preparation of a potable beverage, the capsule having an aluminum capsule body having a side wall and an outwardly extending flange and a sealing member at the outwardly extending flange for providing a fluid sealing contact with an enclosing member of a beverage preparation device. The beverage preparation device comprises an annular element having a free contact end which may be provided with a plurality of radially extending open grooves. The sealing member is integral with the outwardly extending flange and comprises a projection. The sealing member comprises a single annular projection comprising a projection top projecting from an inner projection foot radially outside of a flat inner flange portion extending between the capsule body side wall and the projection and an outer projection foot radially inside of a flat outer flange portion extending between the projection and the curled outer edge. The flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body or the flat outer flange portion and the flat inner flange portion are in line the flat outer flange portion and the flat inner flange portion are in line and a radially outer wall of said projection is oriented transverse to the flat outer flange portion.

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(71) Applicant: **KONINKLIJKE DOUWE EGBERTS B.V.** [NL/NL]; Vleutensevaart 35, 3532 AD Utrecht (NL).

(72) Inventors: **KAMERBEEK, Ralf**; c/o Vleutensevaart 35, 3532 AD Utrecht (NL). **GROOTHORNTE, Arend Hendrik**; c/o Vleutensevaart 35, 3532 AD Utrecht (NL). **DIJKSTRA, Hielke**; c/o Vleutensevaart 35, 3532 AD Utrecht (NL). **VAN GAASBEEK, Erik Pieter**; c/o Vleutensevaart 35, 3532 AD Utrecht (NL).

(74) Agent: **JANSEN, C.M.**; V.O., Carnegieplein 5, 2517 KJ Den Haag (NL).

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(54) Title: A CAPSULE, A SYSTEM FOR PREPARING A POTABLE BEVERAGE FROM SUCH A CAPSULE AND USE OF SUCH A CAPSULE IN A BEVERAGE PREPARATION DEVICE

(57) Abstract: Capsule containing a substance for the preparation of a potable beverage, the capsule having an aluminum capsule body having a side wall and an outwardly extending flange and a sealing member at the outwardly extending flange for providing a fluid sealing contact with an enclosing member of a beverage preparation device. The beverage preparation device comprises an annular element having a free contact end which may be provided with a plurality of radially extending open grooves. The sealing member is integral with the outwardly extending flange and comprises a projection. The sealing member comprises a single annular projection comprising a projection top projecting from an inner projection foot radially outside of a flat inner flange portion extending between the capsule body side wall and the projection and an outer projection foot radially inside of a flat outer flange portion extending between the projection and the curled outer edge. The flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body or the flat outer flange portion and the flat inner flange portion are in line the flat outer flange portion and the flat inner flange portion are in line and a radially outer wall of said projection is oriented transverse to the flat outer flange portion.

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Title: A capsule, a system for preparing a potable beverage from such a capsule and use of such a capsule in a beverage preparation device

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 capsule body bottom, a side wall and an outwardly extending flange comprising a curled outer edge, said outwardly extending flange extending transverse to the central capsule body axis, 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 being provided with a plurality of radially extending open grooves.

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 injection 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, the free contact end of the annular element 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 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 capsule body bottom, a side wall and an outwardly extending flange comprising a curled outer edge, said outwardly extending flange extending transverse to the central capsule body axis, 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.

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 injection 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, the free contact end of the annular element 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 injection 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 capsule body bottom, a side wall and an outwardly extending flange comprising a curled outer edge, said outwardly extending flange extending transverse to the central capsule body axis, 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 a capsule, system and use are e.g. known from EP-B-1 700 548. 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 injected by the fluid injection 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 or closing member) of the beverage preparation device under the influence of fluid pressure in the capsule.

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.

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.

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.

Since the sealing member is integral with the outwardly extending flange and includes an annular projection including a projection top projecting axially towards the capsule body bottom from an inner projection foot radially outside of an inner sealing member portion and an outer projection foot radially inside of an outer flange portion, and the flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body; or the flat outer flange portion and the flat inner flange portion are in line and a radially outer wall of said projection is oriented transverse to the flat outer flange portion, the sealing member is relatively easy to manufacture and provides a satisfactory sealing to the free contact end provided with radially extending open grooves. A transition from the projection to the flat outer flange portion of the outwardly extending flange may for instance have an internal radius of less than 0.15 mm or less than 0.12 mm. In particular, the bottom of the annular trough axially spaced from the outer projection foot away from the bottom of the capsule body allows the flat outer flange portion to be pushed towards the closing member which causes the projection to be forced outwardly due to tilting and "rolling off" of the projection, thereby increasing the radial contact pressure exerted against the free contact end of the annular element, which contributes to achieving a satisfactory seal. Alternatively the features that the flat outer flange portion and the flat inner flange portion are in line and that the radially outer wall of said projection is oriented transverse to the flat outer flange portion, also causes

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the projection to be forced outwardly due to tilting and "rolling off" of the projection, thereby increasing the radial contact pressure exerted against the free contact end of the annular element, which contributes to achieving a satisfactory seal.

Please note that in WO-A1-2014/184652 an embodiment of a sealing member is disclosed (with reference to Figures 13 to 18 thereof) in which a flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body. However, this known capsule is made from a laminate material comprising a ductile structural layer formed from aluminum or an aluminum alloy and a further resilient layer formed from a polymer. During compression (i.e. during closing of the enclosing member) the polymer layer aids the conforming of the sealing member to the shape of the annular element of the enclosing member. Further, contrary to the invention, in the known embodiment the outer wall of the projection comprises three distinct sections - an upper section which, prior to insertion, is perpendicular to the flat inner flange portion, a mid-section that is angled at an angle ß of from 20 to 80°, preferably 60°, to the central capsule body axis and a lower section that includes the flat outer flange portion before merging into the curled outer edge of the flange. This geometry of the outer wall of the projection helps to stiffen the distal end of the side wall but also at least to some extent prevents the projection being urged outwardly.

It is further noted that from WO-A1-2014/184653 an embodiment of a sealing member is disclosed (with reference to Figures 4 and 5 thereof) in which a flat outer flange portion and a flat inner flange portion are in line. However, this known capsule is made from a laminate material comprising a ductile structural layer formed from aluminum or an aluminum alloy and a further resilient layer formed from a polymer. During compression (i.e. during closing of the enclosing member) the polymer layer aids the conforming of the sealing member to the shape of the annular

element of the enclosing member. In addition, contrary to the invention, the projection of the capsule according to this known embodiment has a generally triangular shape, such that the outer wall of the projection encloses an obtuse angle with regard to the flat outer flange portion. Due to this known geometry during closing of the enclosing member the projection is driven downwards, such that the projection is not urged outwardly.

In an embodiment of a capsule according to the invention the projection is configured such that its projection top exerts an outward radial force on the free contact end of the annular element 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.

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.

In case the flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body, it is preferred when the sealing member is deformable such that, in use, closure of the enclosing member causes the axial spacing between the flat outer flange portion and the flat inner flange portion to be reduced in particular the sealing member is deformable such that, in use, closure of the enclosing member causes the axial spacing between the flat outer flange portion and the flat inner flange portion to be eliminated. Preferably the axial distance between the flat inner flange portion and the flat outer portion is between 0.5 and 0.7 mm or is 0.6 mm or is half of the largest dimension of the curled outer edge.

A radially inner wall of said projection is preferably oriented at an angle between 93° and 110°, preferably between 95° and 98°, and most

preferably at an angle of 97° with regard to the flat inner flange portion. If the flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body, it is preferred that a radially outer wall of said projection is oriented at an angle between 93° and 110°, preferably between 95° and 98°, and most preferably at an angle of 97° with regard to the flat outer flange portion. In this manner, upper portions of the projection are effectively supported against collapsing and inward "rolling off" of the projection, similar to a deep drawing operation is facilitated. For the same purpose, it is further advantageous if, at the outer foot of the projection, a transition from the projection to a radially outwardly projecting portion of the outwardly extending flange has an internal radius of less than 0.15 mm and preferably less than 0.12 mm. Compressive movement induces plastic buckling of the projection, increasing the outward contact force applied to the free end of the enclosing member.

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, the extractable product preferably being 5-20 grams, preferably 5-10 grams, more preferably 5-7 grams of an extractable product, such as roasted and ground coffee.

