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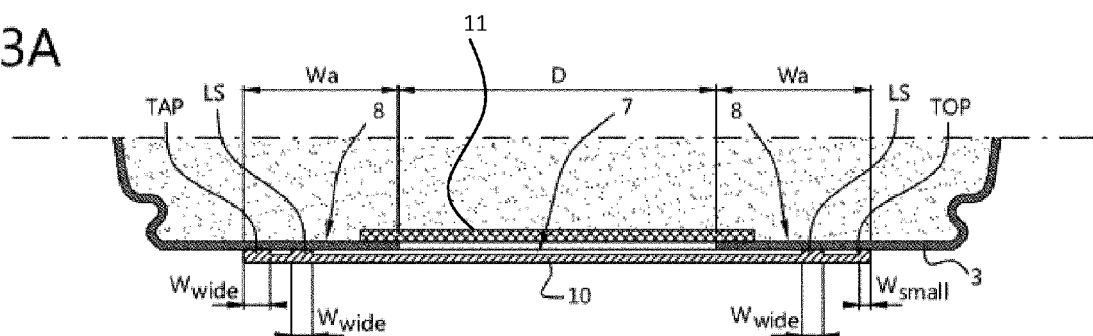
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**KH MA MD TN**(71) Applicant: **Euro-Caps Holding B.V.****3047 AL Rotterdam (NL)**(72) Inventor: **KAY, Anthony****8005 Cape Town (ZA)**(74) Representative: **EP&C****P.O. Box 3241****2280 GE Rijswijk (NL)**(30) Priority: **26.01.2022 NL 2030718**(54) **A CAPSULE WITH A TARGETED TO-REMAIN-ATTACHED PART AND A TARGETED TO-BE-OPENED PART OF A SEALING SEAM**

(57) A capsule with a cup-like capsule body (1) that comprises a base wall (3) having one or more passageways, and a barrier closing element (10) that is attached along a circumferentially closed sealing seam to an attachment portion (8) of the base wall (3). The sealing seam comprises a targeted to-remain-attached part (TAP) and a targeted to-be-opened part (TOP), wherein the targeted to-remain-attached part (TAP) is configured to remain intact and locally keep the barrier closing ele-

ment (10) attached to the attachment portion (8), and wherein the targeted to-be-opened part (TOP) is configured to open up and locally detach the barrier closing element (10) from the attachment portion (8) during pressurized liquid/steam entering the capsule, such that a controlled opened flow opening (FO) is formed between the barrier closing element (10) and the base wall (3) along the opened-up targeted to-be-opened part (TOP).

**Fig. 3A****EP 4 219 338 A1**

## 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, and having a for example frusto-conical 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]** 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.

**[0007]** A disadvantage herewith is that particularly for certain types of coffee or espresso to be brewed, and for which a filter disc needs to be provided on top of the base wall underneath the substance inside the capsule body, 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 brewed, per characteristics of the substance with which the capsule body is filled for this, like density of coffee grindings, 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.

**[0008]** 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

**[0009]** 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 also for those types of beverages that 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 brewed therewith for all kinds of different desired opening pressures and beverage outflow speeds.

**[0010]** 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 with a circumferential side wall, a transverse base wall at a bottom end of the side wall having one or more passageways, 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, and 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 one

or more passageways to close the capsule body at its bottom end. According to the inventive thought the circumferentially closed sealing seam along which the barrier closing element is attached to the attachment portion of the base wall comprises a targeted to-remain-attached part and a targeted to-be-opened part, wherein the targeted to-remain-attached part of the sealing seam is configured to remain intact and locally keep the barrier closing element attached to the attachment portion of the base wall during pressurized liquid/steam entering the capsule, and wherein the targeted to-be-opened part of the sealing seam is configured to open up and locally detach the barrier closing element from the attachment portion of the base wall during pressurized liquid/steam entering the capsule, such that a controlled opened flow opening is formed between the barrier closing element and the base wall along the opened-up targeted to-be-opened part of the sealing seam.

**[0011]** Thus advantageously a truly controlled opening process of the capsule body has become possible. 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. Furthermore, owing to the present invention it can now exactly be determined along which specific part 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 part of the sealing seam stays closed when this maximum pressure level inside the capsule body is reached. 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 what the exit speed/outflow rate of the brewed beverage through the thus controlled opened flow opening is going to be.

**[0012]** This makes it possible to, in dependence of the type of beverage to be brewed, select and incorporate exactly those controlled opening conditions, including maximum opening pressure level and exit speed/outflow rate, simply by changing parameters, like lengths and strengths, of the respective targeted opening and closure parts of the sealing seam.

**[0013]** Even for more difficult types of beverages to be brewed, and/or for which a filter disc needs to be provided on top of the base wall underneath the substance inside the capsule body, the capsule's functioning can now be optimally and reliably be fine-tuned. This incorporating of the selected maximum opening pressure level and flow opening size, can take place during the step of sealing the barrier closing element to the attachment portion of the base wall. For example, it is possible to use different types of heat seal heads with which the barrier closing element may get heat sealed to the attachment portion of the base wall. Each heat seal head can then be provided with a circumferentially closed two-part rib, of which the first part is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-be-

opened part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing, and of which the second part is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-remain-attached part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing. The capsule body's 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.

**[0014]** The controlled opening conditions can not only truly reliably be differed per specific type of beverage to be brewed, but also truly reliably be differed when certain characteristics of the substance with which the capsule body is filled, like density of coffee grindings, may change.

**[0015]** 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 one or more passageways. 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 one or more passageways.

**[0016]** In a preferred embodiment the targeted to-be-opened part of the sealing seam may have a cross-sectional width that is less than half a cross-sectional width of the targeted to-remain-attached part of the sealing seam. In particular, the targeted to-be-opened part of the sealing seam then may have a cross-sectional width of less than 1 mm, whereas the targeted closure part of the sealing seam then may have a cross-sectional width of more than 2 mm. By choosing the targeted to-be-opened part of the sealing seam relative small and the targeted to-remain-attached part of the sealing seam relative wide, the controlled opening reliably can take place within a wide range of different to be incorporated maximum opening pressures.

**[0017]** In a preferred further or alternative embodiment, the targeted to-be-opened part of the sealing seam 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 it is obtained that the controlled opened flow opening covers only such a limited angular part compared to the rest of the sealing seam that has remained closed that dripping of residual beverage out of the capsule after having been used may largely or entirely be prevented. This is obtained due to the fact that due to being pressurized the barrier closing element is prone to

sag in its center, and thus as soon as the injection pressure is taken away again, cause the barrier closing element to also along its controlled opened targeted to-be-opened part move back towards and against the attachment portion of the base wall again, and thus substantially close off the controlled opened flow opening again. Furthermore, due to its slight sagging, the barrier closing element is able to accumulate any residual beverage in its center.

**[0018]** In a preferred further or alternative embodiment the targeted to-be-opened part of the sealing seam may extend along a length in a circumferential direction of the circumferentially closed sealing seam of between 10-20 mm. Thus advantageously a controlled opened flow opening is created during brewing that an acceleration of the exit speed/outflow rate of brewed beverage may take place, which may help to create foam/crema on top of the brewed beverage.

**[0019]** In a preferred further or alternative embodiment the one or more passageways in the base wall may comprise a central throughgoing hole having a diameter of at least 10 mm, in particular about 18-20 mm. This is possible since an upwardly curved dome-shaped central flipping deformation portion is no longer required for the base wall. Instead this entire portion may now be left out. Thus advantageously a saving in capsule body material is obtained. Furthermore, the capsule body's internal volume is 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. This may help to prevent the pressure level inside the capsule body to accidentally rise above the aimed maximum opening pressure level.

**[0020]** In a preferred further or alternative embodiment the attachment portion of the base wall may be constructed 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 during manufacturing with its targeted to-be-opened part and targeted to-remain-attached part getting to extend exactly there where they are supposed to be, and with exactly those dimensions that are foreseen for them.

**[0021]** In a preferred further or alternative embodiment the attachment portion of the base wall has a width of at least 3 mm. Thus advantageously enough surface area is available for the targeted to-remain-attached part of the sealing seam to be made against it.

**[0022]** In a preferred further or alternative embodiment the capsule may furthermore comprise a bowl-like spout body that is connected to the base wall and/or bottom end of the side wall of the capsule body, wherein the spout body may have at least one receiving space and an outlet for the collecting and outflow of beverage that has entered into the receiving space via the controlled opened flow opening. Thus the barrier closing element can be connected against the lower outer side of the attachment portion of the base wall, while still lying in a pro-

tected area of the receiving space between the cup-like capsule body and the bowl-like spout body.

**[0023]** In addition thereto the spout body may comprise upwardly projecting supporting ribs at least underneath the one or more passageways, which supporting ribs are configured to support the barrier closing element during pressurized liquid/steam entering the capsule, and for that preferably extend upwards to substantially the level of the barrier closing element respectively base wall. Thus advantageously a damaging of the barrier closing element at that location is prevented, and a same advantage may go for a filter if used.

**[0024]** In addition thereto or in the alternative the spout body may have a circumferential space that is separated from the receiving space by a partition, wherein through-flow openings are provided in the partition, wherein the circumferential space lies directly underneath at least the targeted-to-be-opened part of the sealing seam. Thus advantageously the controlled opened flow opening is well able to connect to the circumferential space as soon as the controlled opened flow opening is formed between the barrier closing element and the base wall along the opened-up targeted to-be-opened part of the sealing seam.

