[00025] According to a preferred embodiment of the present invention, it is provided that the grooves form an identifier that allows individualizing the portion capsule. In the context of this invention individualizing preferably means that the respective portion capsule can be assigned to a group of capsules that are suitable for the respective coffee machine or the machine producing a beverage. It is not necessary that the coffee machine or the device for producing a beverage is able to specify and/or identify the portion capsule. It is more important that the device for producing a beverage, in particular a coffee machine, associates the portion capsule with a group of portion capsules, which is appropriate for the respective device for producing a beverage, in particular a coffee machine. In particular, individualizing means that those portion capsules that are not appropriate for the coffee machine (or the device producing the beverage) cannot be inserted into and/or directly fall through the holder, which is designed for the portion capsules in the coffee machine (or the device producing the beverage), and/or the coffee machine (or the device producing the beverage) operates only with corresponding portion capsules ("proper portion capsule"). In particular, individualizing means that the coffee machine or the device producing the beverage will not operate properly in the intended use, if the used portion capsule is not customized according to the invention. Preferably a sensor/detection system, attached to the coffee machine or the device producing the beverage, records the identifier and substantially compares it with a stored reference. In particular, it is possible that such an identification process is based on a mechanical fitting, especially a fitting of a gearwheel or of a contour comparable with a gearwheel, which is attached to the device producing the beverage or the coffee machine and interacts with the portion capsule. It is preferred that the device for producing the

beverage or the coffee machine only will operate, if the identifier matches to the reference or the mechanical fittings match with each other. In this case the device for producing the beverage particularly starts to operate, especially activates a pressure or water pump. The mean for detection or mechanical fitting is preferably located in the region of the media chute or in the region of the device for producing the beverage. Alternatively the identifier or the mechanical fitting may avoid that an unsuitable portion capsule is inserted into the device for producing the beverage. A portion capsule, which is designed in accordance with the invention, makes it possible that a portion capsule that is not designed for the device for producing a beverage cannot be inserted into it. Additionally the identifier allows that the device for producing the beverage, especially the coffee machine, may specify the sort of the portion capsule and thereby control the production process of beverage and food by adapting, for example, the pressure, the temperature and/or the amount of water.

[00026] According to a further preferred embodiment of the present invention, it is provided that at least a part of the grooves and at least in a subarea parallel to the main plane of the membrane is gearwheel shaped.

[00027] According to the present invention it is an advantage that it is possible to increase the stability of the portion capsule's wall region, to realize improved turbulences of the extraction liquid and thereby to improve the extraction's process under the same conditions, for example, such as material thickness and the like. Another advantage is that it is easy to generate a mechanical identifier or a mechanical fitting that matches with a fitting tool that belongs to the device for producing a beverage. According

to the invention it is an further advantage that, for example, a gearwheel, which is attached to the device for producing a beverage and is, for example, located in the region of the media chute or similar, can possibly interacts with the gearwheel's contour of the portion capsule. In this way it is possible to generate a mechanical fitting that allow to individualize the portion capsule as a proper one and/or to specify the sort of portion capsule and/or to rotate the portion capsule about an axis of rotation, that is perpendicular to the membrane's main plane, by using the gearwheel's arrangement. Such an embodiment of the invention makes it possible that the portion capsule is always opened with the device for producing a beverage on the same spot (with respect to its angular position) and therefore the raw material is extracted on the same manner. Moreover the grooves prevent the portion capsule from being inserted into the coffee machine.

[00028] In a preferred version of the invention, it is provided that there is a flange/edge region being averted from the bottom region, for fixing the membrane to the base element, where in the wall region between flange/edge region and bottom region preferably has a border and the grooves are being preferably extended to this border.

[00029] Because of this it is another advantage according to the invention that on the one hand the wall region can be constructed in a stable and reinforced manner and on the other hand the gearwheel shaped contour of the grooves, located at the wall region, is able to absorb a relative high load. With that it is possible that the portion capsule can be rotated easily and without any damaging of the portion capsule within the device for producing a beverage.

[00030] Preferably the base element's diameter is enlarged in the border's region compared to the wall region, which range from the border to the bottom region.

[00031] This gives rise to the advantageous possibility to stack portion capsule or portion capsules' base elements easily and robustly.