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.

The invention is in particular advantageous when in an embodiment of a capsule the thickness of the aluminum capsule body is between 20 to 200 micrometer, preferably between 80 and 110 micrometer, most preferably 90 or 100 micrometer, 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.

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 30-45 micrometer and more preferably 39 micrometer.

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. The cover can be attached to the flat inner flange portion and/or to the flat outer flange portions. 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.

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.

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.

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°.

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.

In practically all cases a satisfactory seal can be obtained in an embodiment of a capsule according to the invention in which the height of the sealing member portion to be contacted first by the free end of the enclosure member when the enclosure member is closed is at least about 0.1 mm, more preferably at least 0.2 mm and most preferably at least 0.8 mm and at most 3 mm, more preferably at most 2 mm and most preferably at most 1.2 mm.

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 the inner coating being composed of the same material as the sealing lacquer. In dependence of the inner coating used it is preferred that the sealing member is free from an inner coating in order to prevent crumbling off of the inner coating from the sealing member.

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.

For achieving a reliable seal, it is also advantageous if the projection has an extreme top end extending around the capsule axis at a diameter of 31.9 to 32.4 mm. Thus, when used in commercially available coffee making apparatuses such as the Citiz, Lattisima, U, Maestria, Pixie, Inissia and Essenza, an outer edge area of the free end of the enclosing member is firmly pressed against the projection.

In accordance with the invention there is provided, in a second aspect, a system for preparing a potable beverage.

The flat inner flange portion preferably has a radial width that is substantially larger than the radial thickness of the free contact end portion of the annular element, so that a clearance is left between said free contact end portion of the annular element and the side wall of the capsule body. Thus, it is ensured that the full axial force is available for generating a sealing between the enclosing member and the sealing member.

The projection top may constitute a portion of the projection, for instance a half, a third or a quarter of the projection that is axially most distal from the feet of the projection.

The invention is particularly suitable for use 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 such high pressures a satisfactory seal between capsule and beverage preparation device can be obtained.

Preferably the system is arranged such that, in use, during brewing, a free end of the enclosing member of the beverage preparation

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device exerts a force F2 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 F2 is in the range of 500-1500 N preferably in the range of 750-1250 N when the fluid pressure P2 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 F1 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 F1 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 P1 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.

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.

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 positon towards the second position in the direction of the closing member under the influence of fluid pressure in the enclosing member. The force F1 as discussed above may be reached if the second part is in the first position with a fluid pressure P1. The force F2 as discussed above may be reached if the second part is moved towards the second position under the influence of the fluid pressure P2 in the enclosing member.

In accordance with the invention there is provided in a third aspect a use of a capsule according to the invention.

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Further features, details and effects of the invention will now be further elucidated by means of, non-limiting, 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 schematic cross section, shows an embodiment of a capsule according to the invention before use;

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

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

Fig. 4 is an enlarged cross-sectional view of an embodiment of a sealing member at the outwardly extending flange of a capsule according to the invention in which the flat outer flange portion is axially spaced from the flat inner flange portion towards the bottom of the capsule body, and wherein a transition from the projection to the flat outer flange portion of the outwardly extending flange has an internal radius of less than 0.15 mm, preferably less than 0.12 mm, in combination with an end portion of the enclosing member and a closing member of a beverage making apparatus; and

Fig. 5 is an enlarged cross-sectional view of an embodiment of a sealing member at the outwardly extending flange of a capsule according to the invention in which the flat outer flange portion and the flat inner flange portion are in line and wherein a radially outer wall of said projection is oriented transverse to the flat outer flange portion, in combination with an

end portion of the enclosing member and a closing member of a beverage making apparatus.

In the figures and the following description, like reference numerals refer to like features.

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.

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 beverage preparation device 4 further comprises a fluid injection 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.

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 comprises a side wall 16, a bottom 18 closing the side wall 16 at a first end, and a 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 is an extractable product for the preparation of a potable

beverage, the 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.

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.

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.

The capsule 2 further comprises a sealing member 28 integral with the outwardly extending flange, in Figures 1, 3A and 3B indicated as a general box but more detailed described with regard to Figure 4, which sealing member 28 is arranged 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. This means that a fluid sealing contact between the sealing member 28 and the free contact end is established.

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.

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 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 100 micrometer, but in other embodiments the thickness can be 20 to 200 micrometer.

In the shown embodiment, the wall thickness of the aluminum cover 14 is 39 micrometer. The wall thickness of the aluminum cover 14 is preferably smaller than the thickness of the aluminum capsule body 12.

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

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 and axially extends at both sides of a flat outer flange portion 56. The axial distance between the flat inner flange portion 52 and the flat outer flange portion 56 preferably is about half of the largest dimension of the curled outer edge 43. 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. The radius about the central capsule body axis of the inner edge 43A of the curled outer edge 43 is preferably at least 32 mm.

As shown in Figures 3A and 3B the sealing member 28 is positioned between the free end 42 of the side wall 16 of the aluminum capsule body 12 and the inner edge 43A of the curled outer edge 43 of the outwardly extending flange. The sealing member 28 is indicated as a general box, but will be described in more detail below. Irrespective of the embodiment of the sealing member 28 the height of the sealing member portion to be contacted first by the free end of the enclosure member when the enclosure member is closed is at least about 0.1 mm, more preferably at least 0.2 mm and most preferably at least 0.8 mm and at most 3 mm, more preferably at most 2 mm and most preferably at most 1.2 mm for providing a correct seal.

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 central portion 18A has a diameter DEE of about 8.3 mm and in which central portion 18A the entrance opening(s) 25 may be made. The entrance openings may also be made in the truncated portion between the central portion 18A and the side wall 16. The total height TH of the aluminum capsule body 12 of the capsule is about 28.4 mm.

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

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.

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).

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 F1 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 F1 is in the range of 30-150 N preferably 40-150 N, more preferably 50-100 N, when the fluid pressure P1 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 F2 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 F2 is in the range of 500 -1500 N, preferably in the range of 750-1250 N, when the fluid pressure P2 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 F2 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 positon 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 F1 as discussed above may be reached if the second part 6B is in the first position with a fluid pressure P1. The force F2 as discussed above may be reached if the second part 6B is moved towards the second position under the influence of the fluid pressure P2 in the enclosing member 6.

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.

Now an embodiment of a sealing member 28 at the outwardly extending flange 20 of the capsule 2 according to the invention, in which the flat outer flange portion 56 is axially spaced from the flat inner flange portion 52 towards the bottom of the capsule body, will be described in more detail with regard to Fig. 4. The axial distance between the flat inner flange portion 52 and the flat outer flange portion 56 is between 0.5 and 0.7 mm, preferably the axial distance is 0.6 mm.

In the first embodiment shown in Fig. 4 a sealing member 28 forms an additional bearing at the outwardly extending flange 20 of the capsule body 12. The sealing member 28 and the remainder of the capsule body 12 are made of the same plate material. The sealing member 28 has a single projection 50, projecting axially from inner and outer foot portions 53, 54 in an axial direction 55 towards the bottom of the capsule body 12. A trough having a flat inner flange portion 52 is located inwardly adjacent to the projection 50. The flat inner flange portion 52 of the trough is positioned at an axial distance from the outer foot 54 of the projection 50 in a direction away from the bottom of the capsule body 12 and also at an axial distance away from a flat outer flange portion 56 of the outwardly extending flange 20 between the sealing member 28 and the curled outer edge 43.

Further, the projection 50 and the flat inner flange portion 52 of the trough are arranged such that the free contact end 60 of the annular element 41 is contacted by the flat inner flange portion 52 of the trough if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by the closing member 8.

The distance between the projection 50 and a side wall 16 of the capsule body 12 is preferably 0.9-1.25 mm, which allows the inner ridge or free contact end 60 of the enclosing member 6 of widely used and commercially available beverage preparation devices (such as the Citiz, Lattisima, U, Maestria, Pixie, Inissia and Essenza) to be reliably squeezed against the projection 50 with the side wall 16 in close proximity thereto, but slightly spaced from the side wall 16.