**[0025]** In a preferred further or alternative embodiment the barrier closing element furthermore can be attached to the attachment portion of the base wall by means a number of labyrinth segments that are provided at locations that lie within the circumferentially closed sealing seam and that are configured to form a labyrinth-like flow path between the one or more passageways and the controlled opened flow opening, wherein the labyrinth segments are configured to remain intact and locally keep the barrier closing element attached to the attachment portion of the base wall during pressurized liquid/steam entering the capsule.

**[0026]** In addition to or in the alternative of using varying widths for the respective two different types of sealing seam parts, in particular smaller widths for the targeted-to-be-opened parts of the sealing seam and wider widths for the targeted-to-remain-attached parts of the sealing seam, it also is possible to use varying strengths for the respective two different types of sealing seam parts, in particular weaker strengths for the targeted-to-be-opened parts of the sealing seam and stronger strengths for the targeted-to-remain-attached parts of the sealing seam. By choosing the targeted to-be-opened part of the sealing seam relative weak and the targeted to-remain-attached part of the sealing seam relative strong, the controlled opening reliably can take place within a wide range of different to be incorporated maximum opening pressures. In a preferred embodiment the targeted to-be-opened part of the sealing seam then may have a strength that is less than half a strength of the targeted to-remain-attached part of the sealing seam.

**[0027]** For example, the targeted to-remain-attached parts of the sealing seam then can be formed with relative high strength due to locally using relative high sealing

temperatures, whereas the targeted-to-be-opened parts of the sealing seam then can be formed with relative low strength due to locally using relative low sealing temperatures. For this, it is possible to use a heat seal head with which the barrier closing element may get heat sealed to the attachment portion of the base wall, which heat seal head then can be provided with a circumferentially closed two-part rib, of which the first part is heated in a controlled manner to said relative low sealing temperature corresponding to the weaker targeted to-be-opened part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing, and of which the second part is heated in a controlled manner to said relative high sealing temperature corresponding to the stronger targeted to-remain-attached part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing. The capsule body's 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.

**[0028]** In another example, the targeted to-remain-attached parts of the sealing seam then can be formed with relative high strength due to locally using relative long sealing times, whereas the targeted-to-be-opened parts of the sealing seam then can be formed with relative low strength due to locally using relative short sealing times. For this, it is possible to use a heat seal head with which the barrier closing element may get heat sealed to the attachment portion of the base wall, which heat seal head then can be provided with a circumferentially closed two-part rib, of which the first part is heated in a controlled manner during said relative short sealing times corresponding to the weaker targeted to-be-opened part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing, and of which the second part is heated in a controlled manner during said relative long sealing times corresponding to the stronger targeted to-remain-attached part of the sealing seam to be formed between the barrier closing element and the attachment portion of the base wall by means of heat sealing. The capsule body's 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.

**[0029]** In yet another example, the targeted to-remain-attached parts of the sealing seam then can be formed with relative high strength due to locally treating the sealing seam with strength increasing coating, and/or the targeted-to-be-opened parts of the sealing seam then can be formed with relative low strength due to locally treating the sealing seam with a strength reducing coating.

**[0030]** The invention also relates to a method for manufacturing the capsule according to claim 14 or 15.

**[0031]** Further preferred embodiments of the invention are stated in the dependent subclaims.

## DETAILED DESCRIPTION OF THE DRAWINGS

**[0032]** 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 a first embodiment of a capsule body according to the invention;
- 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. 3a shows an enlarged partial view of fig. 3;
- Fig. 4 shows a bottom view of fig. 2 with heat-sealed targeted to-be-opened resp. to-remain-attached parts and to-remain-attached labyrinth segments indicated with dashed lines;
- Fig. 5 is a view over the line V-V in fig. 3 through the heat-sealed targeted to-be-opened resp. to-remain-attached parts and to-remain-attached labyrinth segments;
- Fig. 6 shows the view of fig. 3 in a controlled opened state during brewing;
- Fig. 6a shows an enlarged partial view of fig. 6;
- Fig. 7 shows a perspective view of a seal-head for making the heat-sealed targeted to-be-opened resp. to-remain-attached parts and to-remain-attached labyrinth segments;
- Fig. 8 shows a perspective view of a spout body;
- Fig. 9 and 10 show the views of fig. 3 and 6 with the spout body connected to the capsule body;
- Fig. 11 and 12 show enlarged partial views of fig. 9 and 10;
- Fig. 13 shows a cross-section of a second embodiment of a capsule body according to the invention in a filled closed state;
- Fig. 13a shows an enlarged partial view of fig. 13;
- Fig. 14 shows a bottom view of fig. 13 with heat-sealed targeted to-be-opened resp. to-remain-attached parts indicated with dashed lines;
- Fig. 15 is a view over the line XV-XV in fig. 13 through the heat-sealed targeted to-be-opened resp. to-remain-attached parts;
- Fig. 16 shows the view of fig. 13 in a controlled opened state during brewing;
- Fig. 16a shows an enlarged partial view of fig. 16;
- Fig. 17 and 18 show the views of fig. 13 and 16 with the spout body connected to the capsule body;
- Fig. 19 shows a perspective view of a seal-head for making the heat-sealed targeted to-be-opened resp. to-remain-attached parts; and
- Fig. 20 and 21 show enlarged partial views of fig. 17 and 18.

**[0033]** In fig. 1-6 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.

**[0034]** The base wall 3 is flat, extends in a transverse vertical direction and is provided with a large central throughgoing hole 7. The part of the flat base wall 3 that directly circumvents the hole 7 is referred to as attachment portion 8.

**[0035]** 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.

**[0036]** 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 18 (see fig. 6) pierced through it at a start of a beverage production.

**[0037]** According to the invention, the barrier closing element 10 in the first place is attached along a specific type of circumferentially closed sealing seam to the attachment portion 8 of the base wall 3 that lies around the hole 7. This specific type of circumferentially closed sealing seam comprises a targeted to-remain-attached part TAP and a targeted to-be-opened part TOP.

**[0038]** The targeted to-remain-attached part TAP of the sealing seam 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.

**[0039]** The targeted to-be-opened part TOP of the sealing seam is configured to open up and locally detach the barrier closing element 10 from the attachment portion 8 of the base wall 3, not during transport and storage, but more importantly 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.

**[0040]** According to an aspect of the invention, the barrier closing element 10 in the second place is also attached by means of a plurality of labyrinth segments LS to the attachment portion 8 of the base wall 3 that lies

around the hole 7. Those labyrinth segments LS are configured to delimit meandering labyrinth-like flow paths between them, along portions of the barrier closing element 10 that are not-attached to the attachment portion 8 of the base wall 3. For that, the labyrinth segments LS are provided interspaced at locations that lie within the circumferentially closed sealing seam.

**[0041]** Like the targeted-to-remain-attached part TAP of the sealing seam, the labyrinth segments LS are also 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 the beverage in the beverage production machine, the brewing pressure P inside the capsule body 1 quickly starts to rise.

**[0042]** In order to achieve this double effect of on the one hand targeted opening and on the other hand targeted remaining attached, it is foreseen that the targeted-to-be-opened part TOP of the sealing seam has a relative small vulnerable cross-sectional width W<sub>small</sub> in a radial direction, here less than 1mm, to be more precise about 0.8 mm, whereas the targeted-to-remain-attached part TAP of the sealing seam as well as the labyrinth segments LS have a relative wide robust cross-sectional width W<sub>wide</sub> in the radial direction, here more than 2 mm, to be more precise about 3 mm.

**[0043]** The targeted-to-be-opened part TOP of the sealing seam extends along a relative small segment of the circumferentially closed sealing seam, here about 12,5 %. This corresponds to an arc section that here has an angle  $\alpha$  of about 45 degrees. The targeted-to-remain-attached part TAP of the sealing seam covers the rest of the sealing seam.

**[0044]** Furthermore, the targeted-to-be-opened part TOP of the sealing seam is provided at such a radius that it gets to extend along a length in the circumferential direction of the circumferentially closed sealing seam of between 10-20 mm.

**[0045]** The hole 7 has a relative large diameter D. The ring-shaped attachment portion 8 has a width W<sub>a</sub> in radial direction that is wide enough for the sealing seam and spaced apart labyrinth segments LS to be attached thereto, here at least 5 times the cross-sectional width W<sub>wide</sub> of the targeted-to-remain-attached part TAP of the sealing seam resp. the labyrinth segments LS.

**[0046]** Those specific relative dimensions and relative positions in combination, has the advantageous effect that, during pressurized liquid/steam entering the capsule, only the targeted-to-be opened part TOP gets quickly and easily opened up at its bottom side in a truly controlled manner for automatically forming a controlled opened flow opening FO, whereas a plurality of meandering flow paths towards this controlled opened flow opening FO is automatically maintained between the barrier closing element 10 and the base wall 3.

**[0047]** In fig. 6 this controlled opening during beverage production is shown. There it can be seen that the liq-

uid/steam injection element 18 (see fig. 6) has been pierced through the top closing element 17 and has started injecting hot water into the free injection space between the distribution disc 14 and the top closing element 17. From there, the injected hot water spreads out over the distribution disc 14, flows through the perforations therein to penetrate the entire badge of substance 12. The brewing pressure P inside the capsule body 1 then quickly starts to rise. This brewing pressure P also exerts an increasing force onto the barrier closing element 10 via the big already open hole 7. This shall force the targeted-to-be-opened part TOP of the sealing seam to detach and there form the flow opening FO.

