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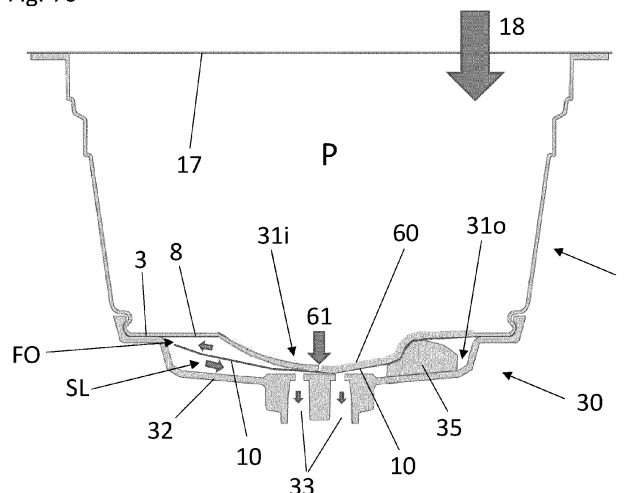
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(54) **A CAPSULE COMPRISING A SPOUT BODY THAT IS EQUIPPED WITH ONE OR MORE FREE SAGGING LOCATIONS IN BETWEEN SETS OF SUPPORTING RIBS FOR CONTROLLED OPENING**

(57) A barrier closing element (10) is attached along a circumferentially closed sealing seam to an attachment portion (8) of a base wall (3) of a capsule body (1). A spout body (30) connected thereto comprises supporting ribs (35) underneath the attachment portion for supporting the barrier closing element during pressurized liquid/steam entering the capsule. Inside the spout body a sagging location (SL) is left free that lies underneath a section of the attachment portion, that is sideways de-

limited by spaced apart neighbouring ones of the supporting ribs, and that is configured to let the barrier closing element locally sag through in between said neighbouring ones of the supporting ribs during pressurized liquid/steam entering the capsule body for a peeling force to be exerted onto a section of the sealing seam above that sagging location for a controlled opening of a flow opening (FO).

Fig. 7c



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a capsule for containing a substance from which a beverage can be produced, the capsule being designed for insertion in a beverage production machine in which pressurized liquid/steam enters the capsule in order to interact with the substance in the capsule and to drain a beverage from the capsule.

BACKGROUND TO THE INVENTION

[0002] A large number of "Dolce Gusto" (Registered Trade Mark) compatible types of capsules are known that each comprise a cup-like capsule body for receiving a substance for preparing a beverage, for example a coffee or espresso powder or a soluble like milk powder, and having a for example frustoconical circumferential side wall merging into a transverse base wall at the lower smaller diameter end and a radially outwardly protruding flange encircling the upper wider end to which a top closing element is secured.

[0003] For example WO-2017/081622 shows such a cup-like capsule body with a base wall and an upper circumferential side wall that together delimit a cavity inside which for example coffee powder is contained. At its upper side the cavity's opening is sealed with a top closing element. The base wall is stepped and on top of a second one of those steps has an outer circumferential edge of a barrier closing element attached to it. On top of the second one of the steps as well as on top of the barrier closing element, a secondary nonwoven fabric filtering disc is provided. On top of the first one of the steps as well as on top of the secondary non-woven fabric filtering disc, a primary paper filtering disc is provided. The barrier closing element is suitable for tearing when a pressure due to injected liquid inside the cavity exceeds a certain resistance force. Underneath the barrier closing element the stepped base wall of the capsule comprises a chamber that is delimited by a lower circumferential side wall and a bottom wall. Inside this chamber a downwardly movable damping element is provided for damping and thus controlling an exit speed of beverage out of the capsule via an outlet opening in the bottom wall during filtration. An inner part of the barrier closing element is fixedly welded to an upper part of the damping element.

[0004] A disadvantage herewith is that the capsule's functioning leaves to be desired. In particular it is rather unpredictable at what pressure inside the capsule the barrier closing element is going to tear loose. This is particularly negative because if the barrier closing element tears loose too soon then an optimum filtration pressure for certain types of coffee might not have been reached yet. On the other hand, if the barrier closing element tears loose too late then this might lead to a dangerous situation. Also the capsule then may start to thermoform

against a holder inside which it has been placed.

[0005] Yet another disadvantage is that the capsule's combined foreseen tearing open and damping construction is relative complex, expensive and vulnerable to malfunctioning. If the barrier closing element tears loose, then the pressure inside the capsule shall drop, and the tearing loose is prone to stop. The exact moment of stopping however is rather unpredictable. It is then uncertain at what extent the barrier closing element remains connected to the base wall. Since the barrier closing element is also fixedly welded to the upper part of the damping element, this may even lead to the damping element starting to tilt and possibly even to get stuck inside the chamber. Thus the foreseen damping shall be obstructed.

[0006] Other examples of cup-like capsule bodies with internal barrier films resting upon profiled base walls are known from for example WO-2016/193961 and WO-2015/121882.

[0007] Another example is known from WO2020/089292, in the name of the present applicant, where a capsule assembly is shown that comprises a capsule body that has a removable spout body connected to the capsule body's bottom end via a latching connection. A base wall of the capsule body comprises a radially outer ring-shaped attachment portion that circumvents a radially inner central deformation portion that in a starting situation extends convexly curved like a dome, upwardly into the capsule body. A barrier closing element is attached to a lower, outer surface of the attachment portion of the base wall by means of a seal. With this, the barrier closing element spans below the upwardly curved central deformation portion. One or more passageways are provided in the base wall, either in the central deformation portion either in the circumventing attachment portion of the base wall. When the capsule assembly is used in a brewing machine, a pressurized hot liquid gets introduced into the capsule body by means of an injection needle that is pierced through a top closing element of the capsule body. This leads to the pressure inside the capsule body to quickly rise until such threshold level is reached that the central deformation portion of the base wall flips over from its upwardly curved starting situation towards a popped situation in which it extends concavely curved like a bowl, downwardly out of the capsule body. The flipping over takes place such instantaneous that the central deformation portion exerts a smashing force onto the barrier closing element. This causes the seal to detach and thus at a same time give free one or more of said passageways in the base wall. The flipped over central deformation portion of the base wall together with the smashed loose barrier closing element, then comes to lie inside and against a concave rib-like structure that is provided in the removable spout body.

[0008] A disadvantage herewith is that particularly for certain types of beverages to be prepared, the capsule's functioning leaves to be improved. It is difficult to carefully

select the capsule's base wall dimensions, like wall thickness/surface area/curvature of the central deformation portion, in such a way that they get to correspond to exactly that desired flipping/opening pressure level at which the base wall is deemed to flip over and open the capsule body at its bottom end. This is further complicated, because the desired flipping/opening pressure level may differ per specific type of beverage to be prepared, per characteristics of the substance with which the capsule body is filled for this, like density of coffee grindings or solubles, per whether or not a filter is used inside the capsule body, and if so what the porosity of the filter then is, and per location/number/size of the one or more passageways.

[0009] Another disadvantage is that if a filter disc is used on top of the base wall, That this filter disc then all of a sudden no longer shall be supported by the flipping central deformation portion of the base wall. This may lead to a local damaging or overstretching of the filter material, and thus to a change in its porosity. Furthermore, it is noted that for this construction with the flipping over central deformation portion of the base wall, the filter's effective filtering surface area is limited by the location/number/size of the one or more passageways. Further, portions of this filter disc may be pushed into the one or more passageways, due to the rising pressure inside the capsule body. This may change the filter characteristics at the positions of those passageways.

BRIEF DESCRIPTION OF THE INVENTION

[0010] The present invention aims to overcome those disadvantages at least partly or to provide a usable alternative. In particular, the present invention aims to provide an economic and user-friendly capsule of which the opening due to a rising pressure inside the capsule body can take place in a more controlled manner, more particularly both for those types of beverages that do or do not require a filter disc inside the capsule body underneath the substance with which they are filled, such that high quality and superb tastes in beverages can be prepared therewith for all kinds of different desired opening pressures and beverage outflow speeds.

[0011] According to the present invention this aim is achieved by a capsule for containing a substance from which a beverage can be produced, the capsule being designed for insertion in a beverage production machine in which pressurized liquid/steam enters the capsule in order to interact with the substance in the capsule and to drain a beverage from the capsule, according to claim 1. The capsule comprises:

- a cup-like capsule body that has:
 - a circumferential side wall;
 - a transverse base wall at a bottom end of the side wall having a passageway; and
 - a radially outwardly protruding flange encircling

the side wall at its upper end,

- a top closing element that is secured to the flange to close the capsule body at its upper end and that is configured to have a liquid/steam injection element pierced through at a start of a beverage production;
- a barrier closing element that is attached along a circumferentially closed sealing seam to an attachment portion of the base wall that lies around the passageway to close the capsule body at its bottom end; and
- a bowl-like spout body that is connected to the base wall and/or bottom end of the side wall,

wherein the spout body has a receiving space and an outlet for the collecting and outflow of beverage that enters into the receiving space after opening up of the barrier closing element, and

wherein at a bottom of the spout body supporting ribs are provided that project upwardly into the receiving space underneath and towards the attachment portion, that are configured to provide support for the barrier closing element underneath the attachment portion during pressurized liquid/steam entering the capsule.

[0012] According to the inventive thought, inside the receiving space of the spout body at least one sagging location is left free that lies underneath a section of the attachment portion, which free sagging location is sideways delimited by spaced apart neighbouring ones of one or more sets of the supporting ribs, wherein the free sagging location is configured to let the barrier closing element locally sag through in between said neighbouring ones of the one or more sets of the supporting ribs during pressurized liquid/steam entering the capsule body for a peeling force to be exerted onto a section of the sealing seam above that sagging location for a controlled opened flow opening to be opened up.

[0013] Thus advantageously a truly reliable controlled opening process of the capsule body has become possible along a well defined, specific and limited section of the sealing seam that lies above the sagging location. The dimension of the thus controlled opened flow opening along that section of the sealing seam is dependent on the dimensions of the free sagging location underneath it. This has the advantage that the size of the flow opening that gets opened can be influenced by using a spout body inside which a larger or smaller sagging location is foreseen.

[0014] After manufacturing of the capsule body, for example by means of injection moulding or thermoforming, the barrier closing element, for example a film or foil, can simply be attached to the lower outer side of the attachment portion of the base wall by means of the circumferentially closed sealing seam. This can for example be done with a heat seal. After that the spout body can be

connected to the lower side of the capsule body, for example by means of a snap on connection. The barrier closing element from then on lies protected between the cup-like capsule body and the bowl-like spout body. In this connected state, the supporting ribs extend upwards to substantially the level of the barrier closing element respectively to substantially the level of the attachment portion of the base wall against which the barrier closing element is attached via the sealing seam. A play of less than 1-2 millimetres may be left between them. Thus the supporting ribs are well able to locally, that is to say tangentially sideways of the sagging location, support the barrier closing element substantially at the level of the barrier closing element respectively substantially at the level of the attachment portion of the base wall against which the barrier closing element is attached via the sealing seam, during pressurized liquid/steam entering the capsule body.

[0015] During this pressurization of the capsule body, a center portion of the barrier closing element also gets downwardly pressurized and shall have a tendency to deform downwardly. Due to this the center portion of the barrier closing element shall start to exert tension forces on its integral circumferential outer portion that via the sealing seam is attached to the attachment portion of the base wall.