The projection 50 has a projection top constituting a portion of the projection, for instance a half, a third or a quarter of the projection that is axially most distal from the feet 53, 54 of the projection 50. The projection 50 is configured such that its projection top exerts a radial force on the free contact end 30 of the annular element 41 if the capsule is positioned in the enclosing member 6 of the beverage preparation device and the enclosing member is closed by means of the closing member 8 of the beverage preparation device.

If the enclosing member 6 and/or the closing member 8 are moved relatively towards each other with the sealing member 28 of the capsule in between, the free contact end 30 of the enclosing member 6 contacts the projection 50. This causes the capsule to be centered relative to the enclosing member 6 together with the contact between the free contact end 60 and the projection. A large contact force is exerted as projection 50 is deformed. Hoop stress in the projection 50, causes counter forces to be evenly distributed circumferentially so that an evenly distributed sealing pressure is achieved.

As can be seen in Fig. 4, the free contact end 60 of the enclosing member 6 has an inner circumferential surface portion 71 and an outer circumferential surface portion 70 contacting the projection 50. The radially extending open grooves 40 are deeper in the inner surface portion 71 than in the outer surface portion 70 or the grooves may be absent in the outer surface portion 70. The projection 50 is firmly and accurately pressed against the relatively smooth outer surface portion 70 of the free contact end 60.

As can be seen in Fig. 4, since the flat outer flange portion 56 is axially spaced from the inner projection foot 53 in an axial direction 55 towards the bottom of the capsule body 12, the flat outer flange portion 56 can be pushed towards the closing member 8 relative to the outside foot 53 of the projection, which causes the projection 50 to be forced outwardly due to tilting and deformation of the projection 50, thereby increasing the radial contact pressure exerted against the free contact end 30 of the annular element 41. Simultaneously, the flat outer flange portion 56 is lowered and may contact the closing member 8.

In the first stage of contact between the annular element 6 and the sealing member 28 an initial seal is created between a generally inwardly facing surface portion of the projection 50 and an outer surface portion 70 of the free end 60 of the annular element 6. The radial location of this inwardly facing surface portion of the projection 50 and the local radius of curvature of the projection 50 are arranged to ensure that the faces contacting each other are oriented almost vertically. This allows a very strong wedging effect to be achieved, so that a very small vertical closing force results in very large horizontal contact pressures. These large horizontal forces are exerted with little deformation of the outer projection 50 while retaining a high degree of flexibility to accommodate to tolerances and misplacement of the capsule.

In the second stage, the closure and further compression of the brew chamber onto the sealing ring is supported by the build-up of hydraulic pressure. As the compressive force builds, the flat outer flange portion 56 is pushed downwards by the mechanical and hydraulic loading until the flat outer flange portion 56 touches the closing member 8. Motion of the sealing member 28 as well as deformation of the sealing member shape result in additional contact pressure being transferred to the primary sealing face. Since much of the deformation occurs plastically, the contact region conforms effectively to sealing area of the enclosure member and allows some misalignment and manufacturing tolerances to be accommodated. In the third stage, a further increase of the axial (here vertical) force causes a slight further deformation of the sealing member 28.

In the present example, the cover 14 is attached to the flat inner flange portion 52. This (preferably aluminum) cover 14 also contributes to the sealing properties of the sealing member 28, since it tries to retain the projection 50 axially inwards against radially outward forces exerted thereon by the free end 30 of the enclosing member 6.

In the shown embodiment the radially inner wall 50A of the projection 50 is oriented at an angle between 93° and 110°, preferably between 95° and 98°, and most preferably at an angle of 97° with regard to the flat inner flange portion 52 and a radially outer wall 50B of the projection 50 is also oriented at an angle between 93° and 110°, preferably between 95° and 98°, and most preferably at an angle of 97° with regard to the flat outer flange portion 56. The transition from the projection 50 to the flat inner flange portion 52 of the outwardly extending flange 20 has an internal radius of less than 0.15 mm, preferably less than 0.12 mm.

Please note that in a not shown embodiments the radially inner wall 50A of the projection 50 is oriented substantially parallel to the capsule body axis, so that upper portions of the projection 50 are effectively supported against collapsing and inward "rolling off" of the projection 50,

similar to a deep drawing operation is facilitated. For the same purpose, the transition from the projection 50 to the radially outwardly projecting portion 56 of the outwardly extending flange 20 has the said small internal radius, e.g. of less than 0.15 mm and preferably less than 0.12 mm.

Since the outwardly extending flange 20 has no more than one single annular projection, the capsule body 12 can be manufactured efficiently, in particular when deep drawing the capsule from plate material.

In particular in connection with the final mutual displacement of the enclosing member 6 and the sealing member 28, a particular issue is that, in practice, some enclosing members can have one or more bridges between outer and inner ridges 80, 81of the annular element 41. Such bridges constitute an interruption of an annular head space 62 into which the projection 50 is wedged during the third stage. Leakage in particular at the transitions where, in circumferential sense, a bridge begins and ends is diminished since the projection 50 is shaped to roll and buckle radially outwards, so that excess sealing member material is locally displaced away from the seal between the projection 50 and the annular element 6, thereby reducing interference with this seal and allowing a substantially continuous seal along a line passing underneath the bridge.

Now a further embodiment of a sealing member 28 at the outwardly extending flange 20 of the capsule 2 according to the invention, in which the flat outer flange portion 56 and the flat inner flange portion 52 are in line and wherein the radially outer wall 50B of the projection 50 is oriented transverse to the flat outer flange portion 56 will be described in more detail with regard to Fig. 5. The axial distance between the flat inner flange portion 52 and the flat outer flange portion 56 in this embodiment is thus zero.

Fig. 5 shows a second embodiment of a sealing member 28 forming an additional bearing at the outwardly extending flange 20 of the capsule body 12. The sealing member 28 and the remainder of the capsule

body 12 are made of the same plate material. The sealing member 28 has a single projection 50, projecting axially from inner and outer foot portions 53, 54 in an axial direction 55 towards the bottom of the capsule body 12. A trough having a flat inner flange portion 52 is located inwardly adjacent to the projection 50. The flat inner flange portion 52 of the trough is positioned at the same height as the outer foot 54 of the projection 50 and also at the same height as the flat outer flange portion 56 of the outwardly extending flange 20 between the sealing member 28 and the curled outer edge 43.

Further, the projection 50 and the flat inner flange portion 52 of the trough are arranged such that the free contact end 60 of the annular element 41 is contacted by the flat inner flange portion 52 of the trough if the capsule is positioned in the enclosing member of the beverage preparation device and the enclosing member is closed by the closing member 8.

The distance between the projection 50 and a side wall 16 of the capsule body 12 is preferably 0.9-1.25 mm, which allows the inner ridge or free contact end 60 of the enclosing member 6 of widely used and commercially available beverage preparation devices (such as the Citiz, Lattisima, U, Maestria, Pixie, Inissia and Essenza) to be reliably squeezed against the projection 50 with the side wall 16 in close proximity thereto, but slightly spaced from the side wall 16.

The projection 50 has a projection top constituting a portion of the projection, for instance a half, a third or a quarter of the projection that is axially most distal from the feet 53, 54 of the projection 50. The projection 50 is configured such that its projection top exerts a radial force on the free contact end 30 of the annular element 41 if the capsule is positioned in the enclosing member 6 of the beverage preparation device and the enclosing member is closed by means of the closing member 8 of the beverage preparation device.

If the enclosing member 6 and/or the closing member 8 are moved relatively towards each other with the sealing member 28 of the capsule in between, the free contact end 60 of the enclosing member 6 contacts the projections 50. This causes the capsule to be centered relative to the enclosing member 6, while the projection 50 exerts a large contact force as it is deformed. The relatively high counter pressure provides a particularly reliable seal with high pressure resistance. Also, the exerted radial load is counteracted by hoop stress in the projection 50, which is evenly distributed circumferentially so that an evenly distributed sealing pressure is achieved.

As can be seen in Fig. 6, the free contact end 60 of the enclosing member 6 has an inner circumferential surface portion 71 and an outer circumferential surface portion 70 contacting the projection 50. The radially extending open grooves 40 are deeper in the inner surface portion 71 than in the outer surface portion 70 or the grooves may be absent in the outer surface portion 70. The projection 50 is firmly and accurately pressed against the relatively smooth outer surface portion 70 of the free contact end 60.