**[0048]** Brewed beverage then shall start flowing through the filter disc 11, through the hole 7, along the labyrinth-like flow paths between the labyrinth segments S, the barrier closing element 10 and the base wall 3, and leave the capsule body 1 via the opened-up flow opening FO. Due to this outflow of brewed beverage, the brewing pressure P shall no longer be able to quickly rise further, maybe even drop somewhat, and stabilize at a brewing pressure that corresponds to just that type of beverage that needs to get brewed and that is certainly not high enough for the targeted-to-remain-attached part TAP of the sealing seam and/or the labyrinth segments LS to also start detaching from the base wall 3.

**[0049]** 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.

**[0050]** The limited space between the barrier closing element 10 and the base wall 3, in combination with the labyrinth-like flow path between the labyrinth segments LS, and combined with 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.

**[0051]** 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 20. As soon as this ends, the targeted opened-up part TOP of the barrier closing element 10, shall no longer be pressed downwards, and instead have freedom to move back upwards to substantially come to lie against the base wall 3 again. Thus, an undesired dripping of beverage out of the capsule body 1 after the beverage production has already stopped, is prevented.

**[0052]** In fig. 7 a heat seal head 25 is shown that can be used to heat-seal the barrier closing element 10, here formed by a multi-layer foil, against the attachment portion 8 of the base wall 3. For that the heat seal head 25 is provided with a circumferentially closed two-part rib, of which a first part 25<sub>top</sub> is dimensioned in terms of length and cross-sectional width corresponding to the

targeted to-be-opened part TOP of the sealing seam, of which a second part 25tap is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-remain-attached part TAP of the sealing seam, and of which third parts 25ls are dimensioned in terms of length and cross-sectional width corresponding to the targeted to-remain-attached labyrinth segments LS.

**[0053]** By pre-heating the heat seal head 25 and then pressing the barrier closing element 10 therewith against the attachment portion 8 of the base wall 3 of the capsule body 1, the barrier closing element 10 gets sealingly attached to the base wall 3 along the foreseen pattern.

**[0054]** In fig. 8 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. 9 and 10. The spout body 30 encloses the entire base wall 3, including the barrier closing element 10 attached thereto. 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.

**[0055]** A plurality of radially outer and radially inner supporting ribs 35, 36 are provided that form an integral part of the spout body 30. The radially outer supporting ribs 35 are positioned underneath the attachment portion 8 of the base wall 3 of the capsule body 1, whereas the radially inner supporting ribs 36 are positioned underneath the hole 7 in the base wall 3 of the capsule body 1.

**[0056]** Radially inner parts of the outer supporting ribs 35 are configured such high that, in the situation that the spout body 30 is connected to the capsule body 1, they lie against and support the barrier closing element 10 underneath that radially inner section of the attachment portion 8 where the barrier closing element 10 is not attached to the base wall 3, both before, during and after pressurized liquid/steam entering the capsule. Radially outer parts of the outer supporting ribs 35 are configured such low that, in the situation that the spout body 30 is connected to the capsule body 1, they lie spaced from the barrier closing element 10 underneath that radially outer section of the attachment portion 8 where the barrier closing element 10 is attached to the base wall 3 along the sealing seam, both before, during and after pressurized liquid/steam entering the capsule. Thus the targeted to-be-opened part TOP of the sealing seam has freedom to be pressed open by the pressure P and form the controlled opened flow opening FO.

**[0057]** The outer supporting ribs 35 are positioned spaced apart and thus form a partition with throughflow openings that extends between an outer gutter-type chamber 31o and an inner central collection chamber 31i of the receiving space 31.

**[0058]** The inner supporting ribs 36 are configured such high that, in the situation that the spout body 30 is connected to the capsule body 1, they lie against and support the barrier closing element 10 underneath where

it spans the hole 7 in the base wall 3, both before, during and after pressurized liquid/steam entering the capsule. Thus the barrier closing element 10 and the center part of the filter disc 11 that rests on top of it, are prevented from sagging through.

**[0059]** Together, the outer and inner supporting ribs 35, 36 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.

**[0060]** In fig. 13-21 a second embodiment is shown in which same parts can be given same reference numerals and letters. This second embodiment differs from the first in that the barrier closing element 10 has now only been attached by means of heat sealing along the two-part circumferentially closed sealing seam with its targeted to-remain-attached part TAP and its targeted to-be-opened part TOP to the attachment portion 8 of the base wall 3 that lies around the hole 7. This requires a smaller width Wa' attachment portion 8, and has made it possible to equip the base wall 3 with a larger diameter D' hole 7, which in turn may enlarge the free filtering surface area of the filter disc 11 above the hole 7.

**[0061]** In fig. 19 a heat seal head 25' is shown that can be used to heat-seal the barrier closing element 10 against the attachment portion 8 of the base wall 3. The heat seal head 25' now is only provided with the circumferentially closed two-part rib, of which the first part 25top is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-be-opened part TOP of the sealing seam, and of which the second part 25tap is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-remain-attached part TAP of the sealing seam.

**[0062]** Thus, during manufacturing, that specific type of heat sealing head 25 or 25' or any other type of sealing head can be selected for heat sealing the barrier closing element 10 against the base wall 3 of 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, etc., each requiring their own controlled opening pressure, filter area, passageway, meandering flow path restrictions, flow opening restriction, outflow speed, etc.

**[0063]** 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, as long as they get to form one or more targeted to-remain-attached parts and one or more targeted to-be-opened

parts that together 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. Instead of using an assembly of a capsule body and a spout body, it is also possible to merely use a capsule body. Then also the targeted to-remain-attached and to-be-opened parts can give the capsule its controlled opening provision. For certain types of substance the filter disc and/or distribution disc can be dispensed with. Instead of the entire two-part sealing seam forming a circumferentially closed circle, other circumferential shapes are also possible around the hole.

**[0064]** 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 comprises:
  - a circumferential side wall (2);
  - a transverse base wall (3) at a bottom end of the side wall (2) having one or more passageways; 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; and
- 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 one or more passageways to close the capsule body (1) at its bottom end,

### characterized in that,

the circumferentially closed sealing seam along which the barrier closing element (10) is attached to the attachment portion (8) of the base wall (3) com-

prises a targeted to-remain-attached part (TAP) and a targeted to-be-opened part (TOP),

wherein the targeted to-remain-attached part (TAP) of the sealing seam is configured to remain intact and locally keep the barrier closing element (10) attached to the attachment portion (8) of the base wall (3) during pressurized liquid/steam entering the capsule, and wherein the targeted to-be-opened part (TOP) of the sealing seam is configured to open up and locally detach the barrier closing element (10) from the attachment portion (8) of the base wall (3) during pressurized liquid/steam entering the capsule, such that a controlled opened flow opening (FO) is formed between the barrier closing element (10) and the base wall (3) along the opened-up targeted to-be-opened part (TOP) of the sealing seam.

2. The capsule according to claim 1, wherein the targeted to-be-opened part (TOP) of the sealing seam has a cross-sectional width ( $W_{small}$ ) that is less than half a cross-sectional width ( $W_{wide}$ ) of the targeted to-remain-attached part (TAP) of the sealing seam.
3. The capsule according to claim 2, wherein the targeted to-be-opened part (TOP) of the sealing seam has a cross-sectional width ( $W_{small}$ ) of less than 1 mm, and wherein the targeted closure part (TAP) of the sealing seam has a cross-sectional width ( $W_{wide}$ ) of more than 2 mm.
4. The capsule according to one of the preceding claims, wherein the targeted to-be-opened part (TOP) of the sealing seam extends along less than 25% of the circumferentially closed sealing seam, in particular about 12.5% of the circumferentially closed sealing seam.
5. The capsule according to one of the preceding claims, wherein the targeted to-be-opened part (TOP) of the sealing seam extends along a length in a circumferential direction of the circumferentially closed sealing seam of between 10-20 mm.
6. The capsule according to one of the preceding claims, wherein the one or more passageways in the base wall (3) comprise a central throughgoing hole (7) having a diameter of at least 10 mm, in particular about 18-20 mm.
7. The capsule according to claim 6, wherein the attachment portion (8) of the base wall (3) directly circumvents and delimits the central throughgoing hole (7).
8. The capsule according to one of the preceding

claims, wherein the attachment portion (8) of the base wall (3) is flat and together with the barrier closing element (10) attached thereto extends in a transverse direction.

9. The capsule according to one of the preceding claims, wherein the attachment portion (8) of the base wall (3) has a width (Wa) of at least 3 mm.

10. The capsule according to one of the preceding claims, furthermore comprising:

- 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 has entered into the receiving space (31) via the controlled opened flow opening (FO).

11. Capsule according to claim 10, wherein the spout body (30) comprises upwardly projecting supporting ribs (36) at least underneath the one or more passageways that are configured to support the barrier closing element (10) during pressurized liquid/steam entering the capsule.

12. Capsule according to claim 10 or 11, wherein the spout body (30) has a partition that separates a gutter-type chamber (31o) and a central collection chamber (31i) of the receiving space (31), wherein throughflow openings are provided in the partition, wherein the gutter-type chamber (31o) of the receiving space (31) lies directly underneath at least the targeted to-be-opened part (TOP) of the sealing seam.