[0016] The present invention now is based on the insight that by locally directing those tension forces in a specific most effective direction, a well-controlled opening process can be obtained leading to a well-defined flow opening to be created.

[0017] There where a section of the barrier closing element lies above the sagging location that is tangentially sideways delimited by supporting ribs, the pressurization shall not only result in the center portion of the barrier closing element to get downwardly pressurized, but shall automatically also result in that section of the barrier closing element that lies above the sagging location, to have a tendency to deform downwardly and start to locally sag down into that free sagging location. This sagging leads to shear tension forces and to normal tension forces being locally executed on the section of the sealing seam above the sagging location. Those combined shear and normal tension forces together are well able to quickly peel open that section of the sealing seam above the sagging location.

[0018] There where remaining sections of the barrier closing element lie above the supporting ribs, the pressurization shall only result in the barrier closing element getting pushed against the supporting ribs. This means that along those remaining sections above the supporting ribs, the barrier closing element keeps on lying substantially at the level of the attachment portion of the base wall against which the barrier closing element is attached via the sealing seam. This non-sagging leads to mainly only shear tension forces being locally executed on the rest of the sealing seam above the supporting ribs. The shear tension forces alone are unable to quickly peel

open the remaining sections of the sealing seam above the supporting ribs. This has to do with the fact that the sealing seam in the sideways transverse direction is much stronger than in the downwards direction perpendicular thereto.

[0019] Owing to the invention it can now exactly be determined to what maximum opening pressure level the pressure inside the capsule body may rise before the controlled opening of the capsule body's barrier closing element is going to take place above the sagging location. Furthermore, owing to the present invention it can now exactly be determined along how big a section of the sealing seam this controlled opening is going to take place as soon as this maximum opening pressure level inside the capsule body is reached, as well as which remaining section of the sealing seam is going to stay closed when this maximum pressure level inside the capsule body is reached. Furthermore, width/strength of the sealing seam itself shall also may play an important role in determining at what maximum opening pressure level the pressure inside the capsule body may rise before the controlled opening of the capsule body's barrier closing element is going to take place above the sagging location. The width/strength of the sealing seam for example can be varied by means of selecting a suitable sealing head of a specific geometry, for heat sealing the barrier closing element against the attachment portion of the base wall of the capsule body, during manufacturing. Thus it can exactly be determined when the controlled opening is induced, how big or how small the controlled opened flow opening size then is going to become, and thus at what exit speed/outflow rate the brewed beverage is going to be allowed to flow out of the capsule body into the receiving space of the spout body connected thereto.

[0020] This makes it possible to, in dependence of the type of beverage to be produced, select and incorporate exactly those controlled opening conditions, including maximum opening pressure level, flow opening size and exit speed/outflow rate, simply by changing width of the sagging location to obtain a targeted opening section and remaining closure section of the sealing seam. Even for more difficult types of beverages to be produced, the capsule's functioning can now optimally and reliably be fine-tuned.

[0021] This incorporating of the selected maximum opening pressure level, flow opening size and exit speed/outflow rate, can take place during the step of selecting a specific type of spout body that needs to be connected to the capsule body. For example, it is possible to have different types of spout bodies manufactured with differently dimensioned free sagging locations spared out between its supporting ribs, and then during assembly for a specific beverage line select a specific one of them that needs to be connected to the capsule bodies. The capsule bodies themselves do not need to be changed for this, which makes it possible to use one and the same capsule body for all kinds of different beverages to be brewed.

[0022] The controlled opening conditions can not only truly reliably be differed per specific type of beverage to be produced, but also truly reliably be differed when certain characteristics of the substance with which the capsule body gets filled, like density of coffee grindings, solubles or the like, may change.

[0023] Furthermore, the controlled opening conditions can now also truly reliably be changed per whether or not a filter is used inside the capsule body, and if so what type of filter is used, what the porosity of the filter then is, and/or per location/number/size of the passageway(s) in the base wall. During the controlled opening, such a filter can remain being supported on top of the base wall in a same manner. The amount of support does not have to change during the controlled opening. A risk for damaging or overstretching of filter material can thus more easily be prevented. Furthermore, a filter disc's effective filtering surface area can now more easily be increased, in particular by increasing the size and/or number of the passageway(s).

[0024] In a preferred embodiment a plurality of sagging locations, preferably three, can be provided inside the receiving space of the spout body, each sagging location lying underneath an own section of the attachment portion. The provision of a plurality of sagging locations brings the advantage that a plurality of controlled opening options is provided, of which always one shall be most likely to open up first in accordance with the aimed beverage production settings. This may help to deal with minor tolerance differences that may occur during production in for example exact locations, widths and local strengths of the sealing seams. Furthermore, the provision of a plurality of sagging locations makes it possible to make the spout body symmetric, by means of equally dividing the plurality of sagging locations and sets of supporting ribs over the circumferential direction inside the receiving space of the spout body. This symmetry can be advantageous both during manufacturing of the spout bodies as well as during their connecting with the capsule bodies. Further, it may help to save material for the spout body since less supporting ribs are then needed.

[0025] In a preferred embodiment an inner central collection chamber and an outer ring-shaped collection chamber may be provided inside the receiving space of the spout body, wherein the one or more sets of the supporting ribs and the one or more sagging locations are positioned in between the outer ring-shaped collection chamber and the inner central collection chamber. The outlet then may be provided in a lower center of the bowl-shaped spout body where it connects with the inner central collection chamber. Brewed or dissolved beverage that starts to flow out of the capsule body as soon as the internal pressure has opened up the flow opening in the section of the sealing seam that lies at the position of the sagging location, then shall firstly arrive in the outer ring-shaped collection chamber. From there it shall spread out and start flowing radially inward to the inner central collection chamber towards the outlet. This flow pattern

shall help to evenly spread out the beverage over the entire receiving space, thus mixing the beverage and thus having the beverage leave the capsule in a smooth and even flow.

[0026] In addition thereto or in the alternative a plurality of the supporting ribs may be provided inside each set, which supporting ribs then can be spaced apart from each other at first spacings, and wherein the neighbouring ones of the supporting ribs that sideways delimit the one or more free sagging locations are spaced apart from each other at a second spacing, wherein the first spacings are smaller than the second spacing(s). The first spacings then may form relative small throughflow openings between the supporting ribs inside the set(s) that are in flow connection with the inner central collection chamber of the receiving space. Those relative small throughflow openings between the supporting ribs inside the set(s) help to guarantee the beverage to always be able to reach the inner central collection chamber even when the one or more sagging locations are largely or entirely blocked by locally sagged-in sections of the barrier closure element. Furthermore, the relative small throughflow openings between the supporting ribs inside the set(s) may help to create some foam/crema on top of the beverage.

[0027] In particular the first spacing is at least 5 times smaller than the second spacing. This is important in order to obtain a venturi effect for the beverage flowing through them and to prevent that the remaining section(s) of the barrier closing element above the supporting ribs may also start to sag into the first spacings.

[0028] In a preferred embodiment each free sagging location may cover an arc section of between 30-90 degrees, in particular about 45 degrees. By dimensioning the sagging location within this range, the controlled opening reliably can take place within a wide range of different to be incorporated maximum opening pressures.

[0029] In a preferred further or alternative embodiment, the targeted to-be-opened section of the sealing seam lying above the sagging location may extend along less than 25% of the circumferentially closed sealing seam, in particular about 12.5% of the circumferentially closed sealing seam. Thus advantageously the controlled opening process is going to take place along a limited angular section compared to the remaining section(s) of the sealing seam that stay closed. The limited opened up angular section also may help to prevent dripping of residual beverage out of the capsule after it has been used in the case of a large passageway being provided in the center of the base wall. The reason for this is that as soon as the injection pressure is taken away again, the barrier closing element has a tendency to move back towards its starting position, that is to say spanning tight in the transverse direction underneath the base wall, and thus largely close off the controlled opened flow opening again. Furthermore, due to its slight central sagging, the barrier closing element is able to accumulate some re-

sidual beverage in its center.

[0030] In a preferred further or alternative embodiment the targeted to-be-opened section of the sealing seam lying above the sagging location may extend along a length in the circumferential direction of the circumferentially closed sealing seam of between 10-20 mm. Thus advantageously such a relative tight controlled opened flow opening is created during beverage production, that an acceleration of the exit speed/outflow rate of produced beverage may take place, which may help to create foam/crema on top of the produced beverage.

[0031] In a first variant the attachment portion of the base wall of the capsule body may circumvent a radially inner central deformation portion of the base wall of the capsule body that in a starting situation extends convexly curved like a dome, upwardly into the capsule body, and that during pressurized liquid/steam entering the capsule body is configured to flip over towards a popped situation in which the central deformation portion extends concavely curved like a bowl, downwardly out of the capsule body, wherein the passageway is provided in the central deformation portion.

[0032] The central deformation portion can be configured such that it flips over at a relative low pressure, in particular at a pressure that is lower than the one required to open up the section of the sealing seam above the sagging location. Since the flipping over may take place at a relative early stage of the opening process, the selection of the capsule body's base wall dimensions, like wall thickness/surface area/curvature of the central deformation portion, is not critical. Also this makes it possible to make the central deformation portion relative small and/or relative flat.

[0033] In addition thereto, the passageway can be configured to close in the starting situation during said pressurized liquid/steam entering the capsule body and be configured to open up during said pressurized liquid/steam entering the capsule body after the central deformation portion of the base wall has flipped over towards the popped situation. The barrier closing element that is attached to the lower, outer surface of the attachment portion of the base wall by means of the circumferentially closed sealing seam, then spans below the upwardly curved central deformation portion. During use the pressure inside the capsule body quickly may rise until such a threshold level is reached that the central deformation portion of the base wall flips over. The flipping over then automatically shall open up the passageway. This opening up of the passageway shall cause the pressure to also reach the barrier closure element underneath it, which in turn shall lead to the section of the sealing seam that finds itself above one of the sagging locations to be locally peeled open.

[0034] In addition thereto the passageway can further be configured to close again after said pressurized liquid/steam entering the capsule body stops, while the central deformation portion after said pressurized liquid/steam entering the capsule body stops maintains its

popped situation in which it extends concavely curved like a bowl, downwardly out of the capsule body. Thus an after dripping gets automatically prevented.

[0035] In addition thereto the passageway in the central deformation portion may comprise one or more cuts, in particular a single straight cut that extends diametrically across a center of the central deformation portion. Such a cut can simply be made in the central deformation portion of the base wall during production. As long as the central deformation portion of the base wall remains being in its starting situation in which it extends convexly curved like a dome, upwardly into the capsule body, pressurized liquid/steam entering the capsule body shall force the walls that delimit the cut to be pushed towards each other and thus keep the passageway initially closed. As soon as the central deformation portion of the base wall flips over towards its popped situation in which it extends concavely curved like a bowl, downwardly out of the capsule body, the pressurized liquid/steam entering the capsule body shall force the walls that delimit the cut to be pushed away from each other and thus open up the passageway.

[0036] This flipping dome portion in combination with the cut therein forming the passageway also brings along another important advantage in that it helps to prevent dripping after the injection pressure is taken away at the end of the beverage production. The walls that delimit the cut then no longer are pushed away from each other by the pressure, and the passageway shall automatically close again due to the downwardly concavely curved central deformation portion retaining its bowl-shape closing the cut.