[00032] Moreover it is preferred that at least a part of the grooves are gearwheel shaped and at least a plane, which is at least partially gearwheel shaped, is parallel to the membrane in such a way that the gearwheel shaped contour expands over the borders or the flange/edge region.

[00033] Further preferred versions of the present invention relate to portion capsules that implement one or more of the following characteristics:

- the base element tapers in the direction of the flange in the border's region,
- the grooves directed toward the bottom region expand over the border's region,
- the grooves approximately cover 20% -80%, preferably 40% - 60% of the wall region, which is placed between the border and the bottom region,
- the grooves are constructed in such a way that the wall region is reinforced and/or the grooves causes an extraction liquid's turbulence in the cavity.

[00034] Other preferred versions of the present invention relate to portion capsules that are manufactured in such a way that the ratio of the diameter of that wall region of the base element which adjoins the flange to the diameter of the flange is between 0.85 and 0.89, and in particular substantially 0.87.

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[00035] In a preferred version, the wall region's diameter, which is adjacent to the flange, is 39 millimeters and the flange's diameter is 45 millimeters. Another advantageous version of the invention prefers a base element having a thicker wall region in the border's region compared to the wall region between bottom region and flange. Since the portion capsule's design, which contains grooves in the wall region, improves its stability, it is possible to save material by manufacturing the portion capsule and therefore to reduce cost and energy required for manufacturing the portion capsules.

[00036] According to the invention it is further provided that a filter element is arranged into the cavity. Such a filter element divides the cavity into a first region for accommodating the beverage raw material and into a second region for accommodating a beverage extract. In particular, it is provided that the filter element is made of a non-woven material.

[00037] According to a further subject matter or a preferred development of the present invention the portion capsule according to the invention is intended for the preparation of a hot beverage. In the following the invention is explained based on the Figures 1 - 22. These explanations do not restrict the general idea of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[00038] **Figures 1A and 1B show** a portion capsule containing sections that differs optically.

[00039] **Figures 2A, and 2B show** a portion capsule containing a barcode.

[00040] **Figure 3** shows a portion capsule with recesses and bulges.

[00041] **Figure 4** shows a portion capsule containing sections that differs optically.

[00042] **Figure 5** shows a portion capsule with a key function.

[00043] **Figure 6** shows a portion capsule's wall that is electrically conductive.

[00044] **Figure** 7 shows a portion capsule's wall containing sections that differs optically.

[00045] **Figure 8** shows an enlarged pot construction of the portion capsule's wall.

[00046] **Figure 9** shows an edge region that is electrically conductive.

[00047] **Figure 10** shows a portion capsule containing a bottom that is electrically conductive.

[00048] **Figure 11** shows an embodiment containing a layer that can be detected by a metal detector.

[00049] **Figure 12** shows a metallic strainer.

[00050] **Figure 13** shows a portion capsule containing a ferromagnetic section.

[00051] **Figure 14** shows a portion capsule containing a barcode.

[00052] **Figure 15** shows a portion capsule containing a section, which is electrically conductive, in the wall.

[00053] **Figures 16A and 16B show** a portion capsule with a gearwheel placed in the brewing chamber.

[00054] **Figures 17 a-c** show different embodiments of the portion capsule according to Figures 16A and 16B.

[00055] **Figure 18** shows the portion capsule according to the Figures 16 A and 16B and Figures 17 a-c, when the portion capsule is fit locking with a gearwheel.

[00056] **Figures 19 and 20** show a schematic view of a portion capsule according to an embodiment of the presented invention.

[00057] **Figures 21 and 22** show two sectional views of the portion capsule according to an embodiment of the presented invention.

DETAILED DESCRIPTION

[00058] **Figures 1A and 1B** show a portion capsule 1 comprising a base element 2 that has a wall region 2.1 and a bottom area 2.2. The wall region 2.1 and the bottom area 2.2 define a cavity 3, which may include the raw material and perhaps a built-in element. After filling, the cavity 3 is sealed by a membrane 4, which is preferably attached to the edge region 2.4 of the base element using seal or glue. This portion capsule can be inserted into a brewing chamber 12, with a liquid, in particular water, flowing through it. During this process, the raw material is extracted or dissolved and therefore the beverage is produced. According to the invention the portion capsule has only one identifier that allows to determine whether the respective portion capsule goes with the coffee machine's brewing chamber and the parameters for processing are chosen properly. If it is not the case, significant security issues arise. Inserting the wrong portion capsule, for example, endangers the brewing chamber's tightness. In this case hot water can be discharged under high pressure and therefore compromise the user's safety. Otherwise it is also possible that inserting the wrong portion capsule damages the coffee machine. In this example the identifier is represented by several raised areas 8, which differ in reflection properties from the sections between the raised areas. As shown by the arrows the bulges are passed by a mean for detection 13 (here: an optical detector)