13. The capsule according to one of the preceding claims, wherein the barrier closing element (10) furthermore is attached to the attachment portion (8) of the base wall (3) by means of a number of labyrinth segments (LS) that are provided at locations that lie within the circumferentially closed sealing seam and that are configured to form a labyrinth-like flow path between the one or more passageways and the controlled opened flow opening (FO), wherein the labyrinth segments (LS) are configured to remain intact and locally keep the barrier closing element (10) attached to the attachment portion (8) of the base wall (3) during pressurized liquid/steam entering the capsule.

14. A method for manufacturing the capsule according to one of the preceding claims, comprising the steps of:

- providing the cup-like capsule body (1);

- attaching the barrier closing element along the circumferentially closed sealing seam to the attachment portion (8) of the base wall (3);
- filling the capsule body (1) with a type of substance (12) that is selected for a corresponding type of beverage to be brewed; and
- securing the top closing element (17) to the flange (4) to close the capsule body (1) at its upper end,

**characterized in that,**

the step of attaching the barrier closing element (10) along the circumferentially closed sealing seam to the attachment portion (8) of the base wall (3), is performed with a heat seal head (25), wherein the seal head (25) is provided with a circumferentially closed two-part rib, of which the first part (25top) is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-be-opened part (TOP) of the sealing seam to be formed between the barrier closing element (10) and the attachment portion (8) of the base wall (3), and of which the second part (25tap) is dimensioned in terms of length and cross-sectional width corresponding to the targeted to-remain-attached part (TAP) of the sealing seam to be formed between the barrier closing element (10) and the attachment portion (8) of the base wall (3).

15. Method according to claim 14, further comprising the steps of:

- providing a set of different heat sealing heads (25; 25'), one for each type of controlled opening conditions that are determined in dependence of types of beverages to be brewed, and for that each have different dimensioned first and second parts (25top, 25tap; 25top', 25tap') in terms of lengths and cross-sectional widths; and
- selecting that heat sealing head (25; 25') that corresponds to the required controlled opening conditions for a type of beverage that is to be brewed with the capsule.

Fig. 1

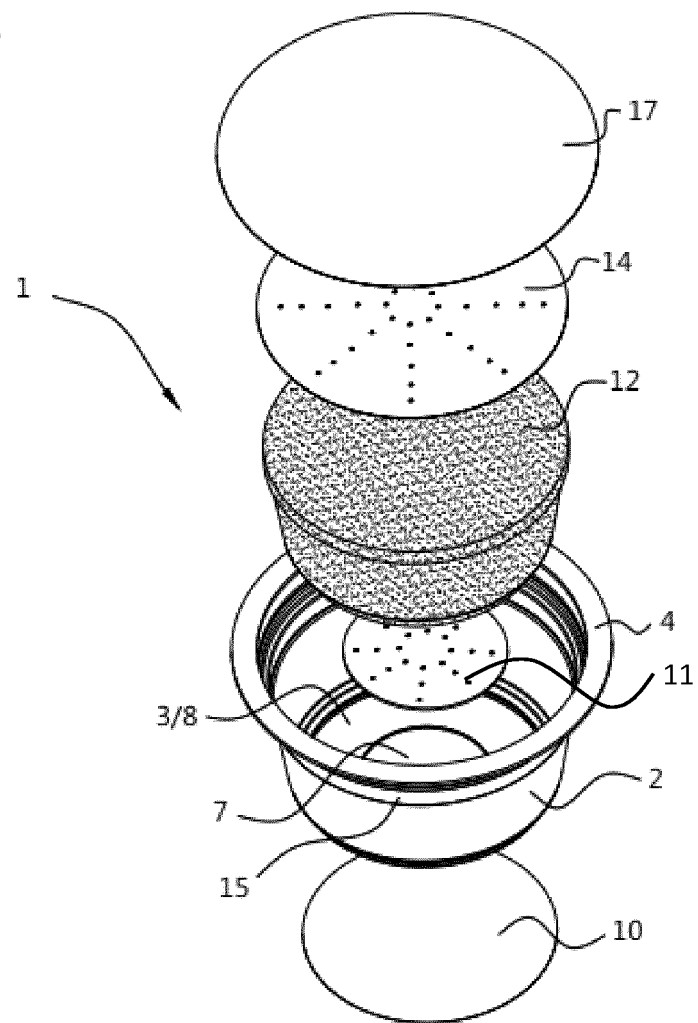


Fig. 2

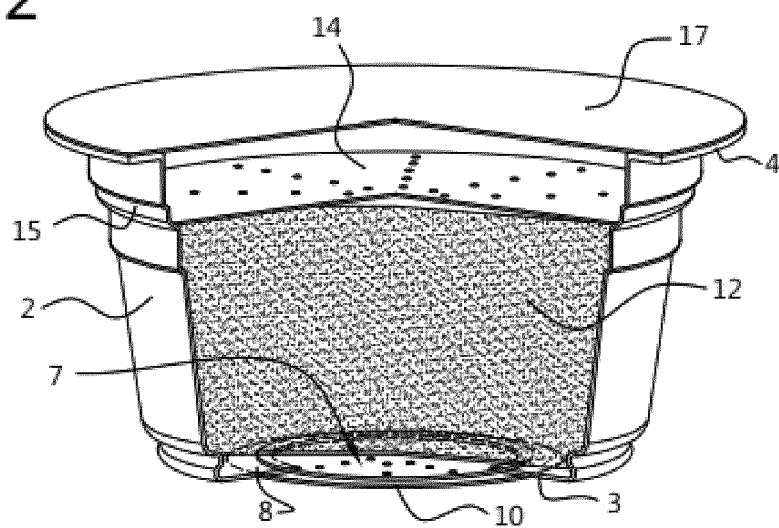


Fig. 3

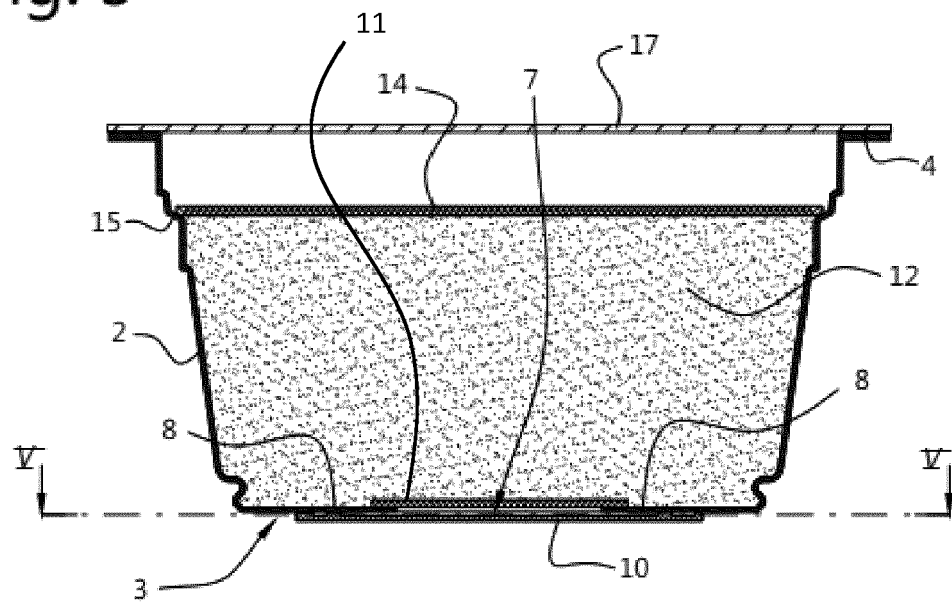
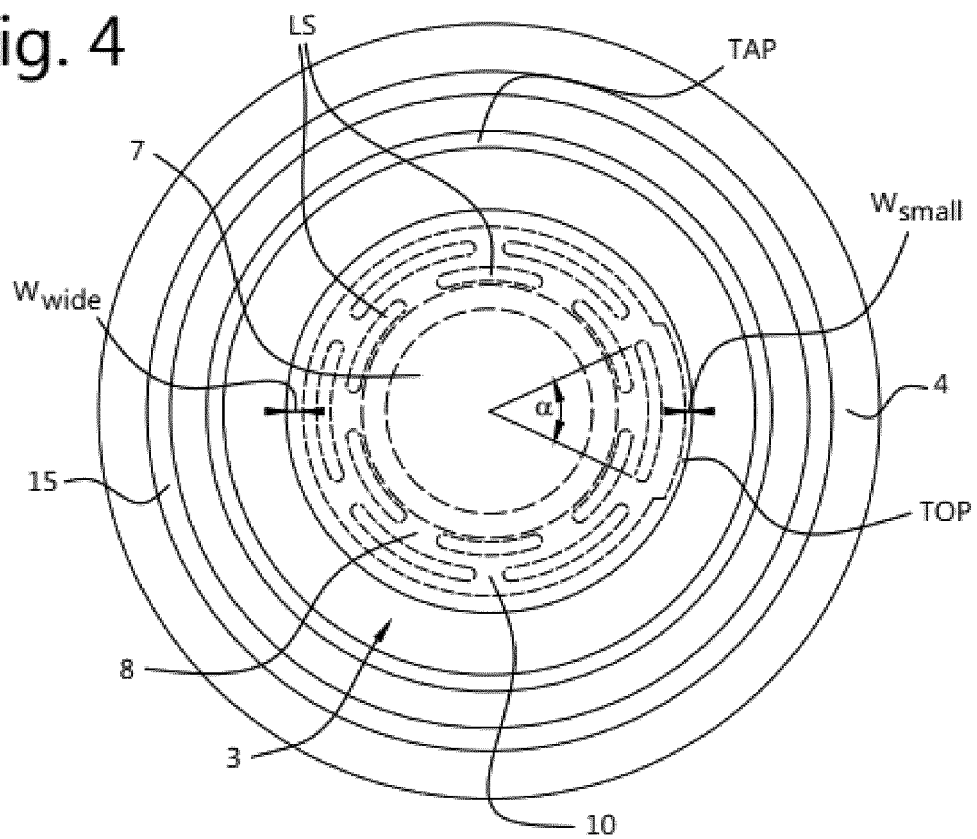