As the projection 50 is forced outwardly the radial contact pressure exerted thereby against the free contact end 30 of the annular element 41 increases.

In the first stage of contact between the annular element 6 and the sealing member 28 an initial seal is created between a generally inwardly facing surface portion of the projection 50 and an outer surface portion 70 of the free end 60 of the annular element 6. The radial location of this inwardly facing surface portion of the projection 50 and the local radius of curvature of the projection 50 are arranged to ensure that the faces contacting each other are oriented almost vertically. This allows a very strong wedging effect to be achieved, so that a very small vertical closing force results in very large horizontal (radial) contact pressures. These large horizontal forces are exerted with little deformation of the outer projection

50 while retaining a high degree of flexibility to accommodate to tolerances and misplacement of the capsule.

In the second stage, the closure and further compression of the brew chamber onto the sealing ring is supported by the build-up of hydraulic pressure. As the compressive force builds, the inner wall 50A of the projection 50 is bent. This tilting and deformation of the sealing member shape result in additional contact pressure being transferred to the primary sealing face. Since much of the deformation occurs plastically, the contact region conforms effectively to sealing area and allows some misalignment and manufacturing tolerances to be accommodated.

In the final stage, a further increase of the axial (here vertical) force causes a slight further deformation of the sealing member 28 in particular the projection 50 is crushed further and the flat inner flange portion is deformed further.

In the present example, the cover 14 extends to the flat outer flange portion 56 and is attached to both the flat inner flange portion 52 and the flat outer flange portion 56. In this manner the (preferably aluminum) cover 14 also contributes to the sealing properties of the sealing member 28, since it tries to retain the projection 50 in its position against radially outward forces exerted thereon by the free end 60 of the enclosing member 6. However, the cover 14 could in another embodiment be attached to the flat outer flange portion 56 only. In a further embodiment the cover 14 could only extend to the flat inner flange portion 52 and be attached thereto.

In the shown embodiment, the radially inner wall 50A of the projection 50 is oriented at an angle between 93° and 110°, preferably between 95° and 98°, and most preferably at an angle of 97° with regard to the flat inner flange portion 52.

Please note that in a not shown embodiments the radially inner wall 50A of the projection 50 can also be oriented substantially parallel to the capsule body axis, so that upper portions of the projection 50 are

effectively supported against collapsing and inward "rolling off" of the projection 50, similar to a deep drawing operation is facilitated. For the same purpose, The transitions from the projection 50 to the flat inner flange portion 52 and/or to the flat outer flange portion 56 as of the outwardly extending flange 20 has an internal radius of less than 0.15 mm, preferably less than 0.12 mm.

Since the outwardly extending flange 20 has no more than one single annular projection, the capsule body 12 can be manufactured efficiently, in particular when deep drawing the capsule from plate material.

In particular in connection with the final mutual displacement of the enclosing member 6 and the sealing member 28, a particular issue is that, in practice, some enclosing members can have one or more bridges between outer and inner ridges 80, 81of the annular element 41. Such bridges constitute an interruption of an annular head space 62 into which the projection 50 is wedged during the third stage. Leakage in particular at the transitions where, in circumferential sense, a bridge begins and ends is diminished since the projection 50 is shaped to roll and buckle radially outwards, so that excess sealing member material is locally displaced away from the seal between the projection 50 and the annular element 6, thereby reducing interference with this seal and allowing a substantially continuous seal along a line passing underneath the bridge.

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 broader spirit and scope of the invention as set forth in the appended claims.

Claims

1. 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 capsule body bottom, a side wall and an outwardly extending flange comprising a curled outer edge, said outwardly extending flange extending transverse to the central capsule body axis, 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 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, wherein the sealing member is integral with the outwardly extending flange and comprises a single annular projection comprising a projection top projecting axially towards the capsule body bottom from an inner foot portion radially outside of a flat inner flange portion extending between the capsule body side wall and the projection and an outer foot portion radially inside of a flat outer flange portion extending between the projection and the curled outer edge, and wherein the flat outer flange portion and the flat inner flange portion are in line and wherein a radially outer wall of said projection is oriented transverse to the flat outer

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flange portion, wherein the curled outer edge axially extends at both sides of the flat outer flange portion,

wherein the cover is attached to the flat outer flange portion,

wherein the capsule comprises a bearing for the enclosing member if the capsule is positioned in the enclosing member and the enclosing member is closed by means of the closing member, said bearing being formed by at least the projection,

wherein the thickness of the aluminum capsule body is between 80 micrometer to 110 micrometer, 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 the closing member of the beverage preparation device,

wherein the thickness of the aluminum cover is 15 to 65 micrometer or 30-45 micrometer or 39 micrometer,

wherein the aluminum cover is arranged to tear open on the closing member of the beverage preparation device under the influence of fluid pressure in the capsule,

wherein the height of the sealing member portion to be contacted first by the free contact end of the enclosing member when the enclosing member is closed is at least 0.8 mm and at most 2 mm,

wherein the sealing member and the remainder of the capsule body are made of the same plate material;

wherein the projection has an extreme top end extending around the capsule body axis at a diameter of 31.9 to 32.4 mm.

2. Capsule according to claim 1, wherein the thickness of the aluminum cover is 30-45 micrometer.

3. Capsule according to claim 1, wherein the thickness of the aluminum cover is 39 micrometer,

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4. Capsule according to claim 1, wherein a radially inner wall of said projection is oriented at an angle between 93° and 110° with regard to the flat inner flange portion.

5. Capsule according to claim 4 wherein said angle is between 95° and 98°.

6. Capsule according to claim 5 wherein said angle is 97°.

7. Capsule according to one of claims 1 to 6, wherein the projection top constitutes a portion of the projection, for instance a half, a third or a quarter of the projection that is axially most distal from the feet of the projection.

8. Capsule according to any one of claims 1 to 7, wherein the projection is configured such that its projection top exerts an outward radial force on the free contact end of the annular element 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.

9. Capsule according to any one of claims 1 to 8, wherein the projection is shaped to roll and buckle radially outwards if compressed in axial direction, while in contact with an outwardly facing surface of a free contact end of the annular element.

10. Capsule according to any one of claims 1 to 9, wherein the outer diameter of the outwardly extending flange of the capsule is larger than the diameter of the bottom of the capsule.

11. Capsule according to any one of claims 1 to 10, wherein the outer diameter of the outwardly extending flange is 31.7 mm.

12. Capsule according to any one of claims 1 to 11, wherein the wall thickness of the aluminum cover is smaller than the wall thickness of the aluminum capsule body.

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13. Capsule according to any one of claims 1 to 12, wherein the curled outer edge of the outwardly extending flange has a largest dimension of about 1.2 millimeter.

14. Capsule according to any one of claims 1 to 13, wherein the aluminum capsule body is truncated, wherein 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°.

15. Capsule according to any one of claims 1 to 14, wherein 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.

16. Capsule according to claim 15, wherein the aluminum cover of the capsule is attached to the outwardly extending flange by means of a sealing lacquer, said inner coating being composed of the same material as the sealing lacquer.

17. Capsule according to any one of claims 1 to 16, wherein the capsule comprises an outer surface, and wherein on the outer surface of the capsule a color lacquer is provided.

18. Capsule according to claim 17, wherein on an outer surface of the color lacquer an outer coating is provided.

19. Capsule according to any one of claims 1 to 18, wherein the is deformable such that said projection contacts at least a portion of the free contact end of the annular element in a fluid sealingly manner if, in use, a maximum fluid pressure in the enclosing member of the beverage preparation device is in the range of 6-20 bar.

20. Capsule according to claim 19, or wherein said maximum fluid pressure is between 12 and 18 bar.

21. Capsule according to any one of claims 1 to 20, wherein the sealing member is deformable such that said projection contacts at least a portion of the free contact end of the annular element in a fluid sealingly manner if, during brewing, said free contact end of the annular element

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exerts a force F2 on the sealing member of the capsule, wherein F2 is in the range of 500-1500 N when the fluid pressure P2 in said enclosing member outside the capsule is in the range of 6-20 bar.

22. Capsule according to Claim 21, wherein F2 is in the range of 500-1500 N when the fluid pressure P2 in said enclosing member outside the capsule is in the range between 12 and 18 bar.