that is able to differentiate between the unequal sections 5, 6 having different optical properties such as, for example, reflection. Switching between the different sections or the number of bulges represents the identifier. After the identifier has been read out the identifier is compared to a stored reference. If the identifier agrees with the reference, the coffee machine will start operating. Particularly the pump, which is for example responsible for pushing hot water through the brewing chamber, will not start operating, if the identifier does not agree with the reference.

[00059] All the remarks concerning the identifier apply to all the examples.

[00060] **Figures 2A and 2B** show another embodiment of the portion capsule 1 according to the invention. The portion capsule 1 comprises a base element 2 that has a wall region 2.1 and a bottom area 2.2. Here the portion capsule 1 has a barcode 50 placed in the area of the membrane's 4 top surface. This barcode may be printed by material removal or may be generated by a medium that is integrated in the foil and can be detected optically such as a fluorescence agent. Alternatively, metal rings may be part of the foil or attached to the foil. The barcode's section may be made of a ferromagnetic material. As shown by the arrow 15 the barcode 50 alternatively can be attached to the base element's edge region being averted from the membrane 4. Such a barcode is read out by a detector 13 placed, for example, in the media chute. The barcode represents the identifier according to invention.

[00061] **Figures 3A and 3B** show another embodiment of the portion capsule 1 according to the invention. In the present case the identifier comprises recesses and bulges

7, 8, which result from material removal or reshaping the portion capsule as shown here by the example of the portion capsule's wall 2.1. In the present case, recesses and bulges interact with a means for detection 13, which operates like a key, wherein the coffee machine only start operating, when all elements 14 are placed in the respective recess 7. Therefore, an electric circuit may be changed or especially closed.

[00062] **Figure 4** shows an embodiment of the portion capsule being substantially identical to the embodiment illustrated in Figure 1. As an alternative version of the invention, the figure additionally shows that the unequal sections 5, 6 differing in terms of optical properties can be attached to the cover foil, for example in the form of a barcode.

[00063] **Figure 5** shows an embodiment of the portion capsule being substantially identical to the embodiment illustrated in Figure 3 that includes recesses 7 and bulges 8. Again, the recesses represent the key bit. The coffee machine only will start operating, if the recesses interact with the corresponding bulges and therefore an electric circuit is changed respectively. The placement of such a system is not restricted to the brewing chamber. For instance, the system may be placed in the portion capsule's media chute.

[00064] **Figure 6** shows a version of the invention that includes a base element 2 and an electric material forming a surrounding ring 2.3, which preferably has a raised form. The electrically conductive material is scanned by means for detection 13 having electric sliding contacts, which are placed in the media chute and form electric contacts of an electric circuit, while the portion capsule is inserted.

[00065] **Figure** 7 shows an embodiment of the portion capsule being substantially identical to the embodiment illustrated in Figure 6, in which it is provided that the ring area has reflective 21 or mat 22 sections, for example in form of a covering, and allows a read-out by means for detection 13 for optical detection, which are placed in the media chute and are part of a control current, while the portion capsule is inserted.

[00066] **Figure 8** shows a relative broad and raised ring 2.3 which represents the identifier. The media chute is equipped with a corresponding vacancy that tests whether the portion capsule has the proper identifier. The broad ring is scanned, for example, by means for detection 13 having mechanical sensors, which are placed in the media chute and close the contacts of an electric circuit, while the portions capsule is inserted.

[00067] **Figure 9** shows another embodiment of the portion capsule according to the invention. In the present case an electrically conductive coat 10 is integrated in the edge region's back and is scanned by electric sliding contacts, which are placed in the media chute and form electric contacts of an electric circuit, while the portion capsule is inserted.

[00068] **Figure 10** shows another embodiment of the portion capsule according to the invention. In the present case the portion capsule has an electrically conductive coat 10 at the bottom area 2.2 such as a conductive varnish layer or an aluminum foil. The coat is scanned by means for detection 13 having electric sliding contacts, which form electric contacts of an electric circuit, while the portion capsule is inserted.