Fig. 4



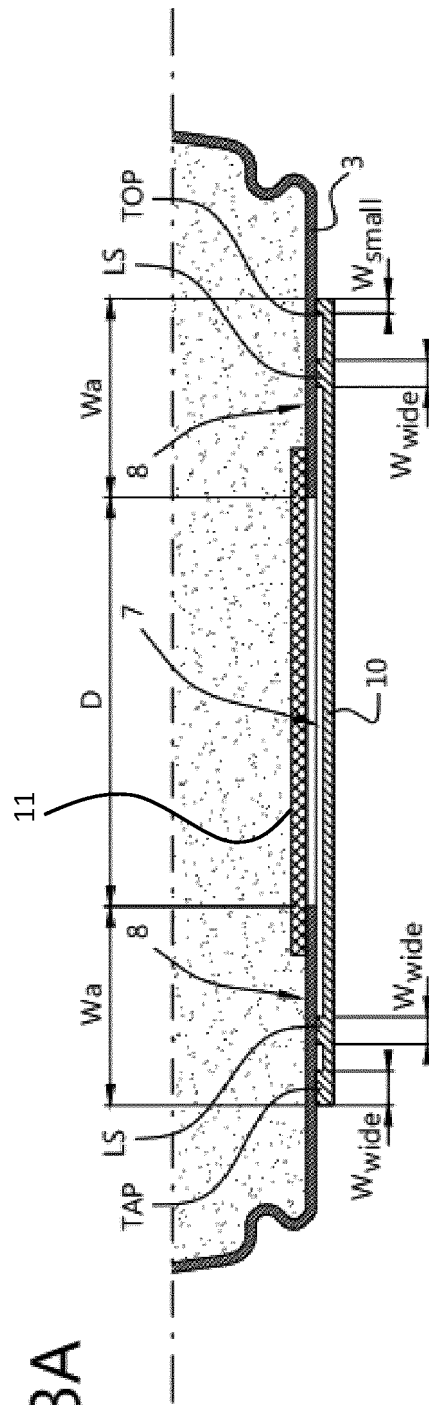


Fig. 3A

Fig. 5

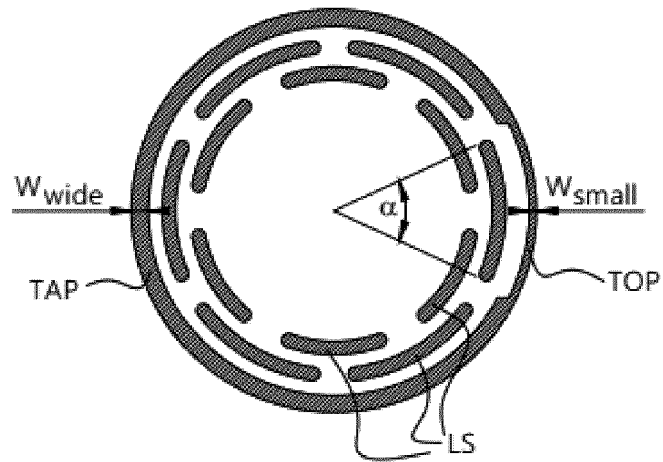


Fig. 6

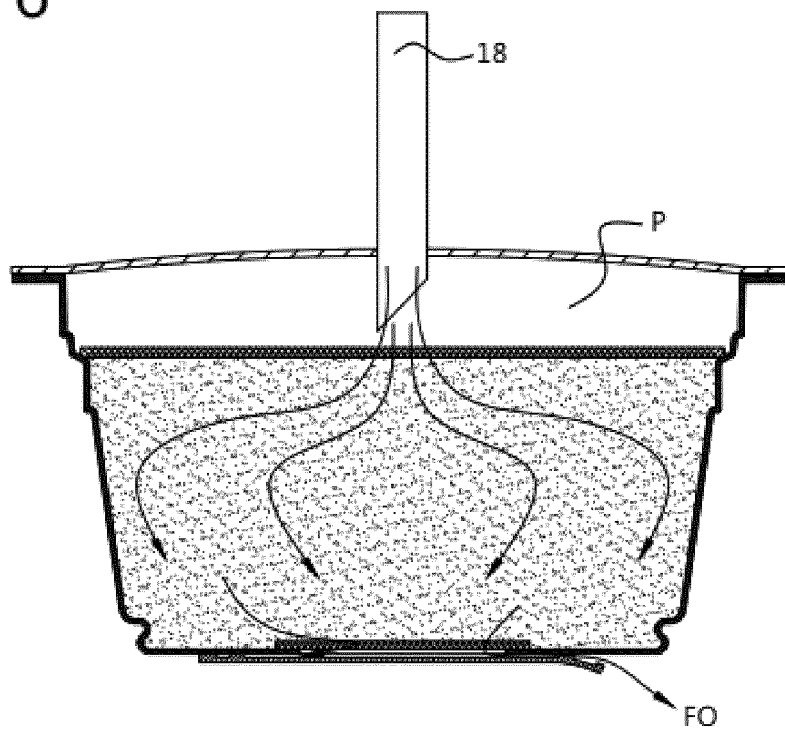


Fig. 6A

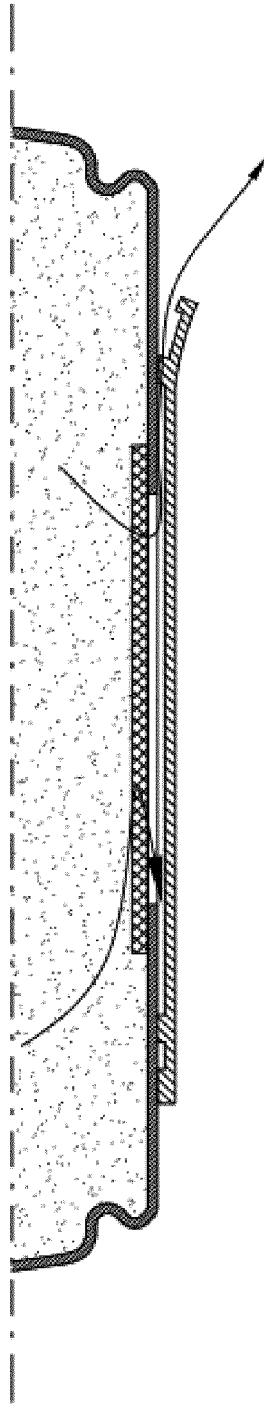


Fig. 7

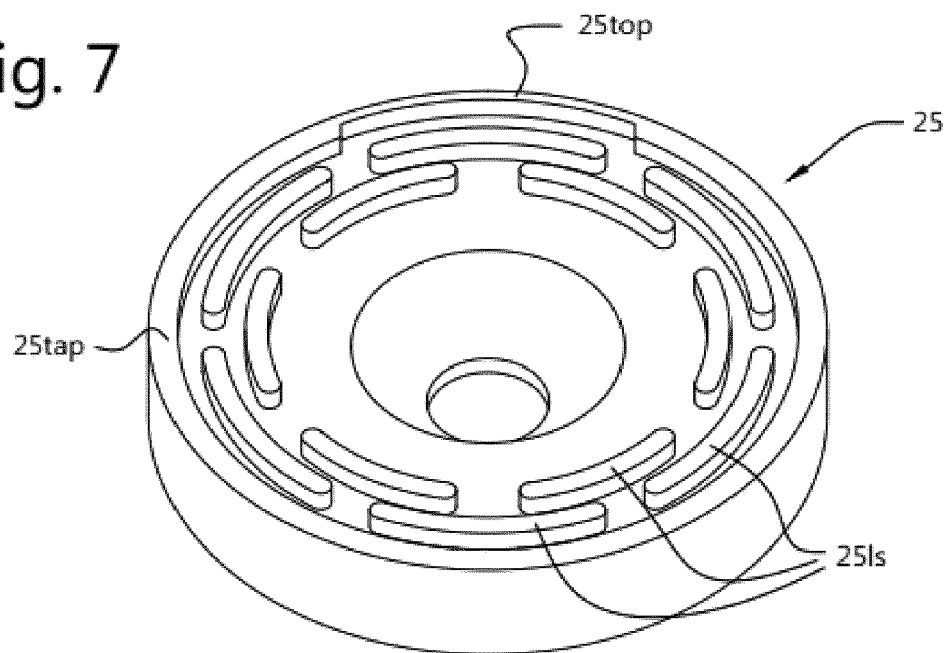