[0037] In a second variant the attachment portion of the base wall of the capsule body may circumvent a radially inner central throughgoing hole as passageway, in particular having a diameter of at least 10 mm, more in particular about 18-20 mm. The barrier closing element that is attached to the lower, outer surface of the attachment portion of the base wall by means of the circumferentially closed sealing seam, then also spans below the central throughgoing hole as passageway. During use the pressure inside the capsule body quickly may rise and directly also reach the barrier closure element underneath it, which in turn shall lead to the sealing seam to be locally peeled open along the section that finds itself above one of the sagging locations. This second variant is now advantageously possible since a central flipping deformation portion is not required for the opening process of the barrier closing element. Instead this entire flipping dome portion may now be left out. Thus advantageously a saving in capsule body material can be obtained. Furthermore, the capsule body's internal volume can be increased such that if desired a larger amount of substance can be stored therein. In the case that a filter is to be used, this filter may span over the large hole, thus creating a large effective filtering surface area.

[0038] In a preferred further or alternative embodiment the attachment portion of the base wall may be construct-

ed flat and together with the barrier closing element attached thereto may extend in a transverse direction. Thus advantageously the sealing seam can reliably be made uniformly strong and resistant against tension forces around its entire circumference.

[0039] In a preferred further or alternative embodiment the attachment portion of the base wall may have a width of at least 3 mm. Thus advantageously enough surface area is available for the sealing seam to be made against it. In line herewith, the sealing seam then may have a width of less than 3 mm, preferably less than 2,5 mm. For some usages the sealing seam may even be given a width of about 1,5 mm in order to dimension it such vulnerable that the foreseen controlled peeling open of the flow opening at the sagging location can take place by means of the there occurring normal tension forces.

[0040] Further preferred embodiments of the invention are stated in the dependent subclaims.

DETAILED DESCRIPTION OF THE DRAWINGS

[0041] The invention shall now be explained in more detail below by means of describing some exemplary embodiments in a non-limiting way with reference to the accompanying drawings, in which:

- Fig. 1 shows an exploded perspective view of an embodiment of a capsule body with a central hole in its base wall;
- Fig. 2 shows an assembled view of fig. 1 partially sectioned in a filled closed state;
- Fig. 3 a cross-section of fig. 2;
- Fig. 4a and 4b show a perspective and front view of a spout body according to the invention;
- Fig. 5a-c schematically show three steps of the controlled opening process for an assembled capsule that has the spout body of fig. 4 connected to the capsule body of fig. 1-3;
- Fig. 6a shows a cross-sectional view of the spout body of fig. 4 connected to another embodiment of a capsule body with a flipping dome in a center of its base wall;
- Fig. 6b shows a cross-sectional view corresponding to fig. 6a but then in a direction perpendicular thereto;
- Fig. 6c shows a partial cut open perspective view along the cross-section of fig. 6b; and
- Fig. 7a-c schematically show three steps of the controlled opening process for the capsule of fig. 6.

[0042] In fig. 1-3 a capsule body is shown that has been given the reference numeral 1. The capsule body has a cup-like shape for receiving a substance, like coffee or espresso powder. The capsule body 1 comprises a stepped circumferential side wall 2, a base wall 3, and a flange 4. The capsule body is rotation symmetric around a central horizontal axis.

[0043] The base wall 3 is flat, extends in a transverse horizontal direction x and is provided with a large central

throughgoing hole 7. The portion of the flat base wall 3 that directly circumvents the hole 7 is referred to as attachment portion 8.

[0044] During manufacturing, a barrier closing element 10 is sealingly attached, for example by means of a heat seal, against an outer side of the attachment portion 8, that is to say underneath the base wall 3.

[0045] During filling, a filter disc 11 is first placed on the bottom of the capsule body 1, that is to say directly on top of the base wall 3. If necessary the filter disc 11 can be attached, for example by means of a heat seal, against an inner side of the attachment portion 8, that is to say on top of the base wall 3. Subsequently, the capsule body 1 can be filled with the substance 12, after which a perforated distribution disc 14 is placed on top of the substance 12. This distribution disc 14 rests upon a step 15 of the circumferential side wall 2. If necessary, the distribution disc 14 can be attached, for example by means of a heat seal, against the step 15. Finally, a top closing element 17 is sealingly attached, for example by means of a heat seal, against the flange 4. The top closing element 17 closes the capsule body 1 at its upper end and is configured to have a liquid/steam injection element pierced through it at a start of a beverage production.

[0046] The barrier closing element 10 is attached along a circumferentially closed sealing seam to the attachment portion 8 of the base wall 3 that lies around the hole 7. The sealing seam has a width in the radial direction of more than 2 mm, to be more precise about 3 mm, and is of a type that can be peeled open.

[0047] A relative large part of the sealing seam then is configured to remain intact and locally keep on attaching the barrier closing element 10 to the attachment portion 8 of the base wall 3, not only during transport and storage, but more importantly also when, during brewing of a beverage in a beverage production machine, a brewing pressure P inside the capsule body 1 quickly starts to rise.

[0048] A relative small section of the sealing seam is configured to open up and form a flow opening FO by locally detaching the barrier closing element 10 from the attachment portion 8 of the base wall 3, not during transport and storage, but as soon as, during brewing of the beverage in the beverage production machine, the brewing pressure P inside the capsule body 1 has risen above a certain threshold value.

[0049] In fig. 4 a bowl-like spout body 30 is shown that is configured to be connected by means of a snap fit onto the bottom end of the capsule body 1, as is shown in fig. 5. The spout body 30 then encloses the entire base wall 3, including the barrier closing element 10 attached thereto.

[0050] The spout body 30 delimits a receiving space 31 with a bottom wall 32 for collecting all brewed beverage that flows into it via the controlled opened flow opening FO. In its center, the bottom wall 32 is equipped with an outlet 33 that is partly covered by a sunshine-like pattern of strengthening ribs 34.

[0051] Above the outlet 33, a free inner central collec-

tion chamber 31i is provided inside the receiving space 31. Positioned around the inner central collection chamber 31i, three sets of five substantially radially extending inwardly pointing V-shaped supporting ribs 35 are provided. The supporting ribs 35 form an integral part of the spout body 30. Each set of five supporting ribs 35 covers an arc section α , that here is 75 degrees. Around the sets of supporting ribs 35, a free outer ring-shaped collection chamber 31o is provided inside the receiving space 31.

[0052] According to the inventive thought, sagging locations SL are left free inside the receiving space 31 in between the sets of supporting ribs 35. Each free sagging location SL covers an arc section β , that here is 45 degrees, or in other words that here is as large as a space that three of the supporting ribs 35 otherwise would have taken in. Each free sagging location is sideways delimited by opposing outer ones of two neighbouring sets of the supporting ribs 35.

[0053] Each V-shaped supporting rib 35 has an intermediate top part from where legs of its V-shape spread out. Those legs extend angled downwards towards the outer ring-shaped collection chamber 31o. The point of each V-shaped supporting rib 35 curves concavely downwards towards the inner central collection chamber 31i.

[0054] Adjacent ones of the V-shaped supporting ribs 35 inside each set are regularly spaced apart at relative small first spacings. With this they have their legs extending in such directions that relative small throughflow channels/openings 37 of constant width are formed between them. Those outflow channels/openings 37 bring the outer ring-shaped collection chamber 31o in flow connection with the inner central collection chamber 31i. The throughflow channels/openings 37 have a width of about 1 millimetre. The opposing outer ones of two neighbouring sets of the supporting ribs 35 that sideways delimit the free sagging locations SL, are spaced apart at relative large second spacings, that define the width dimensions of the sagging locations SL. With this the sagging locations SL widen out from about 5 till 10 millimetres. Thus compared to the relative small throughflow channels/openings 37 of constant width between the supporting ribs 35 within each set, relative wide outwardly diverging free sagging locations SL are foreseen in between those sets. The provision of those free sagging locations SL plays a crucial role in the inventive controlled opening process that shall be described in more detail below.

[0055] Fig. 5a shows the spout body 30 in the assembled connected state to the capsule body 1. It can be seen there that the upwardly projecting supporting ribs 35 as well as the sagging locations SL in this connected state are partly positioned underneath the attachment portion 8 of the base wall 3 of the capsule body 1.

[0056] The top parts of the supporting ribs 35 are provided at such heights that, in the situation that the spout body 30 is connected to the capsule body 1, they project upwardly to substantially the level of the barrier closing element 10 at the transition between the central through-

going hole 7 and the attachment portion 8 of the base wall 3.

[0057] The legs of the supporting ribs 35 are configured such downwards angled that, in the situation that the spout body 30 is connected to the capsule body 1, they lie vertically spaced from the barrier closing element 10 underneath the attachment portion 8 where the barrier closing element 10 is attached to the base wall 3 along the sealing seam.

[0058] The points of the supporting ribs 35 are configured such downwards concavely curved that, in the situation that the spout body 30 is connected to the capsule body 1, they lie increasingly spaced from the barrier closing element 10 underneath the central throughgoing hole 7.

[0059] The sunshine-like pattern of strengthening ribs 34 above the outlet 33 are configured such low that they lie substantially at a level of the bottom wall 32 of the receiving space 31. In the situation that the spout body 30 is connected to the capsule body 1, they lie vertically spaced from the barrier closing element 10 underneath where it spans the central throughgoing hole 7 in the base wall 3.

[0060] Fig. 5b schematically shows a starting phase of a brewing cycle during which the top closing element 17 gets pierced by a liquid/steam injection element 18 and starts injecting pressurized liquid/steam into the capsule body 1. This shall lead to a quickly rising pressure inside the capsule body 1 that through the filter disc 11 shall also exert pressure P onto the barrier closing element 10.

[0061] Since the inner central collection chamber 31i is purposively left free from upwardly projecting supporting ribs or the like, this downwards pressure on the barrier closing element 10 shall cause the center portion of the barrier closing element 10 that lies underneath the hole 7 to start sagging through into the inner central collection chamber 31i. With this the barrier closing element shall get supported on the top parts of the supporting ribs 35, as well as against the downwardly curving points of the supporting ribs 35.

[0062] This local support on the supporting ribs 35 leads to transversely directed shear tension forces getting locally executed on the sections of the sealing seam that lie above the supporting ribs 35.

[0063] Since the sagging locations SL are also purposively left free from upwardly projecting supporting ribs or the like, this downwards pressure on the barrier closing element 10 shall furthermore cause local arc portions of the barrier closing element 10 that lie above the sagging locations SL to start sagging through into those sagging locations SL as well.

[0064] This local sagging into the sagging locations leads to downwardly directed normal tension forces getting locally executed on the sections of the sealing seam that lie above the sagging locations SL. Those downwardly directed normal tension forces shall induce peeling effects on those sections of the sealing seam that lie above the sagging locations SL that are much more ef-

fective than the transversely sideways directed shear tension forces that get locally executed on the remaining sections of the sealing seam that lie above the supporting ribs 35. This guarantees that those remaining sections of the sealing seam that lie above the supporting ribs 35 shall not get peeled open but remain closed, whereas it further helps to guarantee that specifically one of the sections of the sealing seam that lies above one of the sagging locations SL shall firstly get peeled open and form the required flow opening FO.

[0065] As soon as one of the sections of the sealing seam that lie above the sagging locations SL then gets opened first, a pressure drop shall occur inside the capsule body 1. This pressure drop shall then in most cases prevent the other sections of the sealing seam that lie above the other ones of the sagging locations SL to also get peeled open.

