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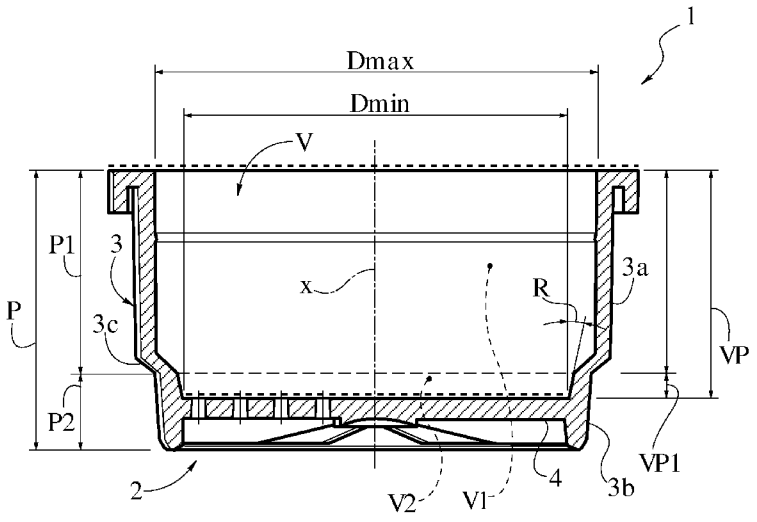
FIG. 6



(57) Abstract: A capsule (1) of a perforated type, for use in machines for the preparation of liquid products, comprises a body (2) made of plastic material that includes a peripheral wall (3) and a perforated bottom (4). The peripheral wall (3) and the perforated bottom (4) define a cavity (V) for containing at least one substance that can form a liquid product via water and/or steam. A closing element (15) permeable to water and/or to steam is associated to the body (2) in a position generally opposite to the perforated bottom (4), for closing the cavity (V) at the top. The peripheral wall (3) has a top portion (3a) of larger diameter and a bottom portion (3b) of smaller diameter, with an intermediate transition portion (3c). The axial development (PI) of the top portion of wall is greater than the axial development (P2) of the bottom portion of wall.

"Capsule for preparing liquid products"

* * *

Field of the invention

The present invention relates to a disposable capsule designed for use in machines for the preparation of liquid products, such as hot beverages, of the type normally used in offices or public places in general, but also in private dwellings.

Description of the known art

The use of disposable capsules in the preparation of hot beverages via automatic machines is widespread.

A first type of capsules envisages a sealed body, containing a dose of a substance that can form a liquid product via water and/or steam; said substance is typically in granular, powdered, or fragmented form, such as, for example, ground coffee. The capsule basically consists of a body made of thermoplastic material compatible for alimentary uses, in the form of a frustoconical cup, containing the aforesaid dose of substance and closed at the top by a sealing membrane (see, for example, IT 1250066 B). In use, the bottom of the plastic body and the sealing membrane are perforated or torn, possibly at different moments, by means of purposely provided members of the automatic machine in the course of preparation of the liquid product; in this way, there is enabled injection of hot water and/or steam under pressure into the capsule and subsequent outflow therefrom of the product resulting from mixing (by infusion or percolation) of the injected fluid and the substance.

In a second type of solutions, to which the present invention specifically refers, the capsule is not sealed (see, for example, IT 1256690 B and IT 1307241 B). In these solutions, the plastic body of the capsule has a substantially cylindrical peripheral wall and a perforated bottom, which define the cavity designed to receive the dose of substance, the body being closed at the top by means permeable to water and/or steam, typically comprising a perforated plastic wall and/or a filtering element made of paper or fabric. For operation of these perforated capsules, then, the corresponding automatic machines do not need to have perforation members: water and/or steam can be introduced freely through the aforesaid permeable means, and the liquid product obtained can flow off through the holes pre-formed in the bottom of the capsule. The through holes pre-formed in the bottom of these capsules generally have a frusto-pyramidal shape and are arranged according to a grid pattern, where the array of holes covers the

bottom of the capsule substantially throughout its extension.

As mentioned previously, the peripheral wall of the body of a capsule of a perforated type is substantially cylindrical or, more precisely, only slightly frusto-conical; the inclination of the peripheral wall is in fact very modest and basically has the purpose of enabling, in the production step, extraction of the plastic body of the capsule from the corresponding mould. The peripheral wall of the body of the capsule has a basically constant cross section so that also the cavity inside the capsule, where the precursor dose of the liquid product is present, is substantially cylindrical.

Summary of the invention

The present invention basically has the purpose of providing a capsule of a perforated type, i.e., of the second type referred to above, in an improved embodiment as compared with the prior art.

In said general framework, an object of the present invention is to provide a capsule of the type referred to above, designed to improve the process of mixing – by infusion or percolation – between water and/or steam introduced under pressure in the capsule and the dose of substance contained therein. Another object of the invention is to provide a capsule of increased strength as compared to those of the known art. Yet another object of the invention is to provide a capsule of the above sort that can be produced with a contained amount of plastic material. One or more of the aforesaid objects is achieved, according to the present invention, by a capsule having the characteristics forming the subject of the ensuing claims, which form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

Further purposes, characteristics, and advantages of the invention will emerge clearly from the ensuing description with reference to the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a perspective view of a capsule according to the present invention from the underside thereof;
- Figure 2 is a perspective view according to the arrow II of Figure 1;
- Figure 3 is a top plan view according to the arrow III of Figure 1;
- Figure 4 is a top plan view according to the arrow IV of Figure 2;
- Figure 5 is a cross-sectional view according to the trace V-V of Figure 3;

- Figure 6 is a cross-sectional view similar to that of Figure 5;

- Figure 7 is a schematic perspective view of an automatic machine suited for use of a capsule according to the invention;

- Figure 8 is a schematic front view of a portion of the machine of Figure 7; and

- Figure 9 is a schematic perspective view, at an enlarged scale, of a component of the machine illustrated in Figures 7 and 8.

Detailed description of preferred embodiments of the invention

Reference to "an embodiment" or "one embodiment" in the framework of the present description is intended to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment" or "in one embodiment" and the like that may be present in various points of the present description do not necessarily all refer to one and the same embodiment. Moreover, the particular configurations, structures, or characteristics can be combined in any adequate way in one or more embodiments. The references used in what follows are merely for convenience and do not define the sphere of protection or the scope of the embodiments.

It is pointed out that in the sequel of the present description and in the attached claims, terms such as "cylindrical" and the like, when they refer to the peripheral wall of the body of the capsule, are intended to identify cylindrical or substantially cylindrical stretches of wall, i.e., ones having even modest inclinations, indicatively of up to approximately 4°. On the other hand, terms such as "frustoconical", "tapered" and the like, when they refer to the aforesaid peripheral wall, are used to indicate stretches of wall with clearly perceptible inclinations, indicatively greater than 4°.

Moreover, in the description and in the annexed claims, the definitions of "internal" and "external" or "inner" and "outer", whenever used without further references, are understood with reference to the cavity designated hereinafter by the reference "V".