23. Capsule according to Claim 22, wherein F2 is in the range of 750-1250 N when the fluid pressure P2 in said enclosing member outside the capsule is in the range of 6-20 bar.

24. Capsule according to Claim 22, wherein F2 is in the range of 750-1250 N when the fluid pressure P2 in said enclosing member outside the capsule is in the range between 12 and 18 bar.

25. Capsule according to any one of claims 1 to 24, wherein the sealing member is deformable such that said projection contacts at least a portion of the free contact end of the annular element in a fluid sealingly manner if, in use, prior to or at the start of brewing, said free contact end of the annular element exerts a force F1 on the sealing member of the capsule, wherein the force F1 is in the range of 30-150 N when the fluid pressure P1 in the enclosing member of the beverage preparation device outside the capsule is in the range of 0.1-4 bar.

26. Capsule according to Claim 25, wherein F1 is in the range of 40-150 N when P1 in the range of 0.1-4 bar.

27. Capsule according to Claim 25, wherein F1 is in the range of 50-100 N when P1 in the range of 0.1-4 bar.

28. Capsule according to Claim 25, wherein F1 is in the range of 30-150 N when P1 in the range of 0.1-1 bar.

29. Capsule according to Claim 25, wherein F1 is in the range of 40-150 N when P1 in the range of 0.1-1 bar.

30. Capsule according to Claim 25, wherein F1 is in the range of 50-100 N when P1 in the range of 0.1-1 bar.

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31. Capsule according to any one of claims 1 to 30, wherein the sealing member is deformable such that said projection contacts at least a portion of the free contact end of the annular element in a fluid sealingly manner if the free contact end of the annular element that is pressed against the sealing member has a plurality of radially extending open grooves uniformly spaced relative to each other in circumferential sense of said free contact end of the annular element.

32. Capsule according to any one of claims 1 to 31, wherein a radially outer wall of said projection is oriented transverse to the flat outer flange portion transition.

33. Capsule according to any one of claims 1 to 32, wherein a transition from the projection to the flat outer flange portion of the outwardly extending flange has an internal radius of less than 0.15 mm

34. Capsule according to Claim 33, wherein the transition has an internal radius of less than of less than 0.12 mm.

35. Capsule according to any one of claims 1 to 34, wherein the substance is an extractable product for the preparation of a potable beverage, the extractable product being 5-20 grams of roasted and ground coffee for the preparation of a single beverage.

36. Capsule according to Claim 35, the extractable product being 5-10 grams of roasted and ground coffee

37. Capsule according to Claim 35, the extractable product being 5-7 grams of roasted and ground coffee

38. Capsule according to any one of claims 1 to 37, wherein 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.

39. Capsule according to any one of claims 1 to 38, wherein the inner diameter of the free end of the side wall of the aluminum capsule body is about 29.5 mm and the distance between the free end of the side wall of the

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aluminum capsule body and an outermost edge of the outwardly extending flange is about 3.8 millimeter.

40. Capsule according to any one of claims 1 to 39, wherein the capsule is manufactured from deep drawing.

41. 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 injection means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member 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; and

a capsule according to any one of claims 1 to 40.

42. System according to claim 41, wherein said free contact end of the annular element is provided with a plurality of radially extending open grooves.

43. System according to claim 42, wherein said free contact end portion of the annular element has an outer circumferential surface portion contacting said projection, if the capsule is positioned in the enclosing member and as the enclosing member is closed by means of the closing member, and wherein said radially extending open grooves are deeper in an inner surface portion than in said outer surface portion or said radially extending open grooves are absent in said outer surface portion.

44. System according to any one of claims 41 to 43, wherein the flat inner flange portion has a radial width that is substantially larger than the radial thickness of said free contact end portion of the annular element, so that a clearance is left between said free contact end portion of the annular element and said side wall of said capsule body.

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45. System according to any one of the claims 41 to 43, wherein the capsule is a capsule according to claim 2, and wherein the annular element is arranged for deformation of the radially inner wall of said projection.

46. System according to any one of the claims 41 to 45, wherein the capsule is a capsule according to claim 6, and wherein the annular element has one or more bridges between outer and inner ridges, the or each bridge constituting an interruption of an annular space between the outer and inner ridges.

47. System according to any one of the claims 41 to 46, wherein, in use, the maximum fluid pressure in the enclosing member of the beverage preparation device is in the range of 6-20 bar.

48. System according to claim 47 wherein the maximum fluid pressure is between 12 and 18 bar.

49. System according to any one of the claims 41 to 48, wherein 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 F2 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 F2 is in the range of 500-1500 N when the fluid pressure P2 in the enclosing member of the beverage preparation device outside the capsule is in the range of 6-20 bar.

50. System according to claim 49, wherein F2 is in the range of 500-1500 N when P2 is between 12 and 18 bar.

51. System according to claim 49, wherein F2 in the range of 750-1250 N when P2 is in the range of 6-20 bar.

52. System according to claim 49, wherein F2 in the range of 750-1250 N when P2 is between 12 and 18 bar.

53. System according to any one of the claims 41 to 52, wherein 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

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force F1 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 F1 is in the range of 30-150 N when the fluid pressure P1 in the enclosing member of the beverage preparation device outside the capsule is in the range of 0.1-4 bar.

54. System according to Claim 53 wherein F1 is in the range of 30-150 N when P1 is in the range of 0.1-1 bar.

55. System according to Claim 53 wherein F1 is in the range of 40-150 N when P1 is in the range of 0.1-4 bar.

56. System according to Claim 53 wherein F1 is in the range of 40-150 N when P1 is in the range of 0.1-1 bar.

57. System according to Claim 53 wherein F1 is in the range of 50-100 N when P1 is in the range of 0.1-4 bar.

58. System according to Claim 53 wherein F1 is in the range of 50-100 N when P1 is in the range of 0.1-1 bar.

59. System according to claim 42, or any one of claims 43 to 58 when dependent on claim 42, 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.

60. System according to claim 42, or any one of claims 43 to 59 when dependent on claim 42, wherein a free contact end of the annular element is provided with a plurality of radially extending open grooves, wherein a greatest width of each groove is 0.9 - 1.1 mm or 0.95 to 1.05 mm, or 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, or 0.03 to 0.07 mm, or 0.045 to 0.055 mm, or 0.05 mm and wherein the number of grooves is 90 to 110, or 96 and wherein optionally the radial

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width of the free contact end at the location of the grooves is 0.05- 0.9 mm, or 0.2- 0.7 mm or 0.3 - 0.55 mm.

61. System according to Claim 60, wherein the greatest width of each groove is 0.98 to 1.02 mm.

62. System according to Claim 60, wherein the maximal height of each groove 0.03 to 0.07 mm.

63. System according to Claim 60, wherein the maximal height of each groove 0.045 to 0.055 mm.

64. System according to Claim 60, wherein the maximal height of each groove 0.05 mm.

65. System according to Claim 60, wherein the number of grooves is 96.

66. System according to Claim 60, wherein a radial width of the free contact end at the location of the grooves is 0.05- 0.9 mm.

67. System according to Claim 66, wherein the radial width is 0.2- 0.7 mm.

68. System according to Claim 66, wherein the radial width is 0.3 - 0.55 mm.

69. System according to any one of the claims 41-68, wherein, in 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, wherein the enclosing member comprises 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

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part between a first and second position wherein 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 wherein optionally the force F1 according to claim 46 is reached if the second part is in the first position with a fluid pressure P1 in the enclosing member as indicated in claim 49 and wherein optionally the force F2 according to claim 53 is reached if the second part is moved towards the second position under the influence of the fluid pressure P2 in the enclosing member as indicated in claim 53.

70. System according to any one of the claims 41-69, wherein during use when the closing member of the beverage preparation device closes the enclosing member of the beverage preparation device 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.

71. Use of a capsule according to any one of the claims 1 to 40 in a beverage preparation device comprising an enclosing member for receiving the capsule, wherein the enclosing member comprises fluid injection means for supplying fluid under pressure into the capsule, wherein the beverage preparation device further comprises a closing member 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; 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 injection means of the beverage preparation device, wherein the capsule further comprises a

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sealing member integral with 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, 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,.

72. Use according to claim 71, wherein, in use, the maximum fluid pressure in the enclosing member of the beverage preparation device is in the range of 6-20 bar.