[0066] Thus the use of the bowl-shaped spout body 30 with its sagging locations SL according to the invention, leads to a truly controlled opening process to take place, that leads to a length of sealing seam to be opened up that is substantially equal to the arc section length of one of the sagging locations SL.

[0067] Fig. 5c shows the situation in which the sealing seam has already been peeled open above one of the sagging location SL such that a controlled opened flow opening FO is obtained above that sagging location SL. The subsequently occurring flow pattern of brewed beverage through the filter disc 11 and the hole 10 from out of the capsule body 1, via the flow opening FO, into the free outer ring-shaped collection chamber 31o of the spout body 30, from there via the throughflow channels/openings 37 and/or underneath the locally sagged down parts of the barrier closing element 10, towards the outlet 33, has been indicated with the arrows. Together, the supporting ribs 35, the throughflow channels-openings 37 and the sunshine-like pattern of strengthening ribs 34, are well able to help making the possibly turbulent flow of brewed beverage flowing out of the outflow opening FO into the receiving space 31, a laminar flow again before reaching the outlet 33. This may help to evenly form a strong and stable layer of foam/crema on top of the beverage inside a glass, cup, or the like.

[0068] Advantageously, the opening-up of the flow opening FO may already take place at a relative low brewing pressure P, for example between 6-9 bar, such that the top closing element 17 shall not be forced to pop or burst open, and such that a thermoforming of the capsule body inside the brewing machine is prevented.

[0069] The relative small but not too small controlled opened flow opening FO, can now advantageously be fine-tuned to bring along a much appreciated increased effect of forming a strong foam/crema layer on top of a cup of brewed beverage.

[0070] As soon as the injecting of hot water is stopped, the brewing pressure P shall quickly drop to environmental pressure, while most of the brewed beverage quickly drains out of the capsule body 1 via the flow opening FO.

As soon as this ends, the barrier closing element 10 shall no longer be pressed downwards. The center portion of the barrier closing element 10 that lies underneath the hole 7, as well as the sagged through local arc portions of the barrier closing element 10 then shall maintain their sagged through shapes. this shall particularly go for the center portion of the barrier closing element 10 because due to the wetted substance resting on top of it shall force it to maintain hanging down with a concave shape into the inner central collection chamber 31i. Thus, an undesired dripping of beverage out of the capsule body 1 after the beverage production has already stopped, is largely or entirely prevented, since any residual beverage automatically gets caught in the downwardly hanging center portion and/or in the sagged through local arc portions of the barrier closing element 10.

[0071] In fig. 6 a second embodiment is shown in which same parts are given same reference numerals and letters. This second embodiment differs from the first in that instead of the central hole in the base wall, now a flipping dome as base wall center is provided. For that the attachment portion 8 of the base wall 3 now circumvents an initially upwardly curved dome-shaped central deformation portion 60. The deformation portion 60 forms an integral part of the base wall 3. The initially upwardly curved dome-shaped central deformation portion 60 is configured to flip over towards a popped situation as soon as a certain threshold pressure inside the capsule body 1 is reached due to injection with hot pressurized water. The central deformation portion 60 then gets to extend concavely curved like a bowl, downwardly out of the capsule body 1. This is shown in fig. 7c.

[0072] Diametrically across a center of the deformation portion 60 a single straight throughgoing cut 61 is made into the base wall 3 during manufacturing. This cut 61 is destined to form a passageway for produced beverage to start flowing through in order to leave the capsule body 1. Due to the dome shape, the cut 61 automatically gets biased towards a largely or entirely closed position as long as the capsule body 1 is not pressurized.

[0073] Fig. 7a shows that the top parts of the supporting ribs 35 now lie at the transition between the central deformation portion 60 and the attachment portion 8 of the base wall 3. The downwards concavely curved points of the supporting ribs 35 are configured such that, in the situation that the spout body 30 is connected to the capsule body 1, they do not stand in the way of the central deformation portion 60 to flip over towards its popped situation. The sunshine-like pattern of strengthening ribs 34 above the outlet 33 for the same reason is configured such low that it also does not stand in the way of the central deformation portion 60 to flip over towards its popped situation. The barrier closing element 10 spans in the transverse direction x underneath the central deformation portion 60 in the base wall 3. The center of the dome here lies at least 3 mm above the level of the barrier closing element 10. This is important in order for the dome to have enough curvature to be able to automatically

close the cut 61 in the popped situation as soon as the pressure drops at the end of beverage production.

[0074] Fig. 7b schematically shows a starting phase of a beverage production cycle during which the top closing element 17 gets pierced by the liquid/steam injection element 18 and starts injecting pressurized liquid/steam into the capsule body 1. This shall lead to a quickly rising pressure inside the capsule body 1. This pressure shall bias the cut 61 to stay largely closed and thus only a limited pressure p to get exerted onto the barrier closing element 10 during that starting phase, whereas the larger pressure P shall immediately full force try to flip over the deformation portion 60.

[0075] As soon as this flipping over has occurred the flipped deformation portion 60 shall force the barrier closing element 10 to follow its concavely downwardly curved bowl-like shape while at a same time pushing it against the top parts of the supporting ribs 35, as well as against the downwardly curving points of the supporting ribs 35.

[0076] Like in the first embodiment, the local support on the supporting ribs 35 leads to merely transversely directed shear tension forces getting locally executed on the sections of the sealing seam that lie above the supporting ribs 35.

[0077] In the popped situation, the pressure P shall force the cut 61 open, after which the full pressure P shall cause the local arc portions of the barrier closing element 10 that lie above the sagging locations SL to start sagging down into those sagging locations SL.

[0078] This local sagging into the sagging locations SL leads to downwardly directed normal tension forces getting locally executed on the sections of the sealing seam that lie above the sagging locations SL. Those normal tension forces shall induce peeling effects on those sections of the sealing seam that lie above the sagging locations SL that are well able to locally open up the sealing seam above one of them.

[0079] Thus in this second embodiment as well, the use of the bowl-shaped spout body 30 with its sagging locations SL according to the invention, leads to a truly controlled opening process to take place, that leads to a length of sealing seam to be opened up that is substantially equal to the arc section length of one of the sagging locations SL.

[0080] Fig. 7c shows the situation in which the sealing seam has already been peeled open above one of the sagging location SL such that a controlled opened flow opening FO is obtained above that sagging location SL. The subsequently occurring flow pattern of brewed beverage through the cut 61 from out of the capsule body 1, via the flow opening FO, into the free outer ring-shaped collection chamber 31o of the spout body 30, from there via the throughflow channels/openings 37 and/or underneath the locally sagged down parts of the barrier closing element 10, towards the outlet 33, has been indicated with the arrows.

[0081] Advantageously, the flipping over, followed by the subsequent opening up of the cut 61, followed by the

controlled opening up of the flow opening FO may already take place at a relative low brewing pressure P , for example between 6-9 bar, such that the top closing element 17 shall not be forced to pop or burst open, and such that a thermoforming of the capsule body inside the brewing machine is prevented.

[0082] The relative small but not too small controlled opened flow opening FO, can now advantageously be fine-tuned to bring along a much appreciated increased effect of forming a strong foam/crema layer on top of a cup of produced beverage.

[0083] As soon as the injecting of hot water is stopped, the pressure P shall quickly drop to environmental pressure, while most of the produced beverage quickly drains out of the capsule body 1 via the flow opening FO. As soon as this ends, the cut 61 inside the flipped over deformation portion 60 shall no longer be forced open, but instead largely or entirely close again. Thus, an undesired dripping of beverage out of the capsule body 1 after the beverage production has already stopped, is prevented.

[0084] Instead of the shown spout body 30 with its sagging locations SL that cover arc sections of 45 degrees, also spout bodies can be made with narrower or wider sagging locations, for example ones wherein the free sagging locations SL cover arc sections that are 30 degrees, or in other words that are as large as a space that two of the supporting ribs 35 otherwise would have taken in, or ones wherein the free sagging locations SL cover arc sections that are 60 degrees, or in other words that are as large as a space that four of the supporting ribs 35 otherwise would have taken in, or even ones wherein the free sagging locations SL cover arc sections that are 90 degrees, or in other words that are as large as a space that six of the supporting ribs 35 otherwise would have taken in.

[0085] During assembly, that specific type of spout body 30 or any other type of spout body then can be selected for connection against the capsule body 1, that corresponds to specific opening conditions for a corresponding specific type of beverage to be brewed, in particular specific types of coffee, like espresso, macchiato, ristretto, americano, latte, cappuccino, milk etc., each requiring their own controlled opening pressure, filter area, passageway, flow path restrictions, flow opening restriction, outflow speed, etc.

[0086] For the second embodiment it is noted that the provision of the three sagging locations SL, brings along the important advantage that the specific rotation orientation with which the spout body 30 may get randomly connected during assembly underneath the capsule body 1, always shall lead to the diametrical transverse direction of the cut 61 to largely correspond with the orientation of one of the sagging locations SL. This has appeared to lead to uniform opening and flowing behaviour of the capsule.

[0087] Besides the shown and described embodiments, numerous variants are possible. For example the

dimensions and shapes of the various parts can be altered. Also it is possible to make combinations between advantageous aspects of the shown embodiments. Instead of using heat sealing techniques other kinds of attachments can be used between the barrier closing element and the base wall, like for example ones that use local pressure and/or locally applied adhesive and/or that use ultrasonic welding, as long as they get to form a circumferentially closed sealing seam around one or passageways in a base wall of a capsule body. All kinds of materials can be used for the capsule body and/or spout body. Preferably however they are made of a biodegradable and/or plastics material, in particular by means of thermoforming or, according to a further variant, by means of injection moulding. The barrier closing element also can be made out of all kinds of materials. Preferably it is made of a biodegradable and/or plastics material, in particular a film or foil that is configured to deform/flex and locally sag through in between said neighbouring ones of the one or more sets of the supporting ribs during pressurized liquid/steam entering the capsule body. For certain types of substance the filter disc and/or distribution disc can be dispensed with. Instead of a hole or cut, other types of passageways can also be provided.

[0088] It should be understood that various changes and modifications to the presently preferred embodiments can be made without departing from the scope of the invention, and therefore will be apparent to those skilled in the art. It is therefore intended that such changes and modifications be covered by the appended claims.

Claims

1. A capsule for containing a substance from which a beverage can be produced, the capsule being designed for insertion in a beverage production machine in which pressurized liquid/steam enters the capsule in order to interact with the substance in the capsule and to drain a beverage from the capsule, comprising:

- a cup-like capsule body (1) that has:

- a circumferential side wall (2);
- a transverse base wall (3) at a bottom end of the side wall (2) having a passageway (7, 61); and
- a radially outwardly protruding flange (4) encircling the side wall (2) at its upper end,

- a top closing element (17) that is secured to the flange (4) to close the capsule body (1) at its upper end and that is configured to have a liquid/steam injection element (18) pierced through at a start of a beverage production;
- a barrier closing element (10) that is attached along a circumferentially closed sealing seam

to an attachment portion (8) of the base wall (3) that lies around the passageway (7, 61) to close the capsule body (1) at its bottom end; and

- a bowl-like spout body (30) that is connected to the base wall (3) and/or bottom end of the side wall (2),

wherein the spout body (30) has a receiving space (31) and an outlet (33) for the collecting and outflow of beverage that enters into the receiving space (31) after opening up of the barrier closing element (10), and wherein at a bottom of the spout body (30) supporting ribs (35) are provided that project upwardly into the receiving space (31) underneath and towards the attachment portion (8), that are configured to provide support for the barrier closing element (10) underneath the attachment portion (8) during pressurized liquid/steam entering the capsule,

characterized in that,

inside the receiving space (31) of the spout body (30) at least one sagging location (SL) is left free that lies underneath a section of the attachment portion (8), which free sagging location (SL) is sideways delimited by spaced apart neighbouring ones of one or more sets of the supporting ribs (35),

wherein the free sagging location (SL) is configured to let the barrier closing element (10) locally sag through in between said neighbouring ones of the one or more sets of the supporting ribs (35) during pressurized liquid/steam entering the capsule body (1) for a peeling force to be exerted onto a section of the sealing seam above that sagging location (SL) for a controlled opened flow opening (FO) to be opened up.