Designated by 1 in the figures is a capsule according to the present invention. The capsule 1 comprises a generally cuplike body 2, having a longitudinal axis designated by X in Figures 5 and 6. The body 2 includes a peripheral wall 3, a perforated bottom 4 in the proximity of or at a first axial end 5 of the wall 3, and a collar 6 integral with a second axial end 7 of the wall 3. The

body 2, which defines in a single piece the wall 3, the bottom 4, and the collar 6, is made of plastic material compatible for alimentary uses, for example, polypropylene that can be injection moulded with a shrinkage of approximately 1.8%.

In the non-limiting example, the perforated bottom 4 is in the proximity of the end 5 in order to define, together with the wall 3, a first spatial region and a second spatial region separated by means of the bottom 4 itself. The first spatial region is a volume or cavity V (Figures 2 and 4-6), axially comprised between the bottom 4 and the second axial end 7, for housing a dose of substance that can form a liquid product with water and/or steam, such as a granular, powdered, or fragmented substance. Said substance is not represented in the figures for reasons of greater clarity: it is assumed here that said substance is ground coffee.

The second spatial region is a disk-shaped recess 8 located in which is a plurality of ribs 9 integral with the bottom 4. The ribs 9 have a radial orientation, are set at equal angular distances apart, and converge on an axial projection 10, which is also integral with the bottom 4 and situated in the disk-shaped recess 8. The axial projection 11 is disk-shaped, shares the axis X, and comprises a preferably spherical and concave axial contrast surface 11.

The ribs 9 divide the disk-shaped recess 8 into a plurality of sectors, some of which are designated by 12 in Figures 1 and 3, which are identical to one another and are each delimited by two adjacent ribs 9 and by the wall 3. In one embodiment, as may be seen, for example, in Figures 1 and 5, each rib 9 comprises a first stretch 13, having an edge 13a inclined with respect to the bottom 4 and converging on the axial projection 10, and a second stretch 14 impinging upon the wall 3 and having an edge 14a parallel to the bottom 4, which enables reduction of the amount of plastic material necessary for definition of the ribs 9, without, however, reducing the effectiveness of their structural function. In this perspective, preferably the stretch 13 also has a thickness progressively decreasing towards the axial projection 10. In a possible variant, the entire top edge of the ribs 9 could be inclined with respect to the bottom 4 and converge on the axial projection 10.

In the embodiment illustrated herein, fixed to the capsule 1 is a top closing element, illustrated in see-through representation in Figures 2, 4 and dashed in Figure 5, where it is designated by 15. Said closing element, of a type permeable to water and/or steam, can be of any type known in the sector, for example,

comprising a wall or film of perforated plastic material and/or a film of paper or fabric for filters; the element 15, or at least one of the parts that makes it up, can be fixed to the collar 6, for example, via heat-sealing or gluing.

The collar 6 can be provided in at least two variants. According to a first preferred variant, as may be seen in Figures 1 and 3, the collar 6 includes a portion of wall that is radially separated from the wall 3 by a circumferential groove, divided into a plurality of compartments by radial diaphragms, which are not indicated but may be clearly seen in Figure 3. This solution enables reduction of the amount of plastic material necessary for formation of the collar, at the same time guaranteeing an adequate structural strength thereof. In accordance with a second variant (not represented), which implies, however, a greater use of plastic material, the collar 6 can be configured as a massive annular element, without compartments or cavities.

With reference to Figures 3 and 4, the bottom 4 comprises a plurality of through holes 18, divided into a number of distinct arrays or sets, preferably having a frusto-conical shape flared outwards and provided only in the sectors 12.

In a preferred embodiment of the invention, the through holes 18 are arranged in sets 19 (delimited by dashed lines in the figures), which are identical and are separated at each of the ribs 9. Preferably, each of the sets 19 is substantially shaped like a sector with a perimeter comprising through holes 18 set at a distance from the ribs 19 and from the wall 2. As emerges from Figure 4, the perimeter of each set 19 comprises two lateral rows 19a, 19b of through holes 18 – converging in a common hole and parallel to respective ribs 9 adjacent thereto – and a circumferential row 19c set at a uniform distance from the wall 3 and having two through end holes 18 shared with the arrays 19a, 19b.

It should be recalled that in perforated capsules of a known type the holes of the bottom have a grid pattern. It has been found that said grid pattern is not exactly compatible, from the geometrical standpoint, with the arrangement of the corresponding ribs. In fact, the latter have a radial orientation that, superimposed on the arrangement of the holes of the grid, can create local lack of uniformity of the area of passage. In practice, one or more holes can be partially obstructed by the presence of one of the ribs or be immediately adjacent thereto, with consequent variation of the local conditions of outflow. Basically, then, assuming that the bottom is divided into circular sectors by the presence of the stiffening ribs, there is a local lack of geometrical uniformity that perturbs outflow of the

beverage from the capsule and renders the various sectors non-uniform with respect to one another.

These drawbacks are overcome, in a preferred embodiment of the invention, thanks to the fact that the through holes 18 are arranged in such a way that none of them borders on one of the ribs 9 or on the wall 3 and in such a way that no rib 9 nor the wall 3 can interrupt and/or partialize one of them.

In greater detail, the through holes 18 of each set 19 are arranged on mutually concentric circumferences having radiuses preferably increasing with constant increments from a minimum radius to a maximum radius. Each set 19 comprises, in the embodiment illustrated herein by way of example, ten through holes 18 arranged along four circumferences, designated by C1, C2, C3, C4 in Figure 3, which are concentric and share the axis X of Figure 5.

The circumference C1 is the circumference having the minimum radius and provided thereon is a single hole 18 for each set, where the aforesaid hole is shared between the two rows 19a, 19b, whereas the circumferences C2, C3, C4, which have a progressively greater radius (C4 has the maximum radius), comprise, for each set 19, a number of through holes 18 increased by one with respect to the radially adjacent circumference (C1, C2, C3, respectively) having a smaller radius.

Except for the circumference C1 having the smallest diameter, which bears a single hole 18 for each set 19, the remaining circumferences C2, C3, C4 comprise through holes 18 set at equal angular distances apart within each set 19. The through holes 18 preferably have a smaller diameter D (Figure 5) equal to approximately 0.8 mm and a total angle of aperture A (Figure 5) equal to approximately 20°. Moreover set on the bottom 4, inside the cavity V, is a filtering layer 20 made, for example, of paper or fabric for filters. The layer 20 can be simply set resting on the bottom 4 or else fixed, for example, via heat-sealing, to at least one between the wall 3 and the bottom 4.

With particular reference to Figure 6, according to the main characteristic of the invention, the peripheral wall 3 of the body 2 has a top portion 3a of larger diameter, a bottom portion of smaller diameter 3b, and an intermediate portion 3c of transition between the top and bottom portions, where the axial development P1 of the top portion of wall 3a is greater than the axial development P2 of the bottom portion of wall 3b and where the axial development of the bottom portion of wall 3b is greater than the axial development of the intermediate transition

portion 3c. Preferably, also just the part of the portion of wall 3b that lies between the intermediate region 3c and the perforated bottom 4 has an axial development greater than the intermediate region 3c.

The body 2 then presents a marked narrowing of its bottom part; indicatively, the transition portion 3c is in the bottom half of the wall 3, with reference to its total height or axial development, even more preferably in the bottom third of the aforesaid height.