Fig. 8

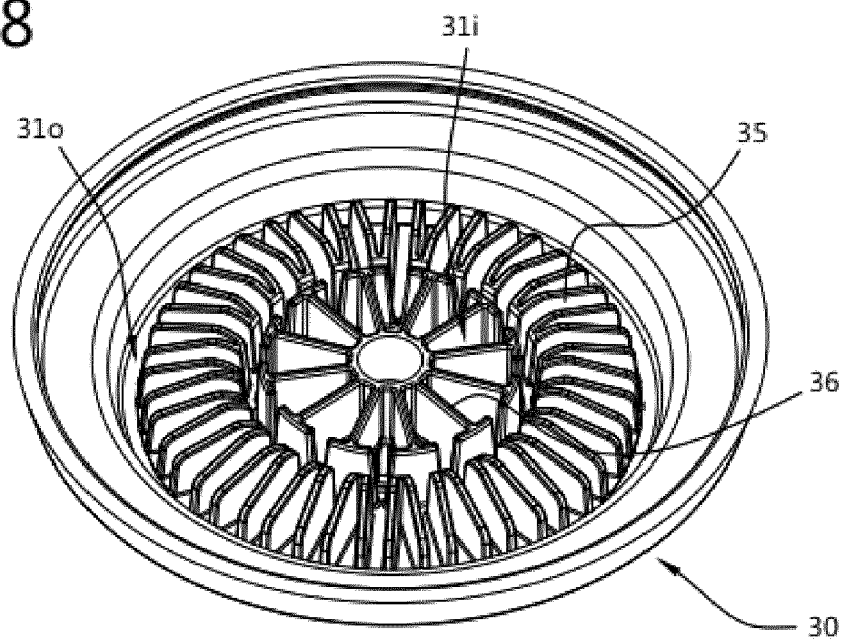


Fig. 9

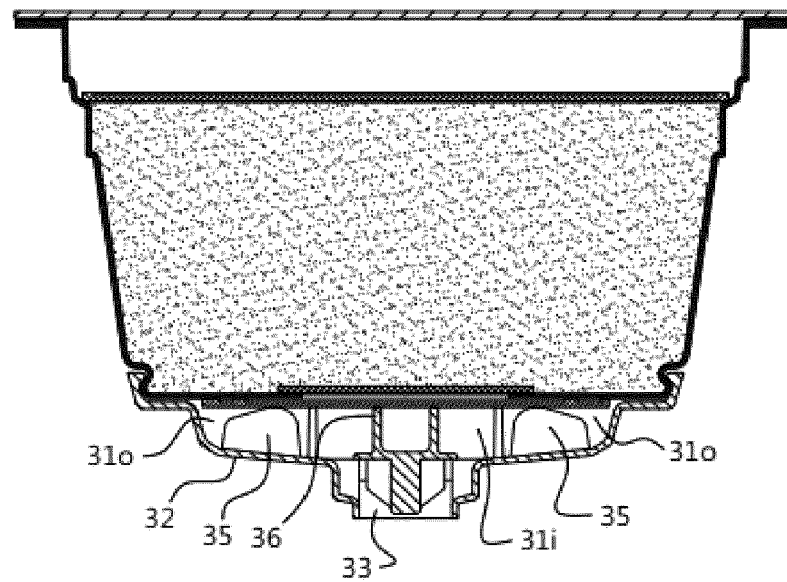


Fig. 10

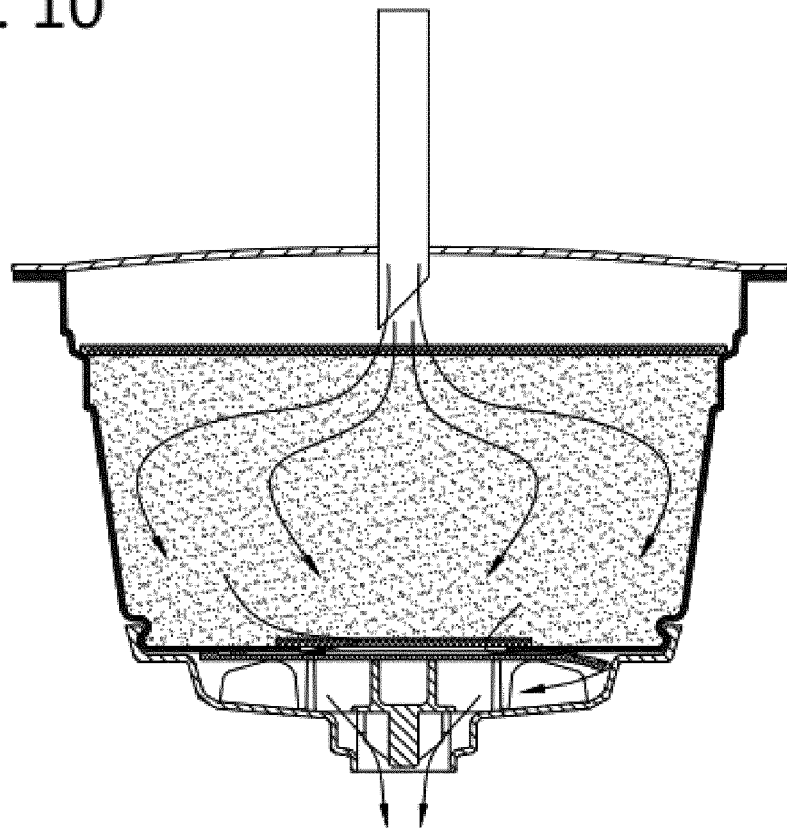


Fig. 11

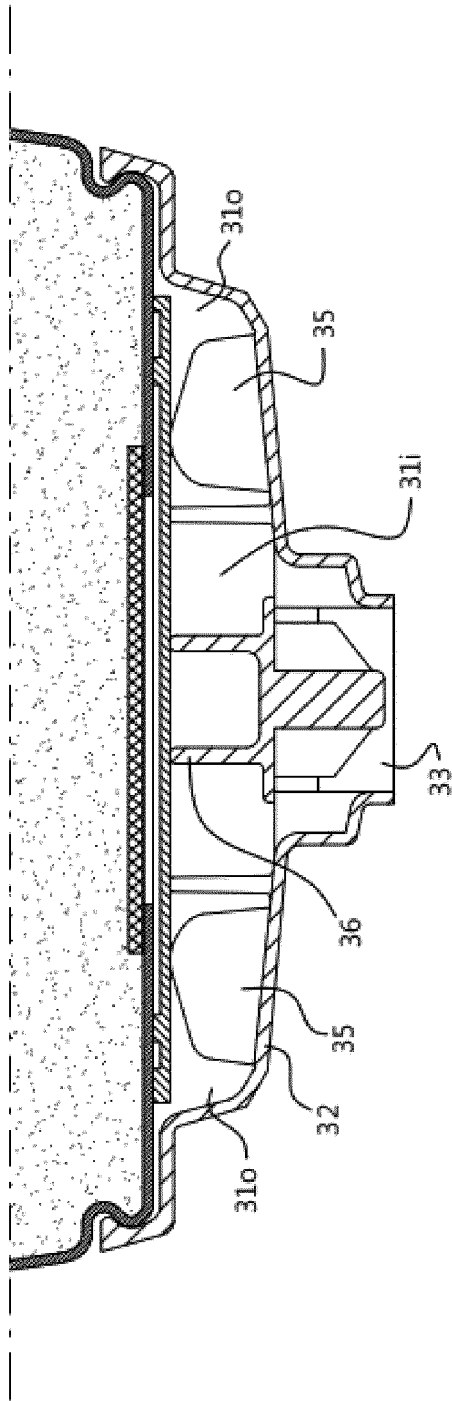
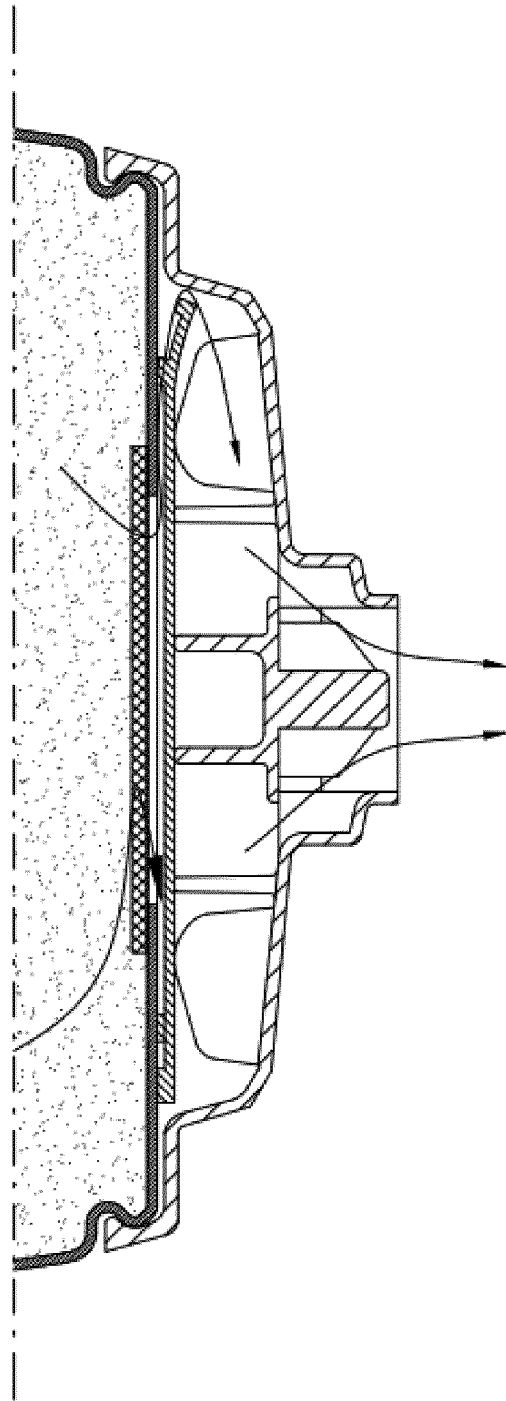