2. Capsule according to claim 1, wherein a plurality of said sagging locations (SL) are provided inside the receiving space (31) of the spout body (30), each sagging location (SL) lying underneath an own section of the attachment portion (8).

3. Capsule according to claim 2, wherein three of said sagging locations (SL) are provided inside the receiving space (31) of the spout body (30), the three sagging locations (SL) lying equally divided from each other by three of the sets of the supporting ribs (35).

4. Capsule according to one of the preceding claims, wherein an inner central collection chamber (31i) and an outer ring-shaped collection chamber (31o) are provided inside the receiving space (31) of the spout body (30), wherein the one or more sets of the supporting ribs (35) and the one or more sagging loca-

tions (SL) are positioned in between the outer ring-shaped collection chamber (31o) and the inner central collection chamber (31i).

5. Capsule according to one of the preceding claims, wherein the supporting ribs (35) inside each set are spaced apart from each other at first spacings forming throughflow openings (37) between them, and wherein the neighbouring ones of the supporting ribs (35) that sideways delimit the free sagging location (SL) are spaced apart from each other at a second spacing, wherein the first spacings are smaller than the second spacing, in particular at least 5 times smaller.
6. Capsule according to one of the preceding claims, wherein the free sagging location (SL) covers an arc section (β) of between 30-90 degrees, in particular about 45 degrees.
7. Capsule according to one of the preceding claims 1-6, wherein the attachment portion (8) circumvents a radially inner central deformation portion (60) of the base wall (3) of the capsule body (1) that in a starting situation extends convexly curved like a dome, upwardly into the capsule body (1), and that during pressurized liquid/steam entering the capsule body (1) is configured to flip over towards a popped situation in which the central deformation portion (60) extends concavely curved like a bowl, downwardly out of the capsule body (1), wherein the passageway (61) is provided in the central deformation portion (60).
8. Capsule according to claim 7, wherein the passageway (61) is configured to close during said pressurized liquid/steam entering the capsule body (1) in the starting situation in which the central deformation portion (60) extends convexly curved like a dome, upwardly into the capsule body (1), and wherein the passageway (61) is configured to open up during said pressurized liquid/steam entering the capsule body (1) after the central deformation portion (60) of the base wall (3) has flipped over towards the popped situation in which the central deformation portion (60) extends concavely curved like a bowl, downwardly out of the capsule body (1).
9. Capsule according to claim 8, wherein the passageway (61) further is configured to close again after said pressurized liquid/steam entering the capsule body (1) stops, while the central deformation portion (60) maintains its popped situation in which it extends concavely curved like a bowl, downwardly out of the capsule body (1).
10. Capsule according to claim 9, wherein the passageway in the central deformation portion (60) comprises

es one or more cuts (61).

11. Capsule according to claim 10, wherein the passageway in the central deformation portion (60) is formed by a single straight cut (61) that extends diametrically across a center of the central deformation portion (60).
12. Capsule according to one of the preceding claims 1-6, wherein the attachment portion (8) circumvents a radially inner central throughgoing hole (7) as passageway in the base wall (3) of the capsule body (1).
13. Capsule according to claim 12, wherein the central throughgoing hole (7) has a diameter of at least 10 mm, in particular about 18-20 mm.
14. The capsule according to one of the preceding claims, wherein the attachment portion (8) is flat and together with the barrier closing element (10) attached thereto via the circumferentially closed sealing seam extend in a transverse direction (x).