During infusion or percolation, this narrowing – together with the underlying part of the portion of wall 3b that extends from the region 3c up to the bottom 4 – enables improvement of the conveyance of the fluid introduced into the capsule towards the perforated bottom 2, with an improved fluid-dynamic effect and without any counterproductive turbulence. The conformation of the portions of top wall 3a and bottom wall 3b defines, within the cavity V, a top cavity portion V1 of larger diameter, where the majority of the dose of substance is found, and a bottom cavity portion V2 of smaller diameter, close to the perforated bottom 4.

Optimal results, in terms of overall quality of the liquid product, in particular coffee, are obtained with a sizing such that the internal diameter Dmin of the bottom portion of wall 3b is comprised between 75% and 90% of the internal diameter Dmax of the top portion of wall 3a. In this perspective, in a preferred embodiment, the ratio between the inlet diameter of the capsule 1 – i.e., the internal diameter of the portion of wall 3a at the top end 7 – and the internal diameter of the portion of wall 3b in its area of joining to the bottom 4, is approximately 0.85. Merely by way of example, in one practical embodiment the diameter Dmax can be approximately 31.5 – 33.5 mm, whilst the diameter Dmin can be approximately 26.5 to 28.5 mm; the external diameter of the portion of wall 3a (collar 6 excluded) can be approximately 34 – 36 mm, whilst the external diameter of the portion of wall 3b can be approximately 29.5 – 31.5 mm.

Particularly advantageous is a conformation such that the bottom portion of wall 3b has an axial development P2 comprised between 15% and 35% of the total axial development P of the peripheral wall 3, in particular not less than 20% of the total axial development P. On the other hand, given the presence of the disk-shaped recess 8 defined between the bottom 4 and the bottom portion of wall 3b, the bottom cavity portion V2 has an axial development VP1 comprised between 8% and 24% of the total axial development VP of the cavity V. In this

perspective, in a preferred embodiment, the ratio between the axial development VP1 of the cavity portion V2 and the total development VP of the cavity V is less than 0.20, preferably approximately between 0.10 and 0.15. Once again with reference to the possible practical embodiment referred to above, the development P can be approximately 20 to 22 mm, the development P1 approximately 12.5 to 14.5 mm, the development P2 approximately 4.5 to 6.5 mm, the development VP approximately 16 to 18 mm, and the development VP1 approximately 1.5 to 2.5 mm.

As may be clearly seen in Figures 5 and 6, in a preferred embodiment the transition portion 3c has a substantially frusto-conical shape, which contributes to the effect of conveyance of the fluid and simplifies moulding of the body 2.

The portions of top wall 3a and bottom wall 3b preferably have substantially cylindrical outer surfaces. In practice, then, said outer surfaces can be slightly inclined with respect to the axis X, indicatively up to 4°. In the preferred embodiment illustrated, the outer surface of the portions of wall 3a and 3b has an inclination not greater than 2°, in particular approximately 1.5°, in any case adequate for enabling convenient extraction of the body 2 from the corresponding mould, in the production step. Also the inner surface of the top portion of wall 3 is preferably substantially cylindrical, with an inclination substantially similar to that of the outer surface.

As may be noted from Figures 5 and 6, the inner surface of the bottom portion of wall 3b is preferably substantially frustoconical or tapered towards the perforated bottom 4. In an embodiment of this sort, the inclination of the aforesaid inner surface of the portion of wall 3b with respect to the axis X (designated by R in Figure 6) is comprised between 5° and 15°, in particular between 8° and 12°, very preferably approximately 10°. It should be noted in any case that also the inner surface of the portion of wall 3b could be substantially cylindrical.

It will moreover be appreciated that, given the substantially cylindrical shape of the outer surface and the tapered shape of the inner surface, the bottom portion of wall 3b has a thickness increasing starting from the area of transition 3c towards the bottom 4 and the disk-shaped recess 8.

It should be emphasized that, in almost all of the capsules at present commercially available, the entirely cylindrical or substantially cylindrical peripheral wall is provided externally with one or more circumferential projections. These projections form external ribbings that, if on the one hand they

enable an increase in the structural strength of the body of the capsule, on the other hand have the effect of determining occasional imprecisions of positioning of the capsule within a corresponding seat provided in the automatic machine for preparation of the liquid product, and this adversely affects the quality or effectiveness of delivery. For this reason, in a preferred embodiment, the peripheral wall 3 of the capsule 1 according to the present invention is without external projections or ribbings.

The presence of the intermediate transition portion 3c, and the possible variable thickness of the bottom portion of wall 3b, guarantees in any case an adequate structural strength for the body 2.

In any case, in a possible embodiment it is also possible to provide in the wall 3 at least one internal ribbing, in particular in its top portion 3a (i.e., further up than the area of transition 3c). Such a case is exemplified in Figures 5 and 6, where in the inner cylindrical surface of the portion of wall 3a a circumferential projection is provided, designated by 21 only in Figure 5, preferably having a double-ramp profile.

The modalities of use of the capsule 1 according to the invention are similar to known capsules of the same type. For this purpose see Figures 7 and 8, where designated by 100 is a machine suited for use of capsules 1 according to the invention. The general structure and the type of operation of the machine 100 are of a known type, except for the part designed for receiving and/or guiding a capsule 1 towards a corresponding position of preparation of the product.

The capsule 1 is inserted in an insertion mouth or area 101 of the automatic machine 100. The area 101 is preferably, but not necessarily, provided with lead-in walls 102 converging towards the aforesaid position of preparation, where the capsule itself is designed to receive from above hot water and/or steam under pressure, through the closing element 15, from an injection device of a conception in itself known.

Given that the peripheral wall 3 of the capsule 1 has stretches of wall 3a, 3b of different diameter, the machine 100 is provided with means designed to guide the capsule itself precisely into the position of preparation. In the example represented, the aforesaid means comprise a pair of fixed guide elements, designated by 103, between which the bottom part of the capsule 1, inclusive of the portion of wall 3b, is designed to be inserted and slide upstream of the position of preparation. The guide elements 103 are preferably configured for providing a

linear guide, for example each including a respective rectilinear stretch, with the rectilinear stretches of the two elements 103 parallel to one another, between which only the bottom portion of wall 3b can be made to slide. In this way, and as may be noted in particular in Figure 8, the elements 103 co-operate with the portion of wall 3b in order to guide the capsule precisely towards the aforesaid position of preparation. The fact that the outer surface of the portion of wall 3a is preferably substantially cylindrical facilitates guiding and positioning of the capsule. Preferably, the guide elements 103 are in a substantially fixed position, but not excluded is the possibility of enabling a slight elastic divarication thereof in the course of insertion of a capsule 1 between them.

Figure 9 illustrates, merely by way of example, a possible embodiment of the means designed to guide the capsule 1. In the example of Figure 9, the guide elements 103 are parts of a single component, designated by 110, for example made of plastic or metal material. In the example, the component 110 also defines the lead-in walls 102, with the elements 103 that branch off from the internal or distal end of the walls 102. In the example, the inner surface of the elements 103 has a first slightly curved stretch 103a, followed by a plane inclined stretch 103b and finally the aforementioned rectilinear stretch 13c.

At outlet from the guide provided by the elements 103, the capsule 1 is in the position for preparation of the product. Next, hot water and/or steam is injected into the capsule, for example, after a pushbutton of the machine has been pressed, and mixes with the dose of substance contained in the cavity C of the capsule itself, producing the hot beverage by percolation or infusion, which can flow out through the filtering layer 20 and the through holes 18 of the bottom 4.