73. Use according to claim 72, wherein the maximum fluid pressure is between 12 and 18 bar.

74. Use according to one of claims 71 to 73, wherein, in use, during brewing, a free end of the enclosing member of the beverage preparation device exerts a force F2 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 F2 is in the range of 500-1500 N when the fluid pressure P2 in the enclosing member of the beverage preparation device outside the capsule is in the range of 6-20 bar.

75. Use according to claim 74, wherein F2 is in the range of 500-1500 N and P2 between 12 and 18 bar.

76. Use according to claim 74, wherein F2 is in the range of 750-1250 N and P2 in the range of 6-20 bar.

77. Use according to claim 74, wherein F2 is in the range of 750-1250 N and P2 is between 12 and 18 bar.

78. Use according to any one of the claims 71-77, wherein, in use, prior to or at the start of brewing, a free contact end of the enclosing member of the beverage preparation device exerts a force F1 on the sealing

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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 F1 is in the range of 30-150 N or 40-150 N, or 50-100 N, when the fluid pressure P1 in the enclosing member of the beverage preparation device outside the capsule is in the range of 0.1-4 bar, or 0.1-1 bar and wherein there exists the fluid sealing contact.

79. Use according to claim 78, wherein F1 is in the range of 30-150 N and P1 in the range of 0.1-1 bar.

80. Use according to claim 78, wherein F1 is in the range of 40-150 N and P1 is in the range of 0.1-4 bar.

81. Use according to claim 78, wherein F1 is in the range of 50-100 N and P1 in the range of 0.1-4 bar.

82. Use according to claim 78, wherein F1 is in the range of 40-150 N and P1 is in the range of 0.1-1 bar.

83. Use according to claim 78, wherein F1 is in the range of 50-100 N and P1 in the range of 0.1-1 bar.

84. Use according to any one of the claims 71-83, wherein said free contact end of the annular element is provided with a plurality of radial grooves, 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.

85. Use according to any of the claims 71-84, wherein the annular element urges the projection outwardly.

86. Use according to any one of the claims 71-85, wherein a system according to claim 46 is used, and wherein the projection rolls and buckles radially outwards where it is compressed by the bridge.

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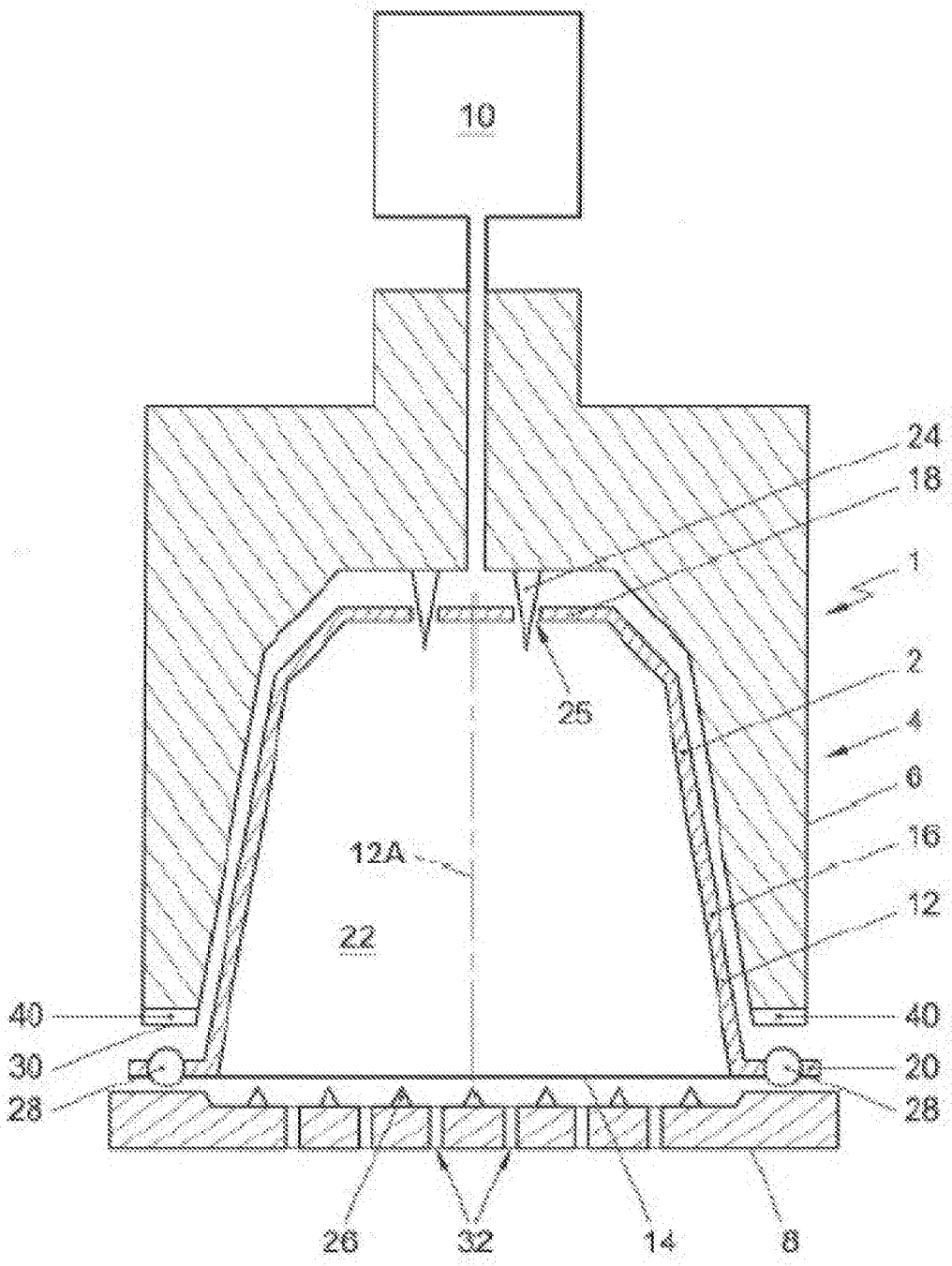