Fig. 1

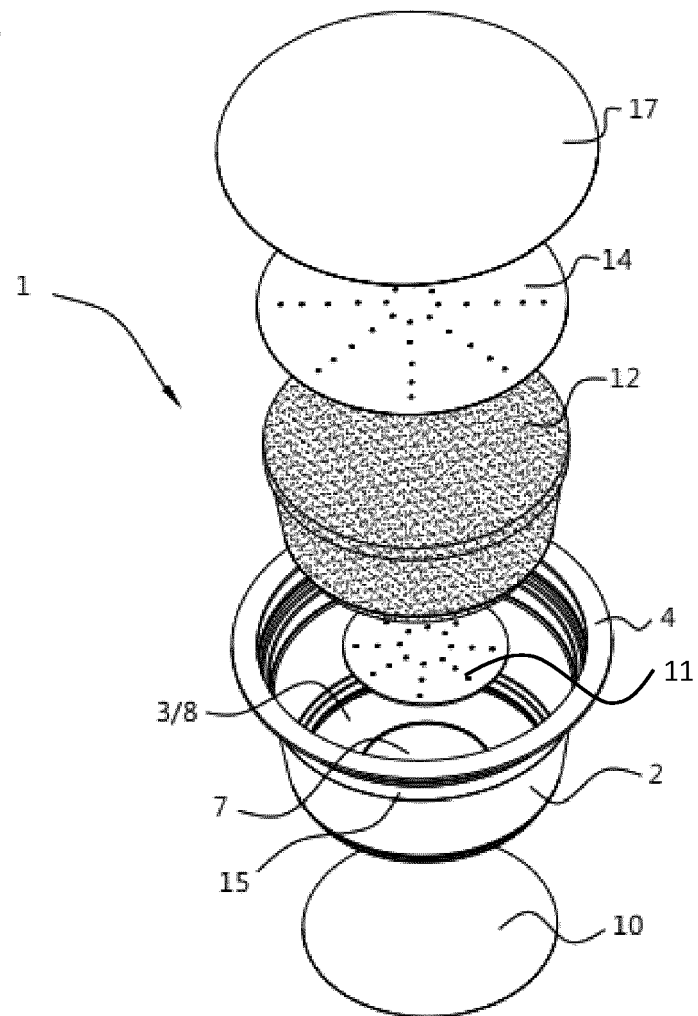


Fig. 2

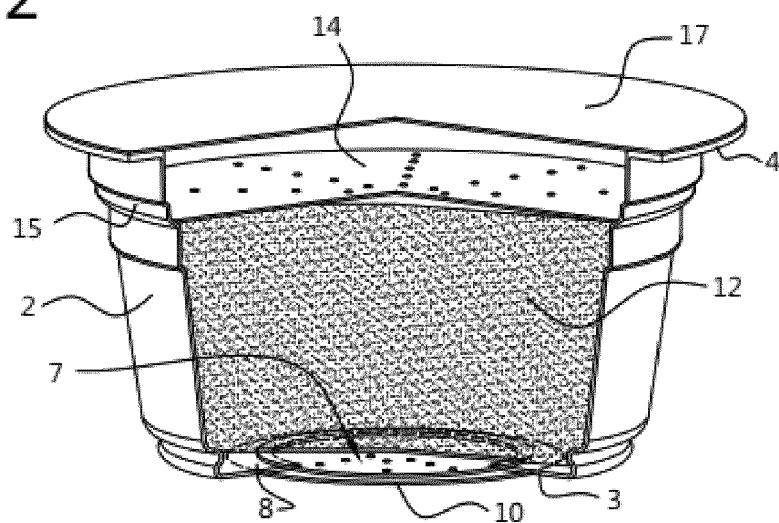


Fig. 3

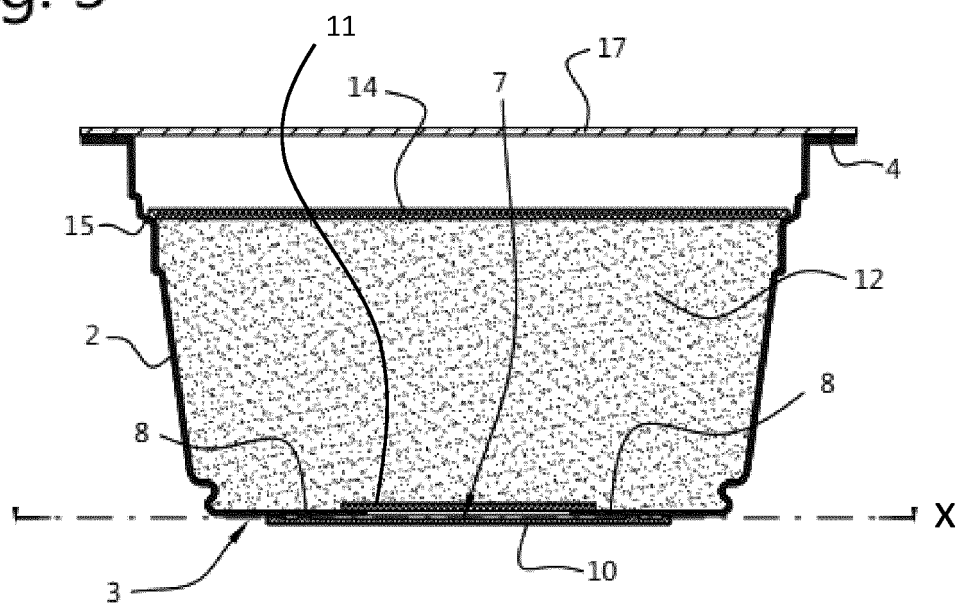


Fig. 4a

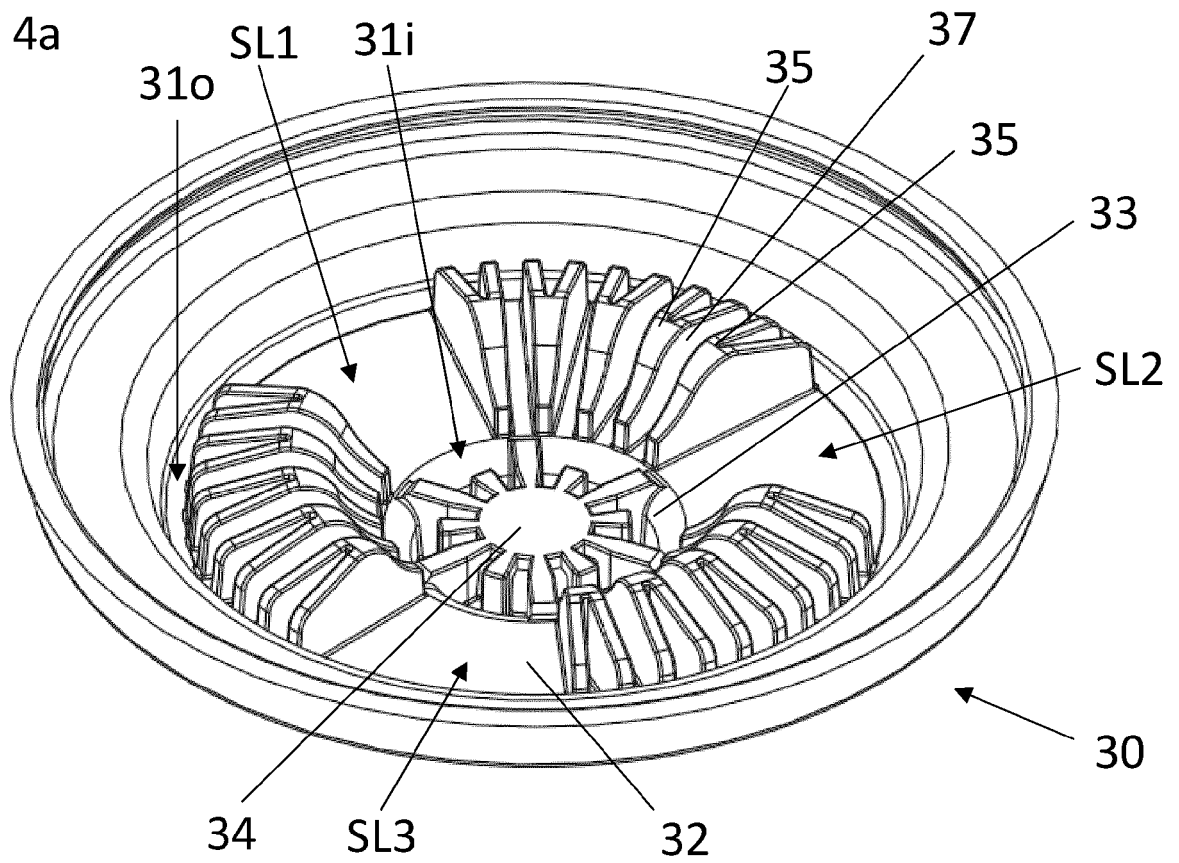


Fig. 4b

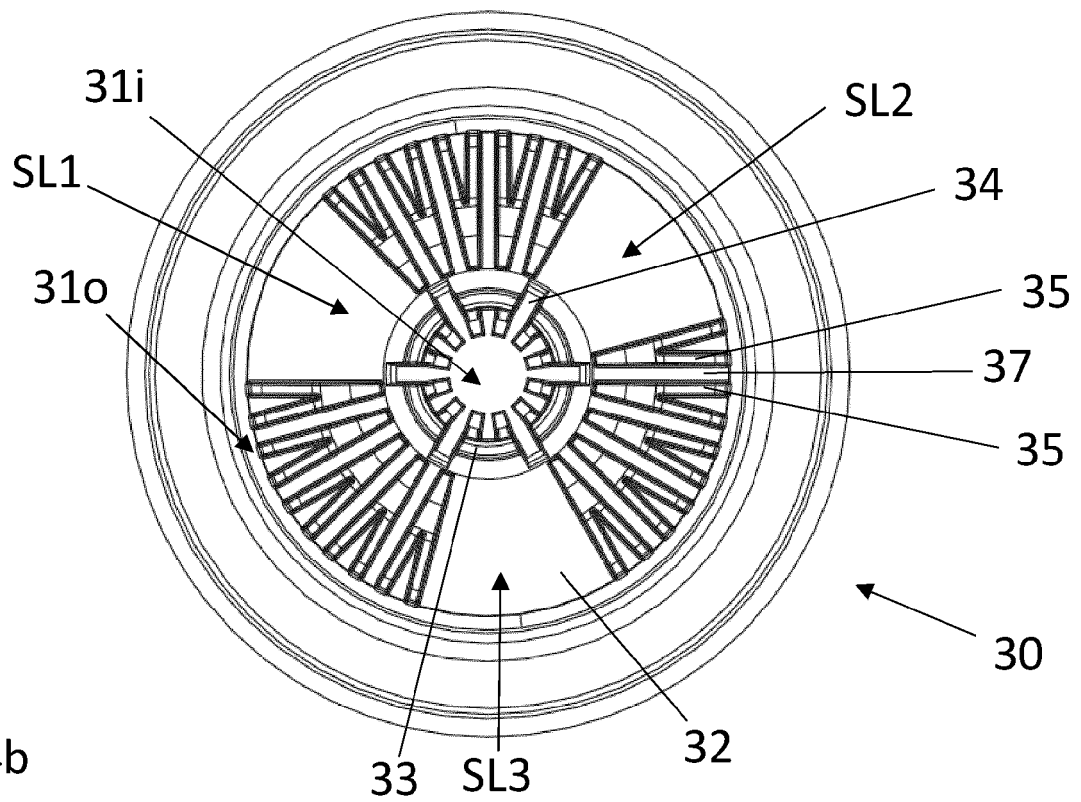