As mentioned previously, the particular configuration of the peripheral wall 3 enables an improved result of infusion or percolation to be obtained, with a regular outflow. In the case of production of coffee or cappuccino, the capsule 1 enables a good production of froth. In the preferred embodiments cited previously, contributing to the improved results is also the arrangement of the holes 18, i.e., the corresponding sets 19, which constitute in themselves an autonomously inventive aspect of the solution proposed herein.

Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what has been described and illustrated herein purely by way of example, without thereby departing from the scope of the present invention, as defined in the ensuing claims.

CLAIMS

1. A capsule of a perforated type for use in machines for the preparation of liquid products, in particular coffee and the like, comprising:

- a body made of plastic material (2) having a longitudinal axis (X), the body (2) including a peripheral wall (3) and a perforated bottom (4) at or in the proximity of a first axial end (5) of the peripheral wall (3), the peripheral wall (3) and the perforated bottom (6) defining a cavity (V) for containing at least one substance that can form a liquid product via water and/or steam, the cavity (V) being axially comprised between the perforated bottom (4) and a second axial end (7) of the peripheral wall (3); and

- at least one closing element (15) generally opposite to the perforated bottom (4) for closing the cavity (V), wherein the at least one closing element (15) is permeable to water and/or to steam and is associated to the body (2) in the proximity or at its second axial end (7),

the capsule (1) being characterized in that the peripheral wall (3) has a top portion (3a) of larger diameter, a bottom portion of smaller diameter (3b), and an intermediate transition portion (3c) between the top portion of wall (3a) and the bottom portion of wall (3b), the top portion of wall (3a) having an axial development (P1) greater than the axial development (P2) of the bottom portion of wall (3b) and the axial development of the bottom portion of wall (3b) being greater than the axial development of the intermediate transition portion (3c).

2. The capsule according to Claim 1, wherein the top portion of wall (3a) and the bottom portion of wall (3b) define, within the cavity (V), a top cavity portion (V1) of larger diameter and a bottom cavity portion (V2) of smaller diameter.

3. The capsule according to Claim 1 or Claim 2, wherein the internal diameter (Dmin) of the bottom portion of wall (3b) is comprised between 75% and 90% of the internal diameter (Dmax) of the top portion of wall (3a).

4. The capsule according to Claim 1 or Claim 2, wherein the bottom portion of wall (3b) has an axial development (P2) comprised between 15% and 35% of the total axial development (P) of the peripheral wall (3), in particular not less than 20% of the total axial development (P).

5. The capsule according to Claim 1 or Claim 2, wherein the bottom cavity portion (V2) has an axial development (VP1) comprised between 8% and 24% of

the total axial development (VP) of the cavity (V), in particular less than 20%.

6. The capsule according to any one of the preceding claims, wherein the transition portion (3c) has a substantially frustoconical shape.

7. The capsule according to any one of the preceding claims, wherein the top portion of wall (3a) and the bottom portion of wall (3b) have substantially cylindrical outer surfaces.

8. The capsule according to any one of the preceding claims, wherein the bottom portion of wall (3b) has an inner surface that is substantially frusto-conical or tapered towards the perforated bottom (4).

9. The capsule according to Claim 8, wherein the inner surface of the bottom portion of wall (3b) has an inclination (R) comprised between 5° and 15° with respect to said longitudinal axis (X), in particular comprised between 8° and 12°.

10. The capsule according to any one of the preceding claims, wherein the bottom portion of wall (3b) and the perforated bottom (4) delimit a disk-shaped recess (8) axially comprised between the perforated bottom (4) and said first axial end (5).

11. The capsule according to Claim 10, wherein the body made of plastic material (2) defines a plurality of ribs (9) set at equal angular distances apart, in particular six ribs, integral with the perforated bottom (4), situated in the disk-shaped recess (8) and having a radial orientation, which divide the disk-shaped recess (8) into a plurality of sectors (12), in particular mutually identical sectors.

12. The capsule according to Claim 11, wherein the perforated bottom (4) comprises a plurality of through holes (18) provided only in said sectors (12), wherein said through holes (18) are arranged in sets (19), in particular mutually identical sets, and separated at each of said ribs (9), said sets (19) having a perimeter comprising through holes (18) set at a distance from said ribs (9).

13. The capsule according to Claim 12, wherein the perimeter of each of said sets (19) comprises two lateral rows (19a, 19b) of through holes (18) converging in a common hole and parallel to respective ribs (9) adjacent thereto, and a circumferential row (19c) set at a uniform distance from the peripheral wall (3) and having two end holes shared with said lateral arrays (19a, 19b), where in particular each of said sets comprises ten through holes.

14. The capsule according to Claim 13, wherein the through holes (18) of each of said sets are distributed along four circumferences (C1, C2, C3, C4) that

are concentric and share said longitudinal axis (X), said circumferences (C1, C2, C3, C4) having radiuses that increase, with preferably constant increments, from a minimum radius (C1) to a maximum radius (C4), where in particular the number of through holes (18) on said circumferences is equal to one on a circumference (C1) having the minimum radius and increases by one on each remaining circumference (C2, C3, C4) with respect to the circumference (C1, C2, C3) having a smaller radius that is radially adjacent, with the through holes (18) on each remaining circumference (C1, C2, C3, C4) that are set at equal angular distances apart within each set.

15. The capsule according to Claim 12, wherein the through holes (18) have a frusto-conical shape flared outwards.

16. The capsule according to Claim 10, wherein the body made of plastic material (2) defines an axial projection (10) sharing said longitudinal axis (X), integral with the perforated bottom (4) and situated in the disk-shaped recess (8), where in particular the axial projection (10) has a spherical and concave axial contrast surface (11).

17. The capsule according to Claim 10, wherein the body made of plastic material (2) defines a collar (6), integral with the second axial end (7) of the peripheral wall (3), the at least one closing element (15) being associated to the collar (6).

18. The capsule according to any one of the preceding claims, wherein the at least one closing element (15) comprises at least one from among a perforated wall, a strainer wall, a film of filter paper or filter fabric.

19. The capsule according to any one of the preceding claims, wherein the through holes (18) have a smaller diameter (D) equal to approximately 0.8 mm and an angle of aperture (A) of approximately 20°.

20. The capsule according to any one of the preceding claims, further comprising a filtering layer (20) on the perforated bottom (4), inside the bottom cavity portion (V2).

21. A machine for the preparation of liquid products by means of capsules according to one or more of Claims 1 to 20, the machine (100) having an area for introduction (101) of a said capsule (1) towards an area of preparation of a liquid product, wherein the capsule itself is designed to receive from above hot water and/or steam under pressure through said closing element (15), the machine (100) comprising, in said area of introduction (101), guide means (103) configured to

co-operate with the outer surface of said bottom portion of wall (3b) of the body (2) of the capsule (1), for guiding the latter towards the aforesaid position of preparation.

22. The machine according to Claim 21, wherein the guide means comprise two generally opposed guide elements (103), between which said bottom portion of wall (3b) is designed to be inserted.

23. The machine according to Claim 21 or Claim 22, wherein the two guide elements (103) are substantially fixed.

24. The machine according to any one of Claims 21 to 23, wherein the guide elements (103) are part of one and the same component (110) of the machine (100).