[00069] **Figure 11** illustrates a version of the portion capsule having also an electrically conductive coat 10 that is placed on its bottom 2.2 and is identified by a means for detection 13 having a metal sensor, which is placed in the chute and, for example, detects inductively, while the portion capsule is inserted.

[00070] The embodiment of the invention shown in **Figure 12** has a build-in element made of metal (here a strainer 19) that is recognized as identifier by a means for detection 13 having a metal detector.

[00071] The version of the invention shown in **Figure 13** includes a ferromagnetic material 20 placed at the portion capsule' bottom. The identifier is scanned, by means for detection 13 for example, by a magnet, which is placed in the chute, while the portion capsule is inserted. The ferromagnetic material acts as identifier.

[00072] **Figure 14** shows another embodiment which includes a barcode placed in the region of the cover foil. The portion capsule includes a flange 17.

[00073] According to the embodiment shown in **Figure 15** a metallic ring 11 is integrated in the wall region 2.1 and closes means for detection 13 having an electric circuit placed in region of the brewing chamber.

[00074] **Figures 16A and 16B** show another embodiment of the portion capsule 1 according to the invention. The illustrated portion capsule features a base element 2 that is basically conical- shaped in the present case and has a bottom region 2.2 and a wall

region 2.1. It is provided that the base element contains the raw material and, if necessary, build-in elements like a filter as illustrated here. The expert knows that the build-in element may also include other build-in elements. A flange 17 /edge region 2.4, which is preferably circular and, for example, may be used for sealing a cover foil 4 to it, is attached to the end of the base element, which is placed opposite to the bottom. The flange/edge region has means for fit locking, friction locking and/or detection 2.4.2 in the outer area (outer circumference). As especially shown in the Figures 17a - 17c the means for fit locking, friction locking and/or detection 2.4.2 is, in the present case, a gearwheel that is formed by several recesses/bulges evenly arranged in the edge region. Preferably, it is provided that the edge region has a sealing surface 2.4.1, which sealingly interacts with the seal 31 attached to the brewing chamber 27, on the interior side of the gearwheel. The sealing 31 makes sure that the water coming from a water inlet 28 flows through the portion capsule by passing an opening, which has been made by a mandrel 29, than around it.

[00075] **Figures 17a - 17c** show different embodiments of the means for fit locking, friction locking and/or detection 2.4.2. According to the version shown in Figure 17a, the gearwheel has forty-five teeth. According to the version shown in Figure 17b or 17c, the gearwheel has twenty-two or twenty-nine teeth, respectively. The expert knows that the manufactured teeth can be shaped arbitrarily. All Figures 17a - 17c demonstrate how the portion capsule 1 can be held by a part of the brewing chamber 27 using two holding arms 30. The holding arms interacts with the means for fit locking, friction locking and/or detection 2.4.2. If they are not available, the holding arms will not hold the portion capsule and the portion capsule will not be inserted into the brewing chamber and will fall

through it into a dropping box instead. The portion capsule has a base element 2, a wall region 2.1, a bottom area 2.2, a sealing surface 2.4.1, and an edge region 2.4.

[00076] **Figure 18** shows the means for fit locking, friction locking and/or detection 2.4.2 along with mean for fit locking 24, which is attached to the coffee machine and is represented by a pinion here. It is provided that the mean for fit locking 24 is placed in the media chute or insertion shaft 26 of an insertion shaft housing 23 having a port for inserting the portion capsule in the coffee machine. The distance between the inner wall 25 of the portion capsule 1 and the mean for fit locking 24 represented by the pinion 24 are designed in such a way that the portion capsule only will pass the port, if the means for fit locking, friction locking and/or detection 2.4.2 is formed complementary to the teeth of the mean for fit locking 24 represented by the pinion. Only in this case the portion capsule rotates the mean for fit locking 24 represented by the pinion 24 while it falls. Both rotating and falling are represented by arrows in the figure. The portion capsule needs the rotation for passing the media chute's port and falling in the intended position afterwards. If the portion capsule has no or wrong mean of fit locking, it will be impossible to place the portion capsule by passing the media chute in the intended position. Additionally or alternatively, it is provided that the mean for fit locking 24 represented by the pinion has a pick-up that detects the rotary movement and transmits it to a control unit. If the rotation at least corresponds a defined rotating element, the control unit will activate, for example, the brewing unit. The expert knows that the portion capsule's border may include means for friction locking that interacts with a mean, for example an edge, and shift it in such a way that the shift is detected and therefore the brewing chamber is activated. The portion capsule 1 has a cover foil 4 and a sealing surface 2.4.1.