Fig. 1

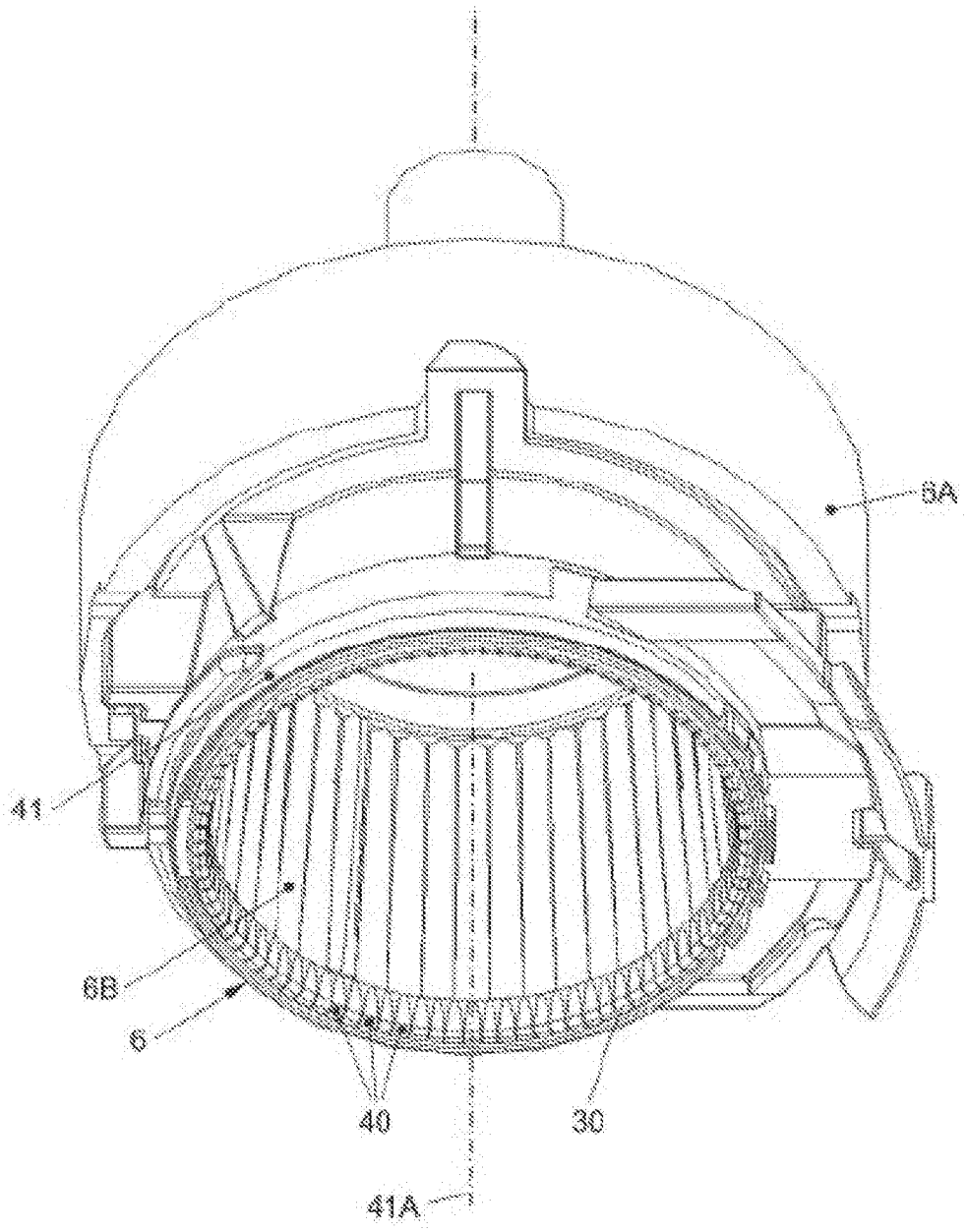
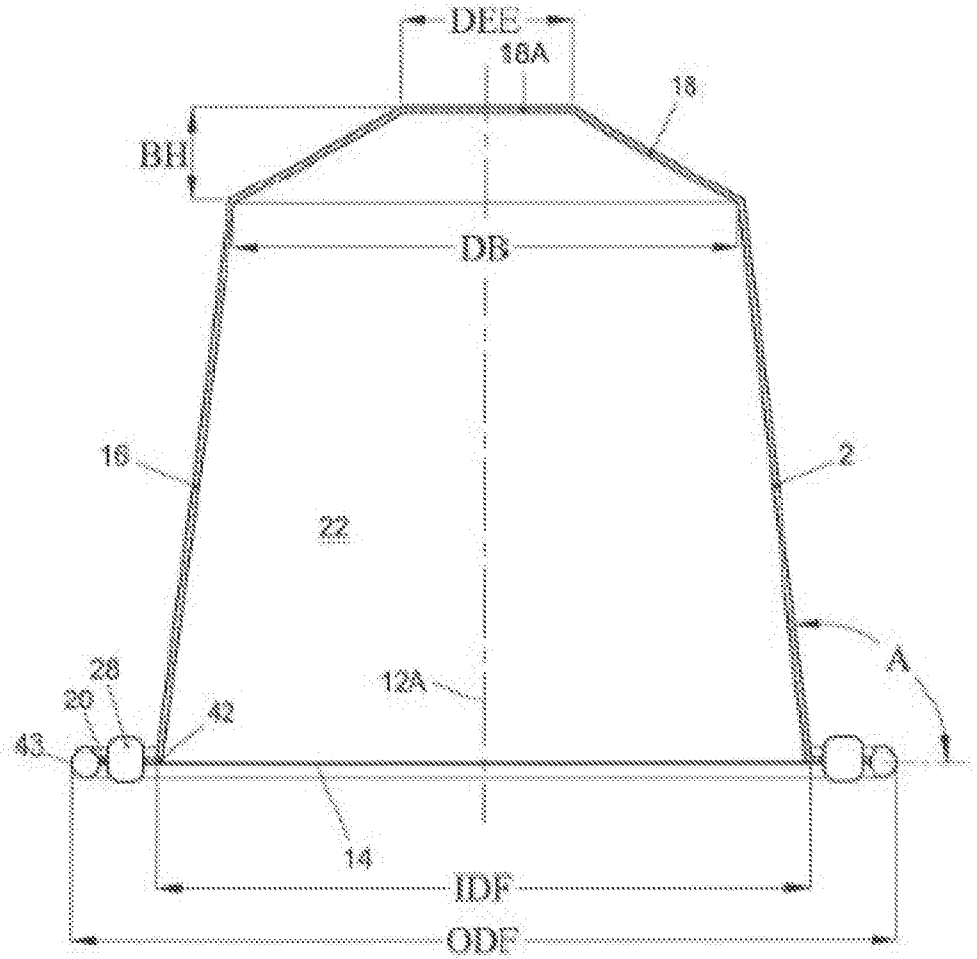


Fig. 2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2
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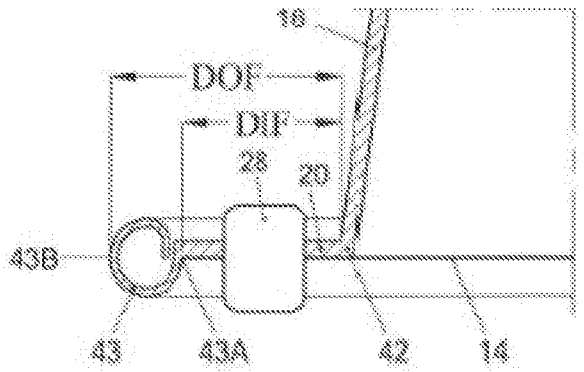
A
28
20
42
12A
43
1
14
IDF
ODF

Fig. 3A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DOF
DIF
28
20
43B
43
43A
42
14