25. The machine according to any one of Claims 21 to 24, wherein each guide element (103) has a guide surface (103a, 103b, 13c) that comprises a rectilinear stretch of surface (103c), the rectilinear stretches of surface (103c) of the two guide elements (103) being substantially parallel to one another.

26. The machine according to Claim 24 or Claim 25, wherein said component (110) moreover defines two generally converging lead-in walls (102), each lead-in wall having a distal end, departing from which is a said guide element (103).

FIG. 1

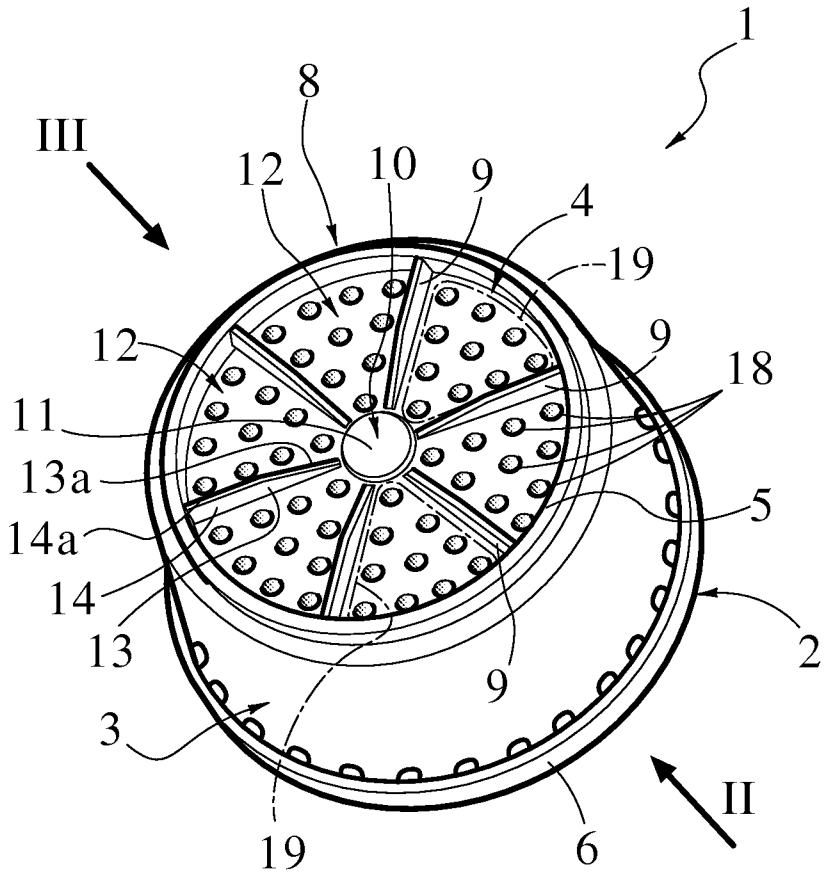

1
8
III
12
10
9
4
19
12
9
18
11
13a
5
14a
14
13
2
9
3
II
19
6

FIG. 2

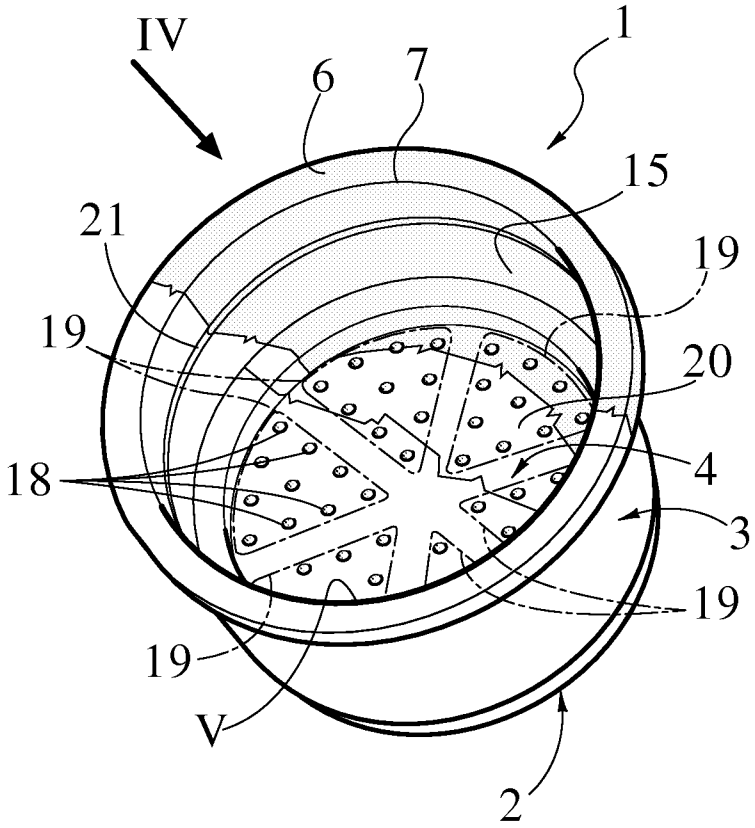

IV
1
6
7
15
21
19
19
20
18
4
3
19
19
V
2

FIG. 3

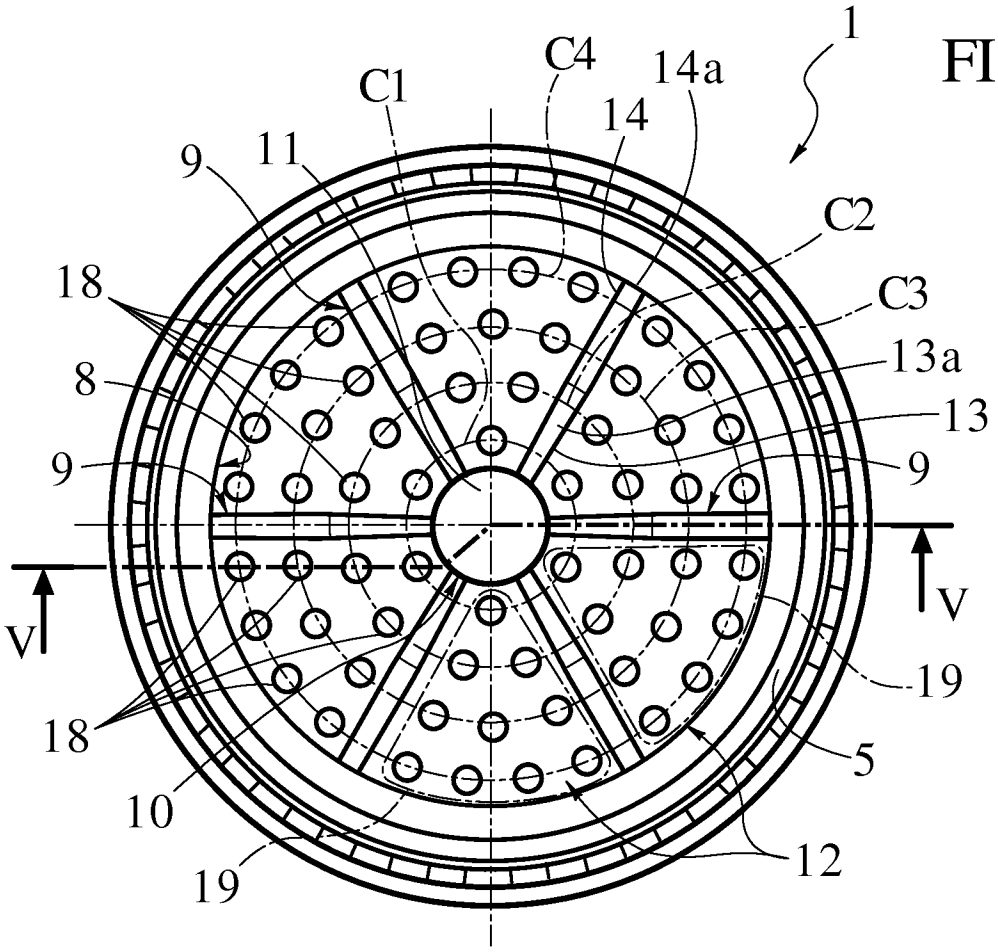

1
C4
14a
C1