[00077] The expert moreover knows that a sensor, being for example a camera, which detects the form of the means for fit locking, friction locking and/or detection 2.4.2., may be installed in the media chute. In the present case the form and/or the distance between the teeth may be detected. If the proper portion capsule was inserted, a resulting signal could be transmitted to a control unit, which activates the brewing chamber.

[00078] **Figure 19** schematically shows a view of another portion capsule's version according to an embodiment of the present invention. **Figure 20** illustrates the same portion capsule from a different point of view schematically. Figure 19 shows the front view of the portion capsule. Figure 20 shows the portion capsule viewed from an angle below. In all figures the portion capsule is labeled with the reference sign 1. The portion capsule substantially has a frustoconically shaped base element 2, which is formed similar to a pot and encloses a cavity 3. The cavity 3 is sealed by a membrane 4. Since the viewing direction of Figure 19 is essentially parallel to the plane, in which the membrane is located, the membrane is at the upper edge of the portion capsule. In particular, the base element 2 comprises a soft, semi-rigid or rigid plastic material which is deep-drown, preferably. The membrane comprises a foil made of plastic material or aluminum. Preferably the base element has a circumferential mounting flange 17 in the region of the membrane, with the membrane and the mounting flange 17 being firmly bonded, in particular by welding or gluing. Preferably a filter element, which is not specifically depicted in the figures, is placed within the base element 2. For instance, the filter element is made of thermoplastic resin such as, for example, polypropylene. The filter element could also be made of a non-woven material such as, for example, thermoplastic resin.

Preferably the filter element divides the cavity 3 in two sections. It is provided that the first section can be filled with a raw material and the second section can be filled with and particularly collect a beverage's extract, which is not shown, during the extractions process. Both sections are not illustrated individually.

[00079] The portion capsule is intended for inserting into a brewing chamber or a device for producing a beverage, which is not shown here. In particular such a device for producing a beverage is a coffee machine. The device for producing a beverage could be also a machine that produces a tea drink, a chocolate drink or any other beverage. Preferably an extraction liquid, which is particularly water or hot water, is brought under high pressure into the brewing chamber of the device for producing a beverage. The extraction liquid interacts with the raw material of the beverage in such a way that an extract of a beverage or a beverage is generated. In particular the filter element is utilized as a strainer for the extract of a beverage.

[00080] According to the invention, the base element 2 has a wall region 2.1 and a bottom area 2.2. The wall region 2.1 basically ranges from the flange 17 to the bottom region 2.2. Several grooves 32 are placed in the wall region. In particular these grooves are keyways that are integrated in the wall region 2.1 and are facing the cavity 3 and range from the flange 17 to the bottom region 2.2 (i.e. they run perpendicular according to Figure 19). According to the invention provision is made for the grooves 32 to be extended vertically across the wall region, i.e. they run straight from the flange 17 to the bottom region 2.2, in which it is not necessary that they are extended over the whole length. The grooves are formed according to the invention in such a way that the wall

region is reinforced or stiffened due to the grooves 32. Moreover, the plurality of the grooves 32, which are distributed over the wall region 2.1, realize an adhesion between wall region 2.1 and the brewing chamber's wall of the device for producing a beverage after the extraction process. This makes it easier to eject the portion capsule from the brewing chamber automatically. The portion capsule's version represented in Figure 19 comprises a circumferential border 16 that is placed at the wall region 2.1 ranging from the flange 17 to the bottom area 2.2, namely adjacent to the flange 17 facing towards the bottom area 2.2. The border 16 has an enlarged diameter (parallel to the membrane 4) compared to the wall region's ranging from the border 16 to the bottom area 2.2. It is provided that the border's contour 16 is designed in such a manner that the border's diameter tapers towards the flange 17.