Fig. 5a

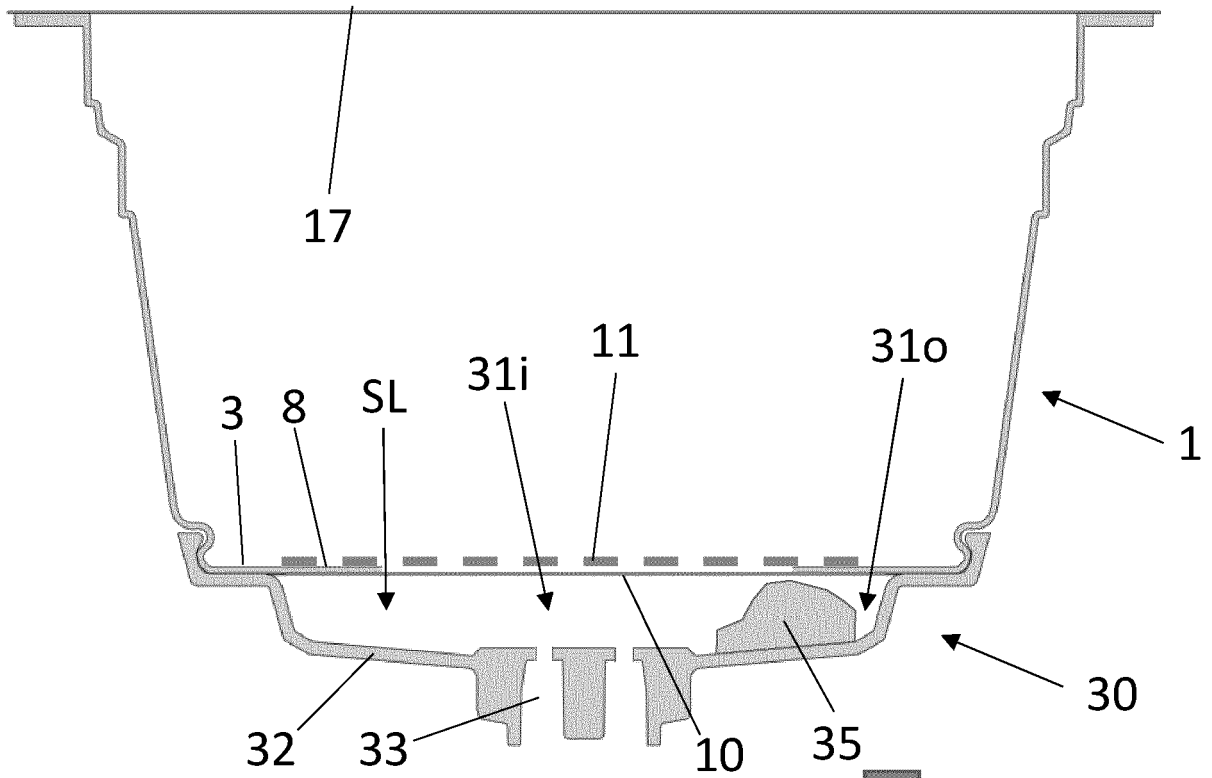


Fig. 5b

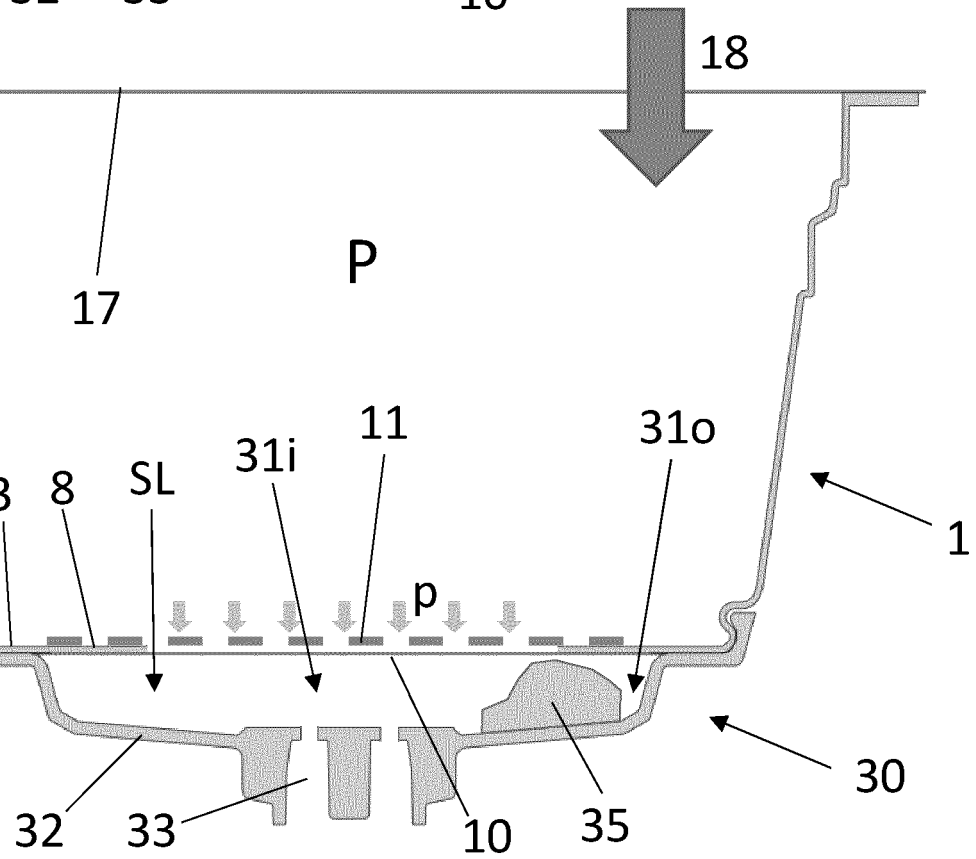


Fig. 5c

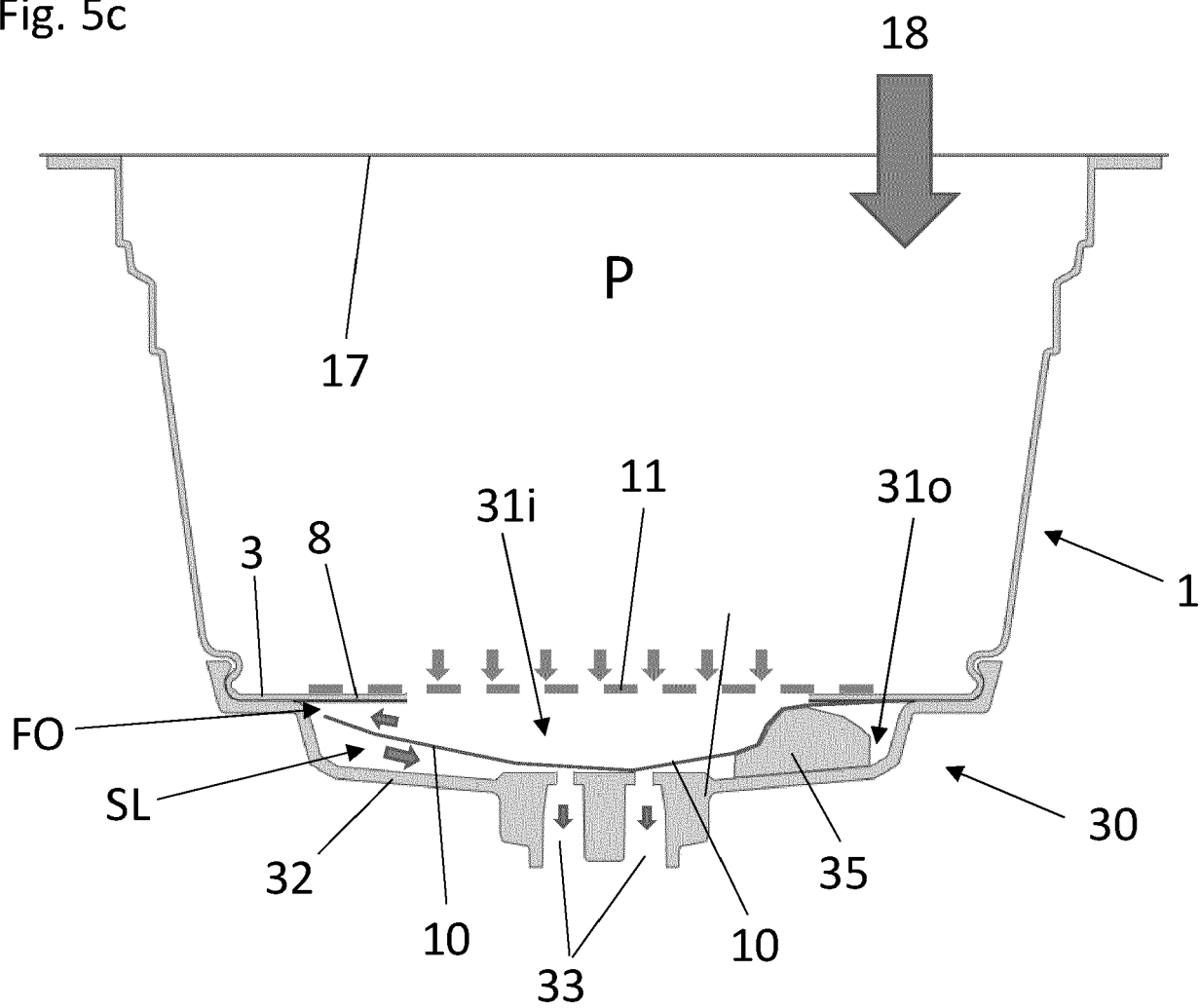


Fig. 6a

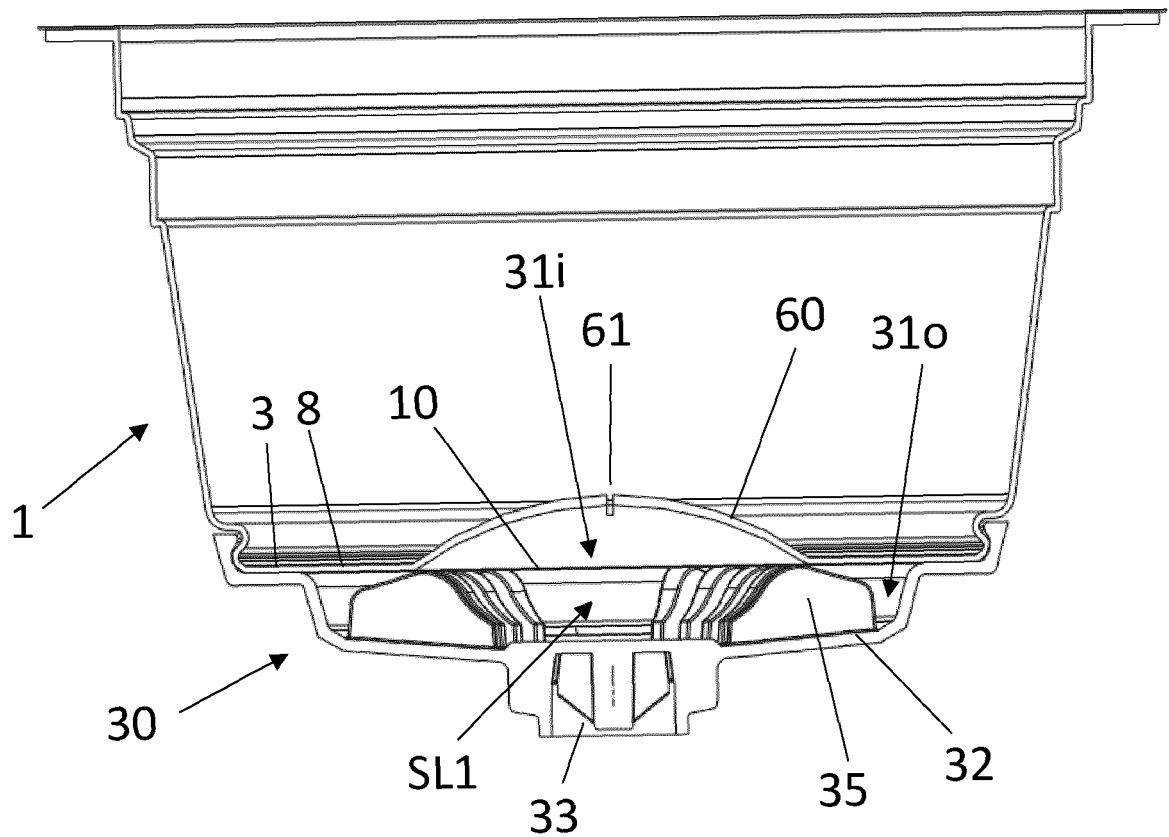
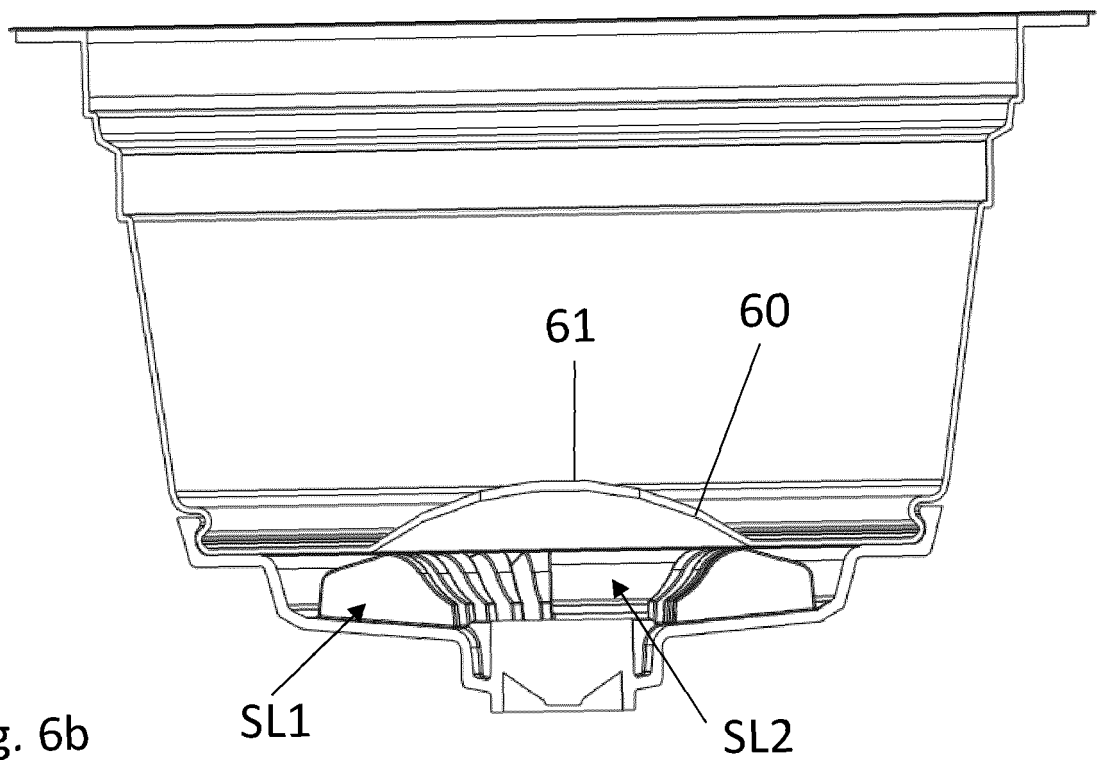