14
11
9
C2
18
C3
13a
8
13
9
9
V
V
19
18
5
10
12
19

FIG. 4

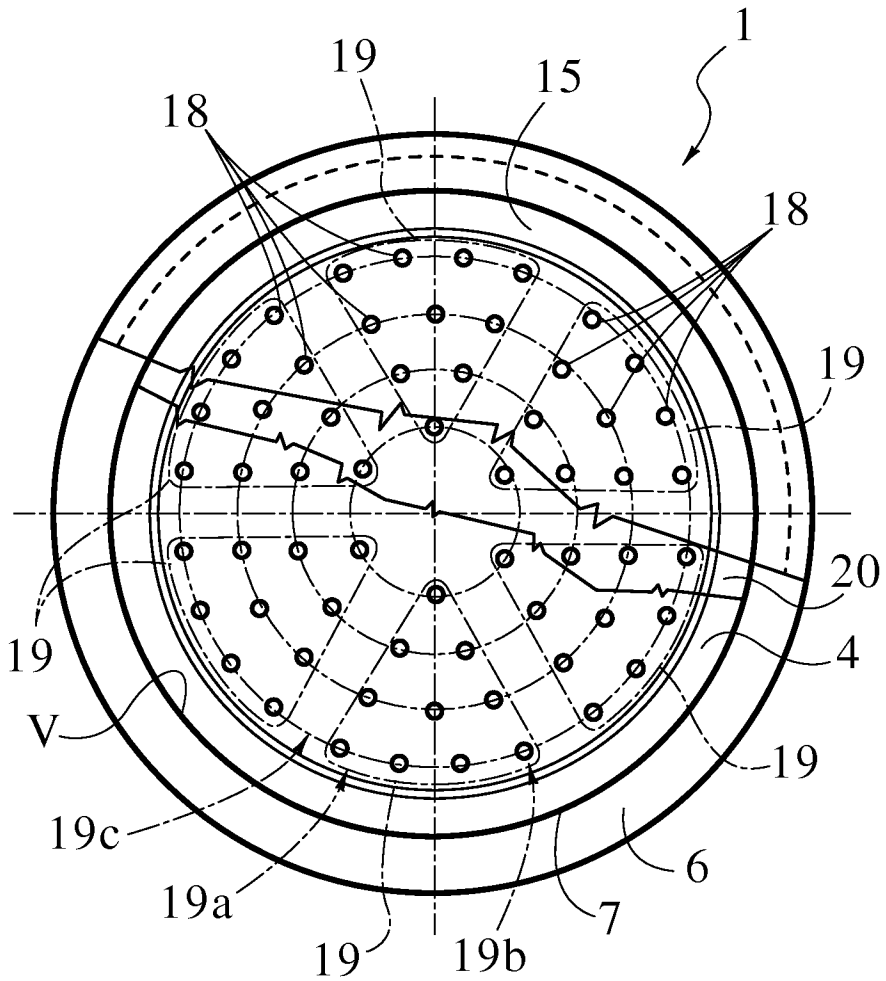

1
19
15
18
18
19
20
19
4
V
19
19c
6
19a
7
19
19b

FIG. 5

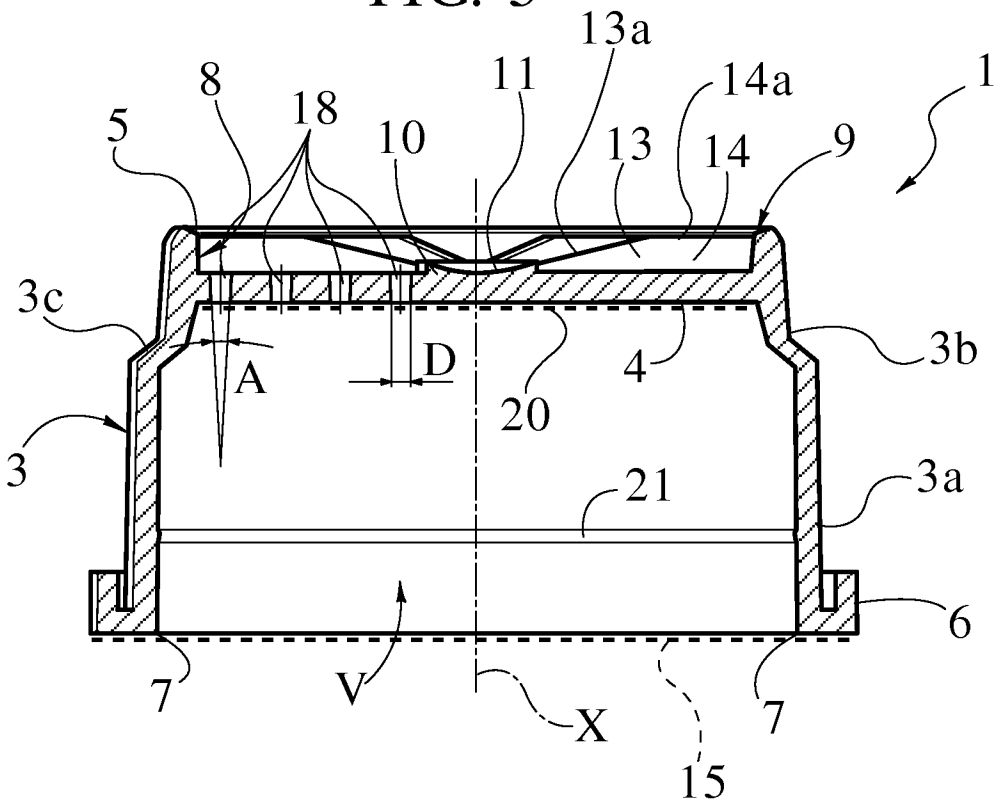

13a
8
11
14a
1
18
5
10
13
14
9
3c
A
D
4
3b
20
3
21
3a
6
7
V
X
7
15

FIG. 6

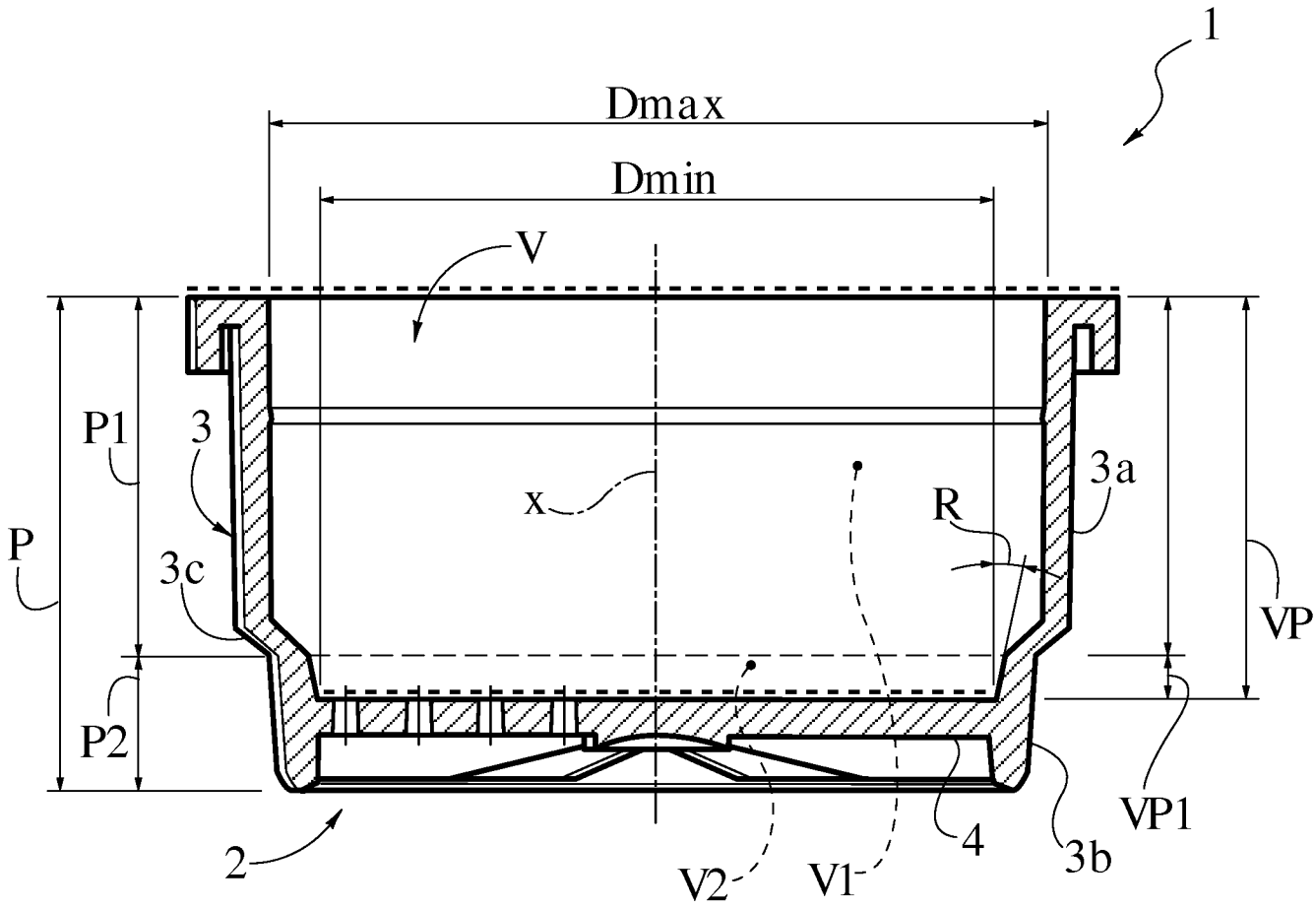

1
Dmax
Dmin
V
P1
3
3a
x
R
P
3c
VP
P2
VP1
2
V2
V1
4
3b

FIG. 7

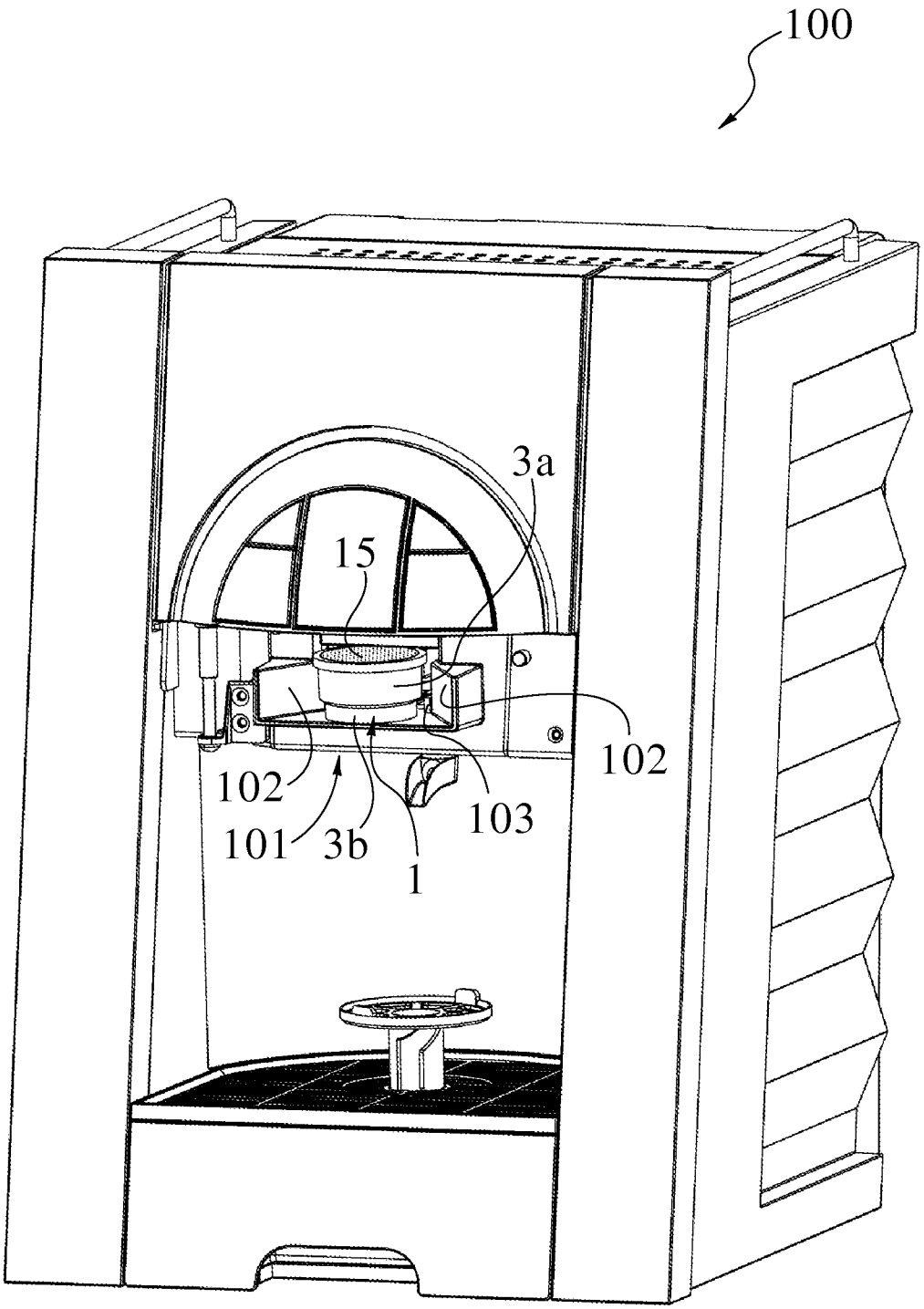


FIG. 8

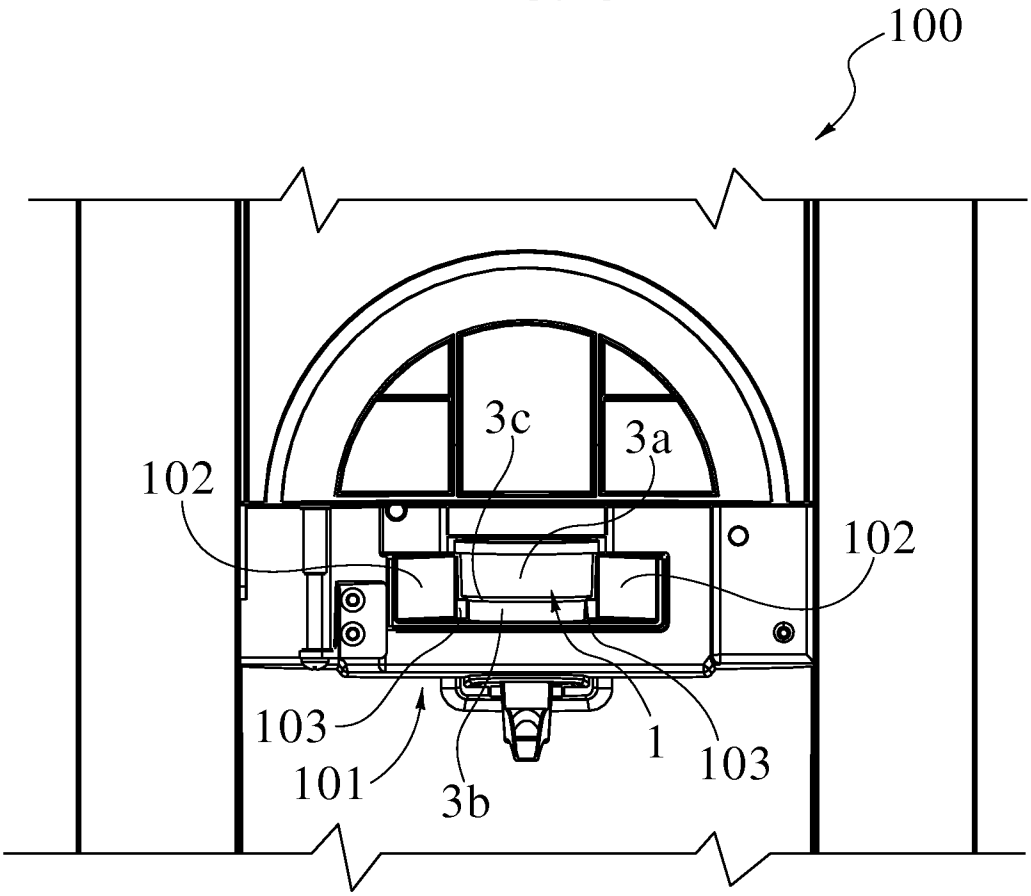
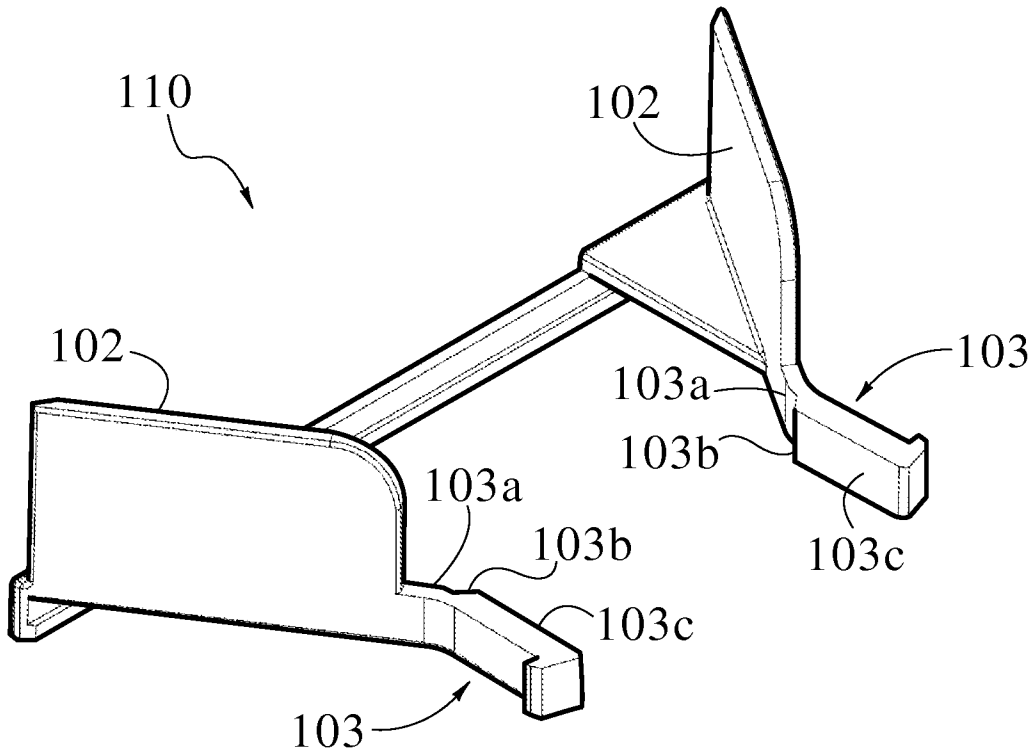

100
3c
3a
102
102
103
101
3b
1
103

FIG. 9


110
102
102
103
103a
103b
103a
103b
103c
103c
103

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/050465

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/816