[00081] It is provided according to the portion capsule's embodiment, which is represented in Figure 19 and is in accordance with the invention, that the grooves 32 are placed in the border's region in the first part, partially range from the border 16 to the bottom area 2.2 across the wall region 2.1, in the second part and then finally end. All in all the grooves cover, for example, around 50 % of the extension of the wall region 2.1, which ranges from the flange 17 to the bottom area 2.2, wherein one-third of the grooves' extension is placed in the border's region and two-thirds of the grooves' extension is placed in the remaining wall region 2.1 that range from the border 16 to the bottom area 2.2.

[00082] A portion capsule 1 according to the invention is shown as sectional view along the portion capsule's extension regarding its height in **Figure 21,** i.e. the

section's plane is perpendicular to the membrane's main plane. **Figure 22** also shows a portion capsule according to the invention in a sectional view portraying the sectional plane, which is parallel to the membrane's main plane. It is noticeable that the interior of the portion capsule's cavity is shown in Figure 21. The portion capsule's material or the base element's material is so thin that the implementation of grooves 32 at the exterior shown in Figure 19 leads to corresponding convexities 34 and impressions at the interior. Figure 22 particularly illustrates the gearwheel shaped contour 36 resulting from insertion of grooves in the portion capsule's 1 wall region.

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PORTION CAPSULE HAVING AN IDENTIFIER

~~CROSS-REFERENCE TO RELATED APPLICATIONS~~

~~[0001] This application claims benefit from and is a divisional of U.S. Application No. 15/211,823 filed July 15, 2016 entitled PORTION CAPSULE HAVING AN IDENTIFIER,~~

~~which claims benefit from and is a continuation of U.S. Application No. 13/744,633, filed January 18, 2013, entitled PORTION CAPSULE HAVING AN IDENTIFIER, which claims benefit from International Application No. PCT/EP2011/003677, filed on July 22, 2011, entitled PORTION CAPSULE HAVING AN IDENTIFIER, which applications are hereby incorporated by reference in their entirety.~~

FIELD

[0001] These teachings relate to a portion capsule and method for producing a beverage.

BACKGROUND

[0002] The present invention relates to a portion capsule for producing a beverage, comprising a base element having a cavity in which a beverage raw material is provided and which is closed by a membrane fastened to the base element.

[0003] Such capsules are well known and are being launched onto the market in abundant variety. Since these capsules are often quite similar, it is possible that the manufacturer's

capsules are used in a coffee machine designed by another manufacturer, although they are not suited for it. This may result in significant security issues and/or the coffee machine may be damaged.

[0004] The object of the present invention is therefore to provide a portion capsule which only is suitable for a specific coffee machine.

SUMMARY

[0005] The object is accomplished according to the present invention by a portion capsule for producing a beverage, comprising a base element having a cavity in which a beverage raw material is provided and which is closed by a membrane fastened to the base element, wherein it has an identifier, which allows to individualize the respective portion capsule.

[0006] The present invention relates to a capsule for producing a beverage or foodstuff, comprising a base element having a cavity in which a beverage raw material is provided. Such capsules are, for example made of plastic, natural materials and/or biodegradable materials and substantially have a base element, in particular a deep-drown base element, i.e. it is substantially designed frustoconically or cylindrically. The beverage raw material is arranged within the portion capsule's cavity and is extracted and/or dissolved in a liquid, in particular water. After the beverage raw material has been filled into the cavity the base element is usually sealed by a membrane. In particular the membrane is localized on the opposite side of the base element's bottom. The membrane can be made of the same or different material as the base element and is substantially attached to the base element using a sealing and/or an adhesive bonding. Additionally the cavity could contain one or

several built-in elements, such as, for example a filter, a non-woven, a felt, a shut-off device and/or something similar to those. For the case that a non-woven and a felt are arranged within the cavity, they are interconnected preferably. The non-woven and/or the felt can be made of several layers in such a way that the layers may differ in the kind of its starting material and/or its preparation. Moreover the membrane and/or the bottom can be provided with a plurality of recesses (holes).