Fig. 12





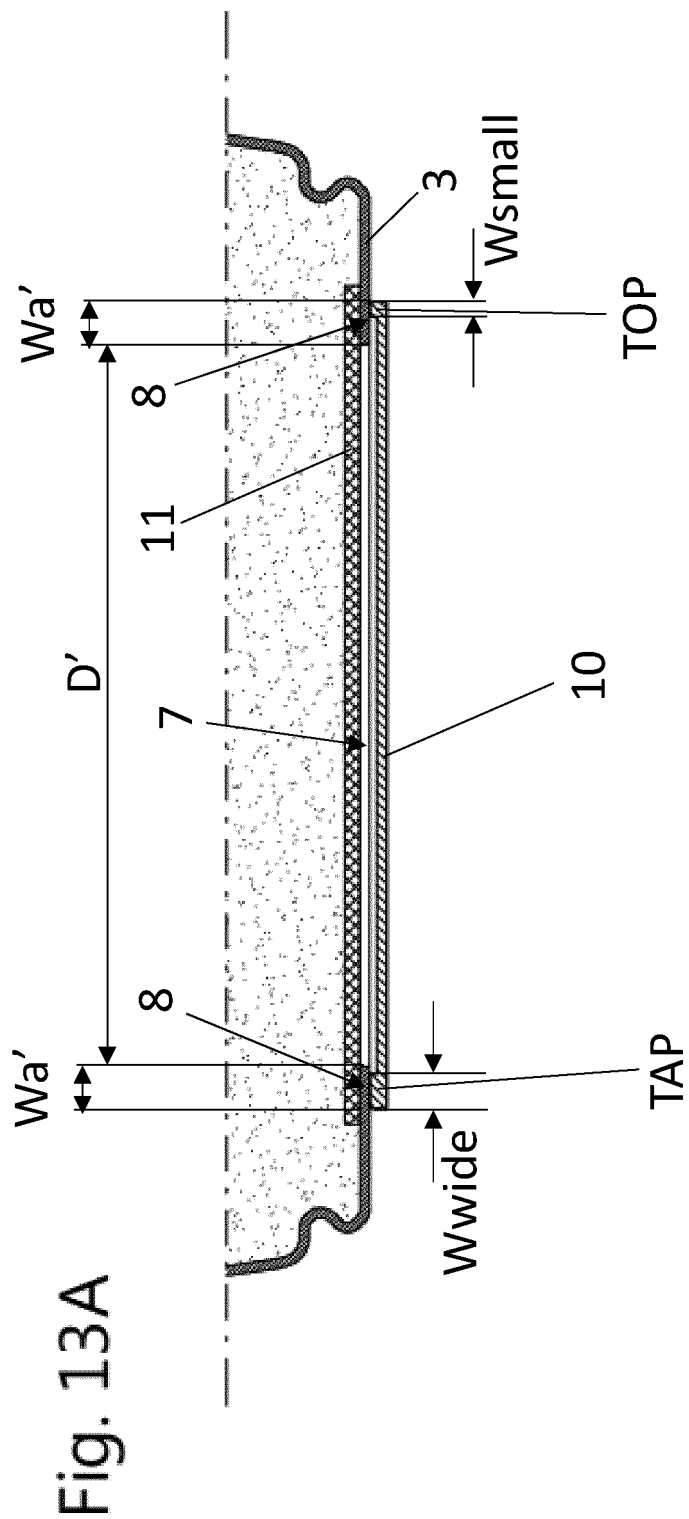


Fig. 15

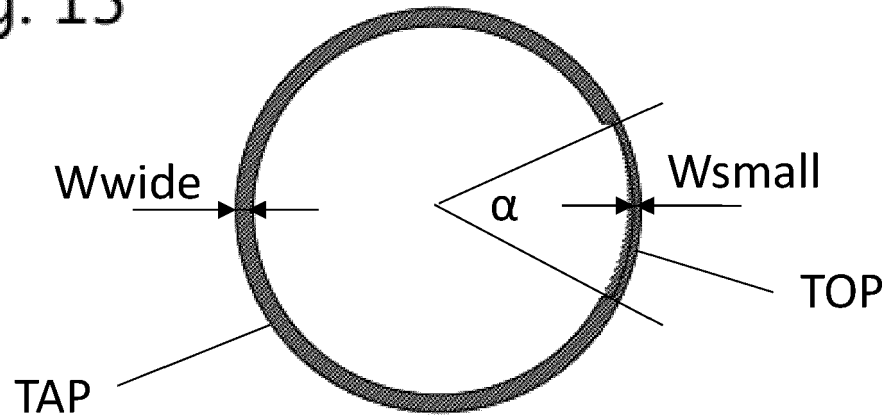


Fig. 16

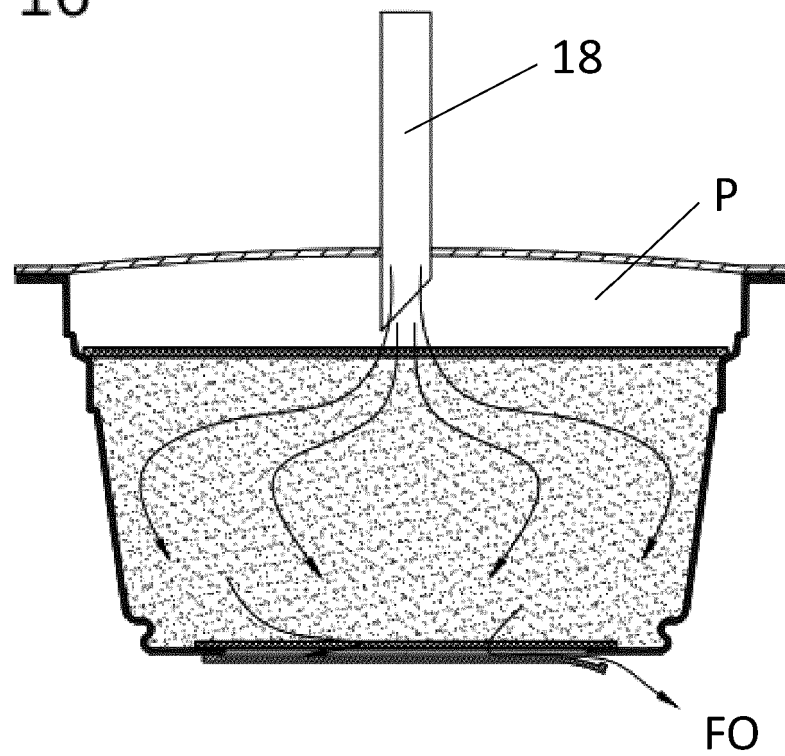


Fig. 16A

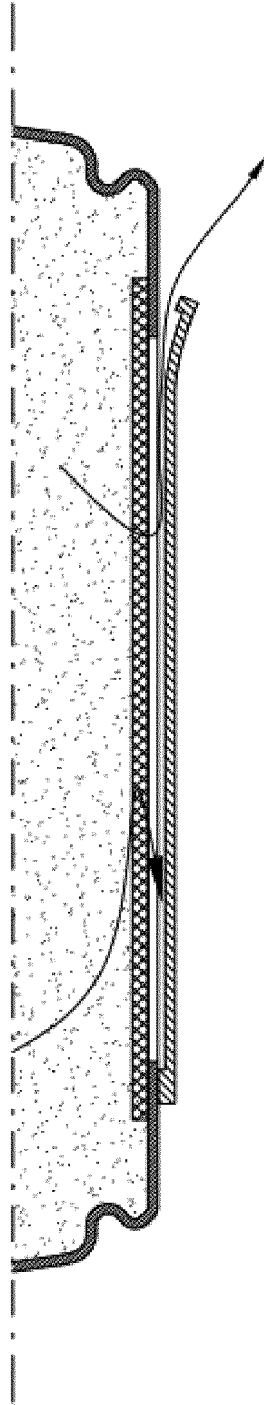


Fig. 17

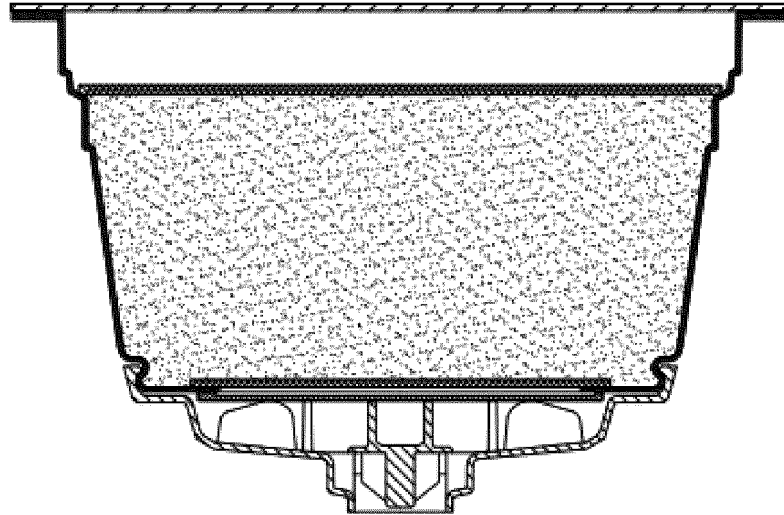


Fig. 18

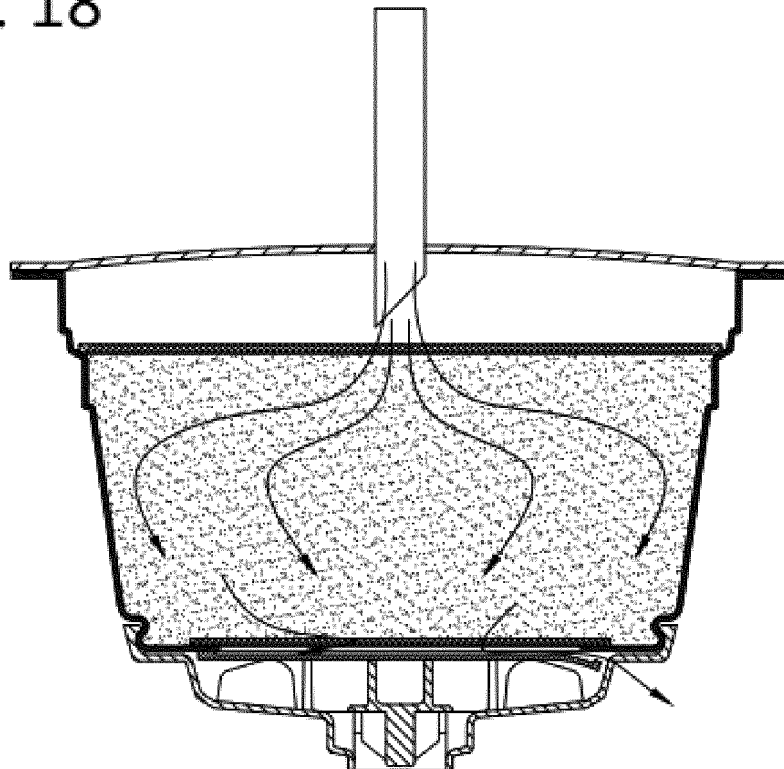


Fig. 19

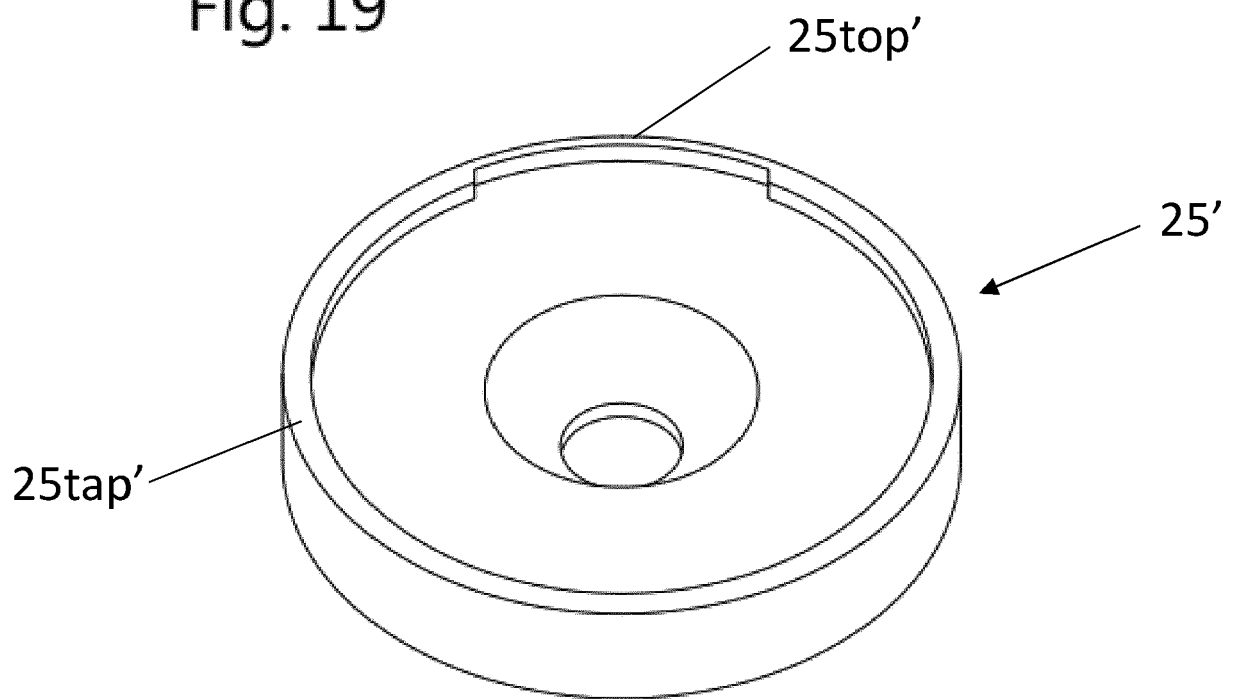


Fig. 20

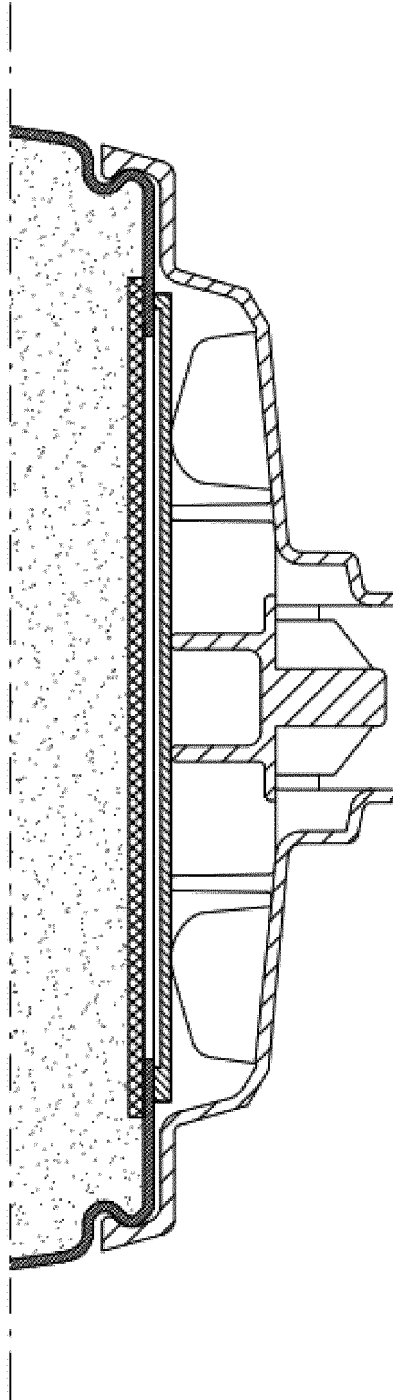
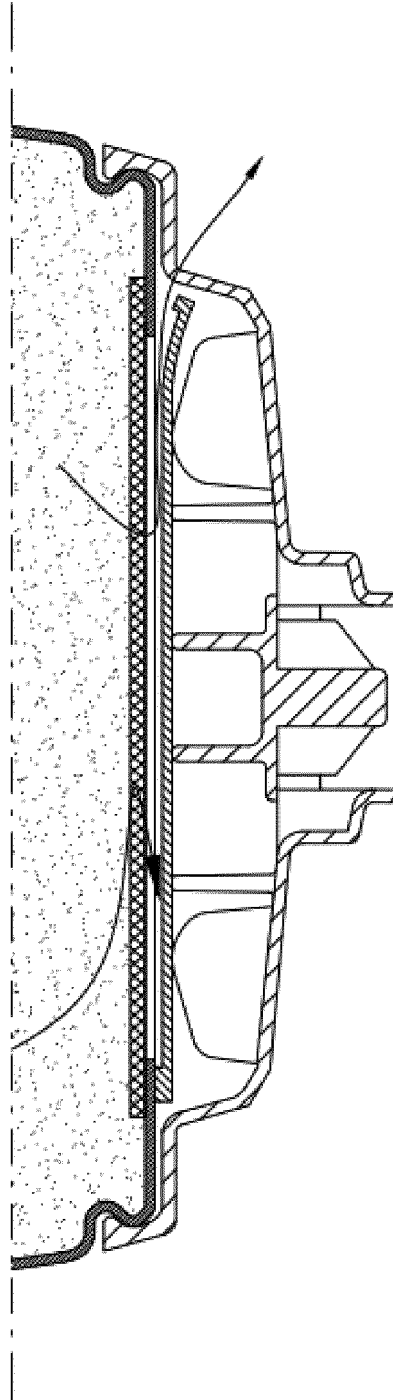


Fig. 21





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| Place of search<br><b>Munich</b>                                                                                                                                                                                                                       |                                                                                                                                                                                     | Date of completion of the search<br><b>16 June 2023</b>                                                                                                                                                                                                                               | Examiner<br><b>Leijten, René</b>        |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                     | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                         |

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