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 992 575 A1 (ARNOPLAST S R L [IT]) 19 November 2008 (2008-11-19) paragraph [0008] - paragraph [0018] figure 5 -----	1-10, 16-18,20
X	EP 1 961 676 A2 (ARNOPLAST S R L [IT] MACCHIAVELLI S R L [IT]) 27 August 2008 (2008-08-27) column 1 - column 3 figures 1, 2 -----	1-5, 7-11, 16-18,20
X	WO 2006/030461 A1 (TUTTOESPRESSO SPA [IT]; DOGLIONI MAJER LUCA [IT]) 23 March 2006 (2006-03-23) column 9, line 12 - column 18, line 21 figure 6D ----- -/--	1-5,7-9, 18,20

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 July 2012	18/07/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Duc, Emmanuel

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/050465

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 119 640 A1 (SARA LEE DE NV [NL]) 18 November 2009 (2009-11-18) paragraph [0001] - paragraph [0041] figures 1-7 -----	1-5,7, 10,11, 16-18,20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2012/050465

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-20

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20

   Capsule wherein the internal diameter of the bottom portion of wall is comprised between 75% and 90% of the internal diameter of the top portion of wall

   ---

2. claims: 21-26

   Guide means comprised in a machine for the preparation of liquid product

   ---

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2012/050465

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1992575 A1	19-11-2008	NONE	
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		US 2008216666 A1	11-09-2008
		WO 2006030461 A1	23-03-2006
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		NL 2001539 C2	30-10-2009