Fig. 6b



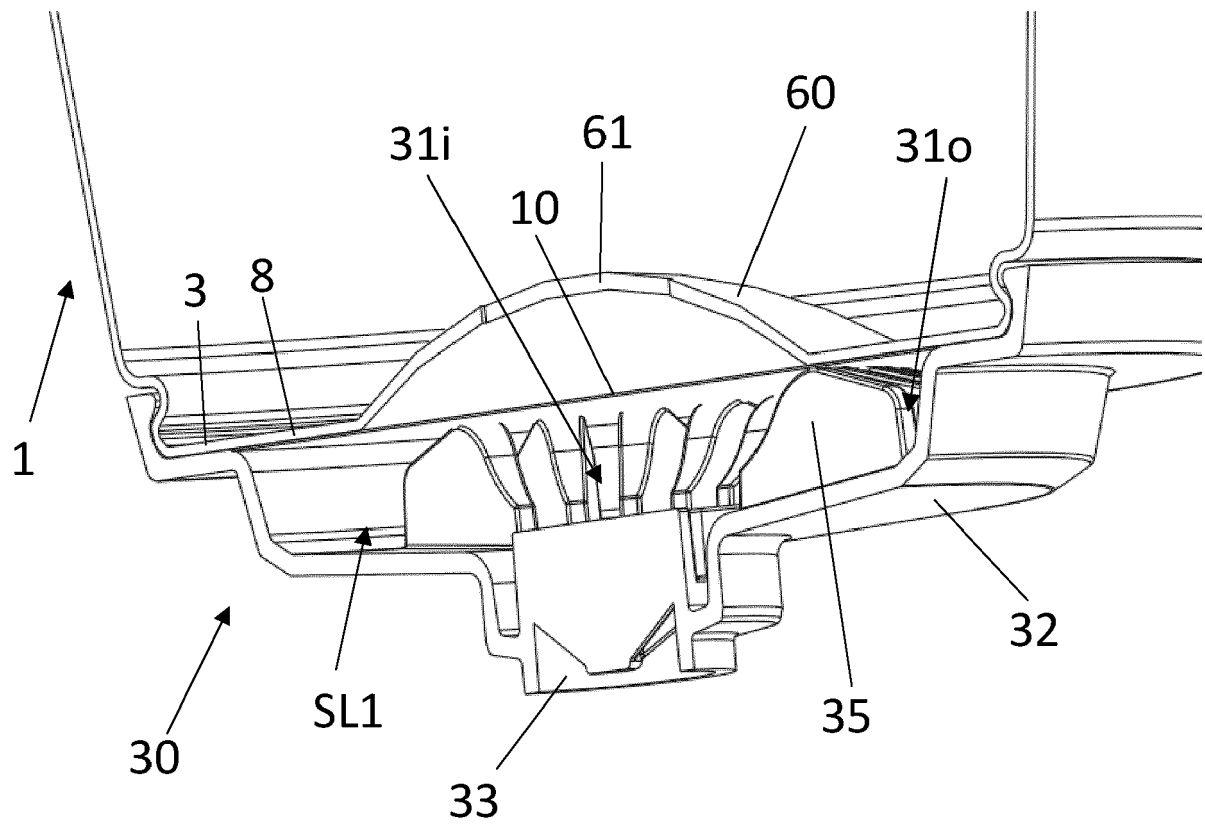


Fig. 6c

Fig. 7a

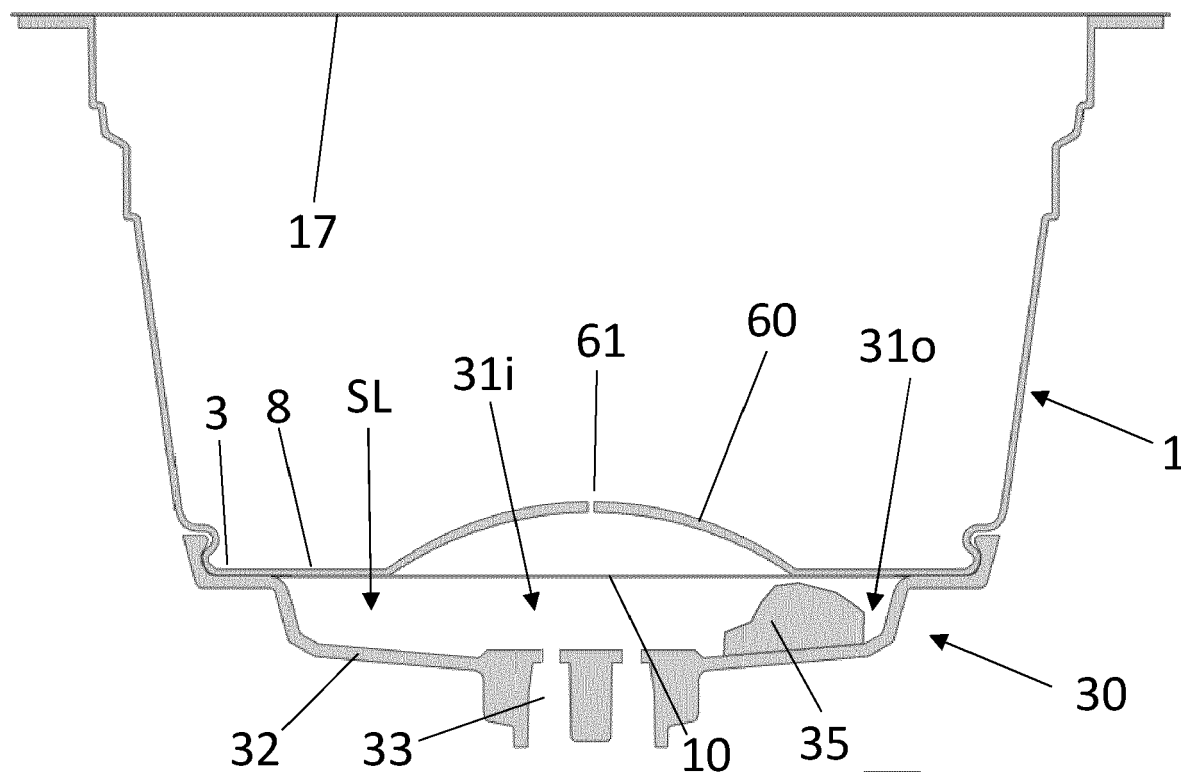


Fig. 7b

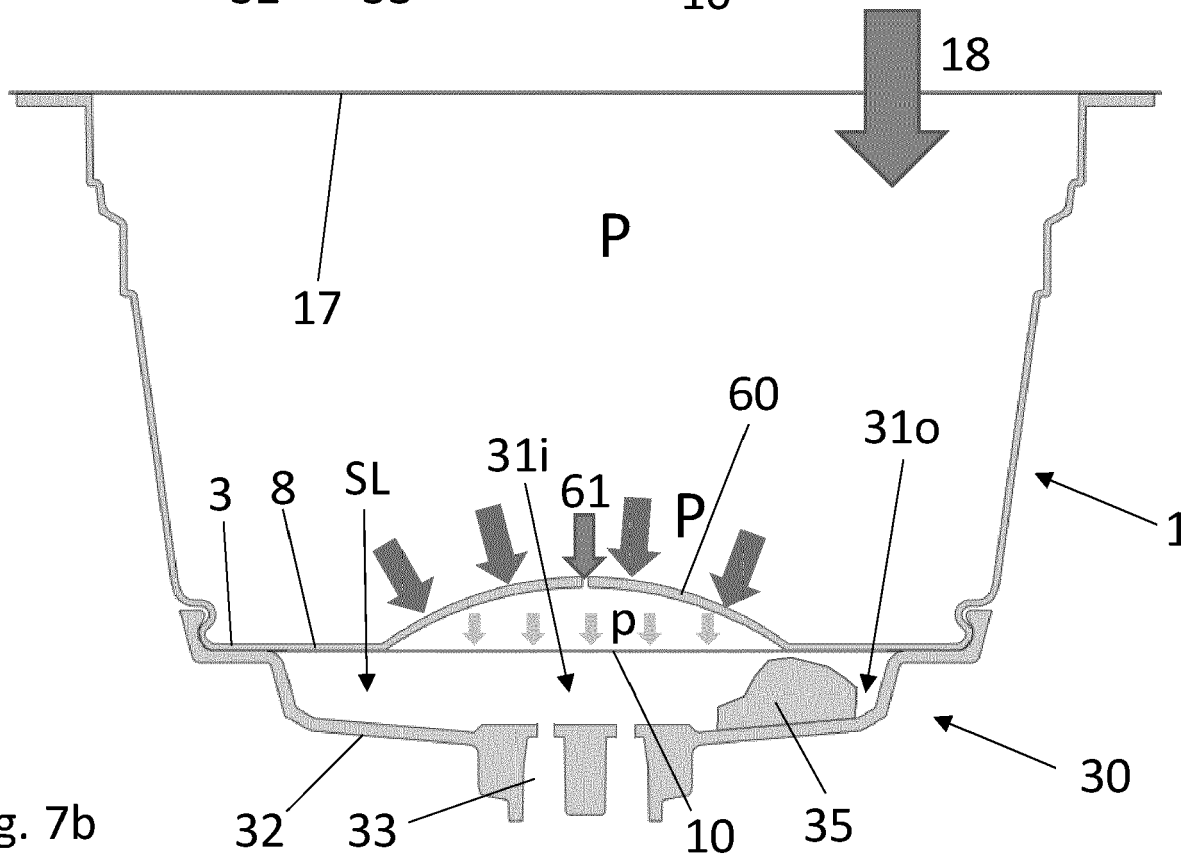
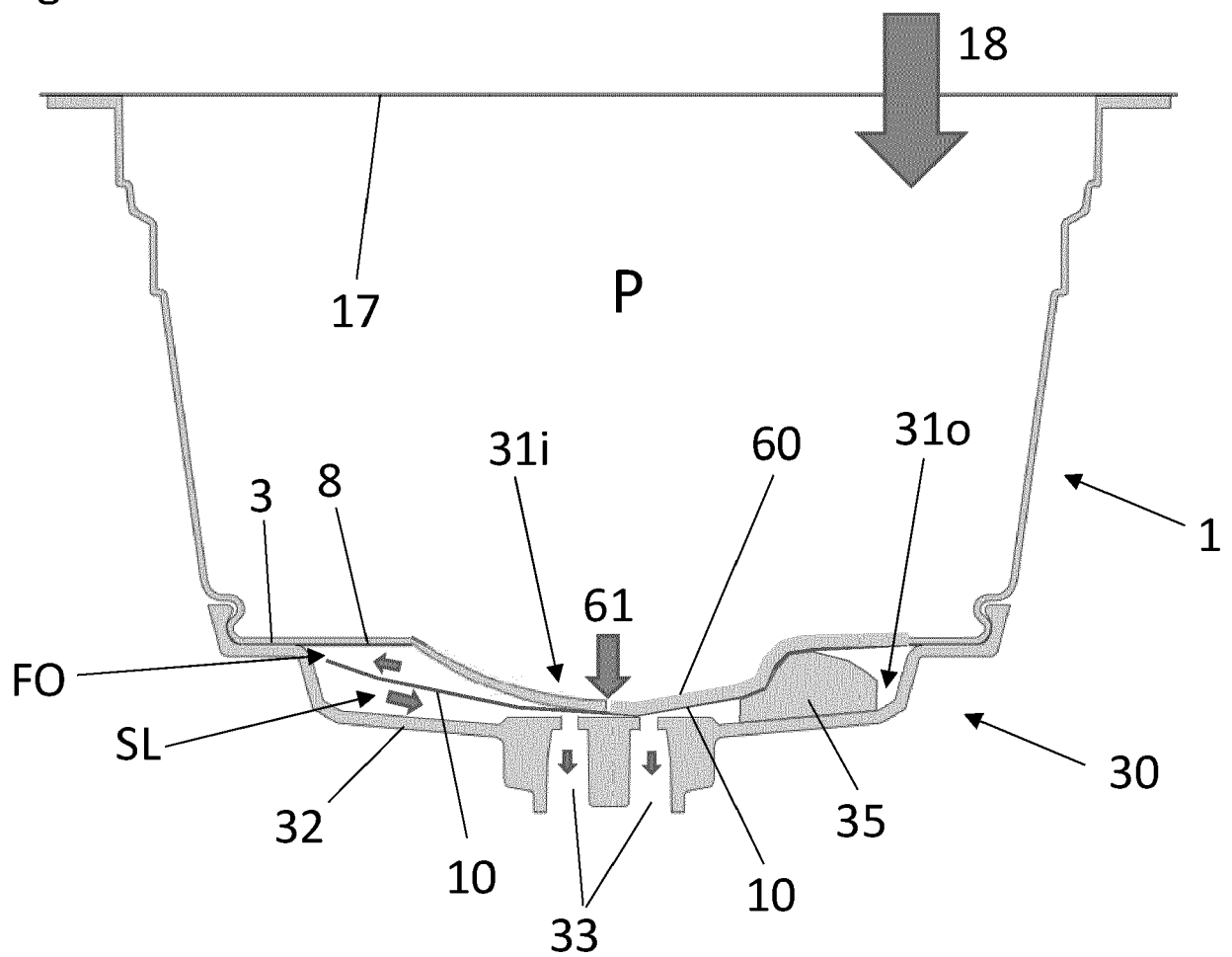


Fig. 7c





EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	WO 2020/089292 A1 (SAENTIS PACKAGING AG [CH]; EURO CAPS HOLDING B V [NL]) 7 May 2020 (2020-05-07) * page 14, paragraph 4 - page 29, paragraph 5; figures 1-20 *	1-14	INV. B65D85/804
A,D	WO 2016/193961 A2 (BISIO PROGETTI SPA [IT]) 8 December 2016 (2016-12-08) * paragraphs [0039] - [0083]; figures 1-15 *	1-14	
A,D	WO 2015/121882 A1 (BISIO PROGETTI SPA [IT]) 20 August 2015 (2015-08-20) * page 5, line 8 - page 8, line 8; figures 1-3b *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 February 2024	Examiner Leijten, René
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

16-02-2024

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REFERENCES CITED IN THE DESCRIPTION

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