Fig. 3B

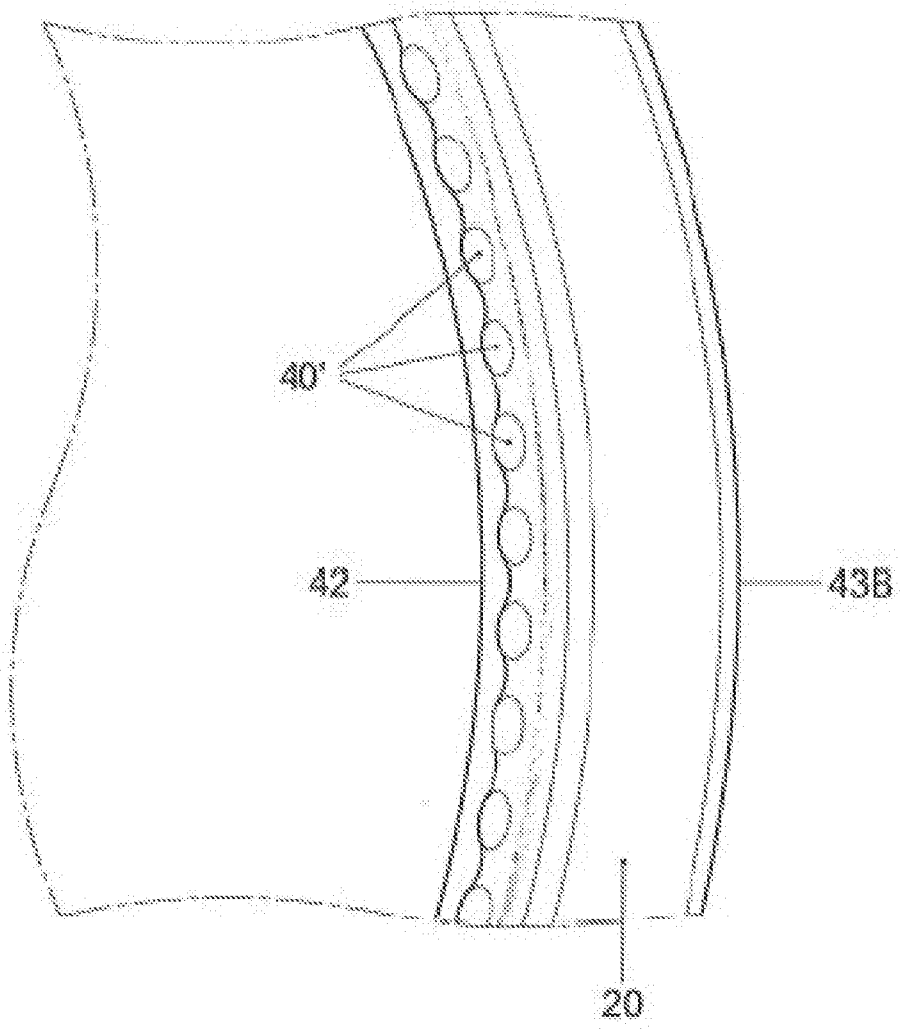

Fig. 3C

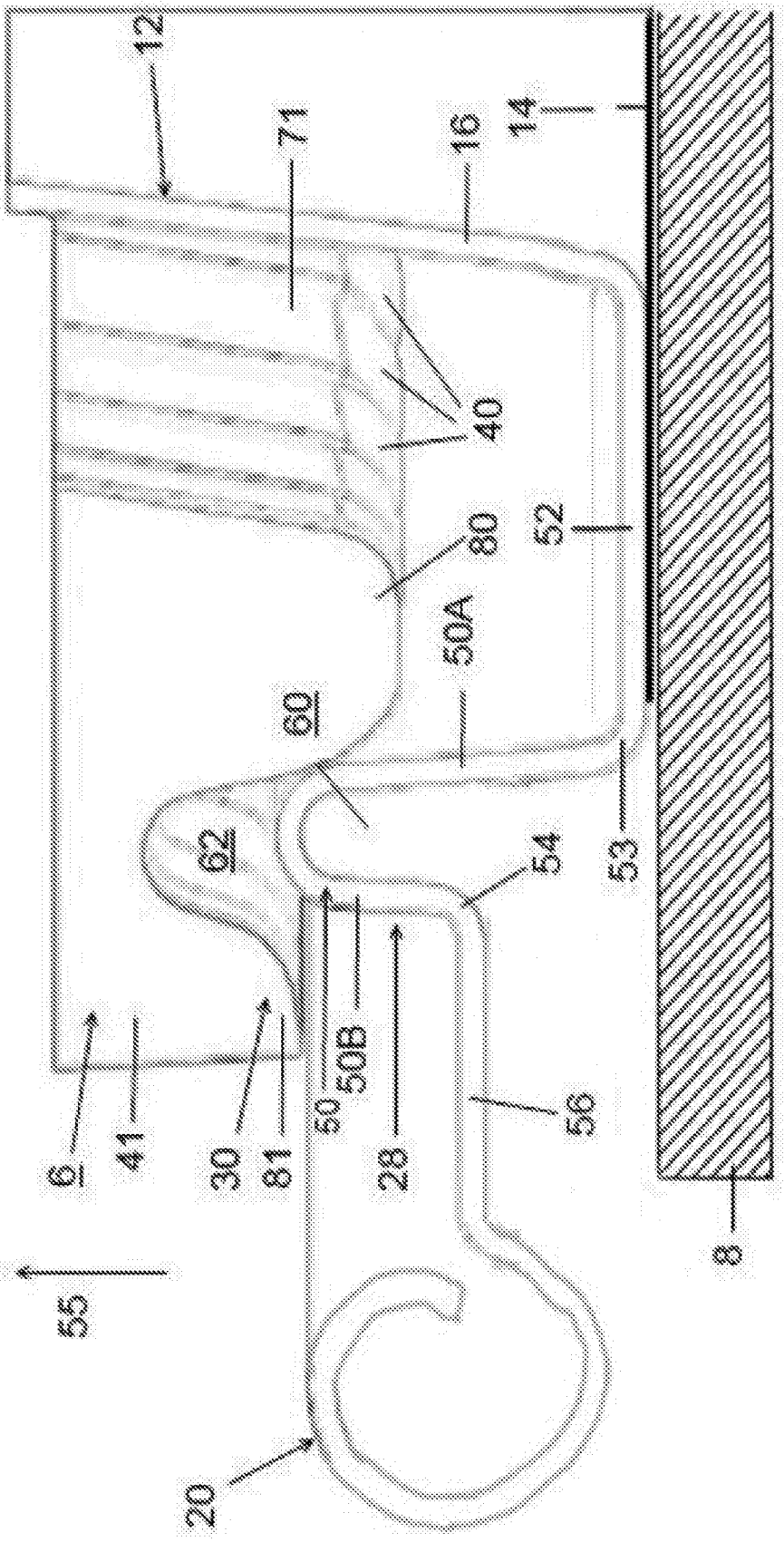

Fig. 4

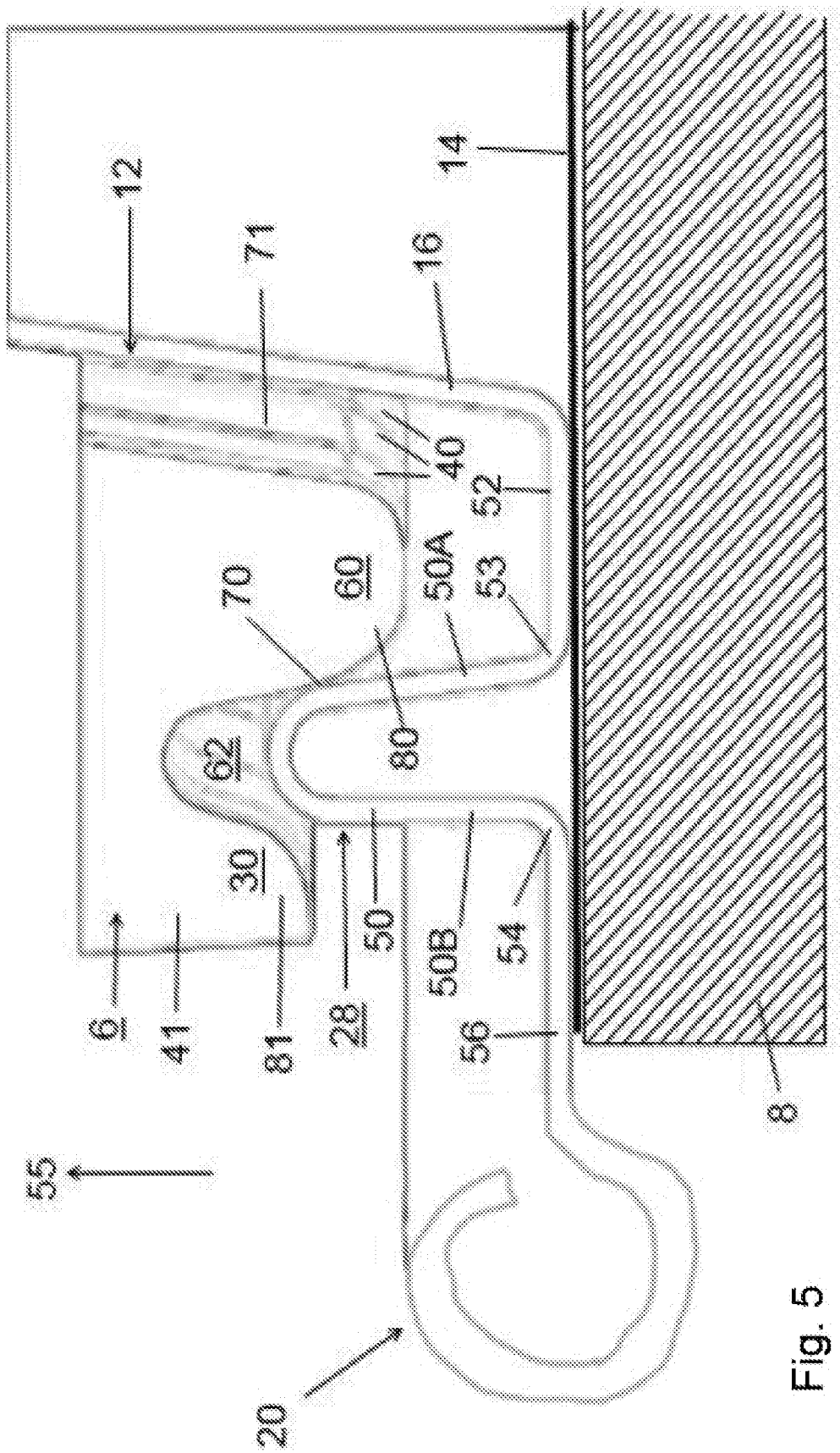

Fig. 5