[0007] According to the present invention, it is provided that the portion capsule has an identifier that allows to individualize the respective portion capsule. In the context of this invention individualizing means that the respective portion capsule can be assigned to a group of capsules that are suitable for the coffee machine preferably. It is not necessary that the coffee machine is able to specify and/or identify the portion capsule. In fact it is much more important that the coffee machine associates the portion capsule with a group of portion capsules, which is suitable for the coffee machine. In particular, individualizing means that those portion capsules that are not appropriate for the coffee machine cannot be inserted into and/or directly fall through the holder, which is designed for the portion capsules in the coffee machine, and/or the coffee machine operates only with the corresponding portion capsules. Preferably a sensor/detection system handles the identifier and compares it with a stored reference substantially. Preferably, the coffee machine, in particular the water-providing- pressure pump, will be activated if the detected identifier matches with the reference. Otherwise the coffee machine will not start operating. Preferably the detection system is placed in the region of the coffee machine's media chute designed for the portion capsules. According to another preferred embodiment of the invention, the detection system may be placed in the region of the

brewing chamber. Another possible embodiment of the invention provides that the identifier prevents portion capsules from inserting into the coffee machine. Alternatively or additionally, means, in particular mechanical means, more preferably, one or more gearwheels, may be added to the media chute in order to guarantee that incorrect portion capsule cannot be inserted into the coffee machines by passing the media chute.

[0008] Preferably the identifier is composed of surface areas having different optical properties, for example reflection. These surfaces may be localized on the membrane, the side wall and/or the bottom of the portion capsules. Preferably, the portion capsule has at least two areas which differ in their optical properties, for example the reflection characteristics.

[0009] The detection of a recess and/or a bulge is also preferred. Preferably, recess and bulges alternate and/or at least two recesses or bulges are separately placed from each other. Especially it is possible that the recess and/or the bulge form a gearwheel that is attached to the outer border and/or at least partially extends to the wall region of the portion capsule. The recess and/or bulge may be produced by any shaping method, for example by deep drawing, preferably.

[00010] Furthermore, the recess may be realized by removing material. In particular the material's ~~remove~~ removal can be accomplished by punching or using a laser on condition that this processing does not damage a barrier layer placed in the portion capsule's material, which prevents moisture or aroma from escaping out of the portion capsule and/or water vapor or oxygen enters the capsule. The reading of the identifier,

which is encoded in the recess and/or bulge, may be a result from a mechanical and/or optical method, for example. Alternatively or additionally, the identifier can be used to avoid that the portion capsule is inserted into the coffee machine. This applies in particular to the media chute. For example it is possible to design a portion capsule comprising a ring gear that is placed on its circumference and is compatible with another ring gear, which is placed in the media chute. If the media chute's ring gear only revolves for a corresponding ring gear of the portion capsule and its revolving allows the portion capsule to pass, only portion capsules equipped with the proper ring gear will pass the insertion lock.

[00011] According to a further subject matter of a preferred development of the present invention, the identifier may be included in the membrane. Preferably, the identifier is a layer or partial layer of the membrane. Such identifiers may be an optically detectable material, for example a fluorescent material. Furthermore, the identifier may be designed with layers made of metal or ferrous metal or stripes made of metal or ferrous metal in or on the membrane, respectively.

[00012] Preferably the identifier is a machine-readable imprint. This is realized with a print in food approved color, preferably. Fluorescent materials like paper or print materials, whose optical properties change under the influence of temperature, are favored also. Preferably the print is a barcode, a logo or a ~~supportrepeat~~ pattern.

[00013] According to a further subject matter of a preferred development of the present invention, the identifier is an electrically conductive section, which can be placed

all over the portion capsule, but is localized on the side wall, the edge and/ or the floor preferably. The electrically conductive section, which is inserted into the coffee machine, can become part of an electric circuit and causes therefore a measurable change, which leads to the identification of the respective portion capsule. In a further preferred embodiment, the identifier is a section made of a ferromagnetic material.

[00014] Another construction version favors a RFID chip being the identifier.

[00015] If the portion capsule is customized according to the invention, portion capsules that are not in line with the coffee machine will be prevented from inserting into the coffee machine. Furthermore it is possible that the identifier allows to identify the portion capsule located in the brewing chamber in such a way that the production process of beverage or food may be controlled, for example by adjusting the temperature, the pressure and/or the amount of water.

[00016] According to a further subject matter of a preferred development of the present invention, the portion capsule's material is weakened in the bottom area caused by a selective material removal, for example by using a laser. The weakening is provided for piercing the portion capsules using a mandrel. This procedure is needed for the beverage's preparation. Since the material is weakened in the section, which is treated with a laser and is supposed to be pierced using the mandrel, the degree of necessary force for piercing the portion capsule is reduced. The mandrel of such coffee machines is usually equipped with a force limitation that limits the force, which is dedicated for pressing the mandrel against the portion capsule's bottom. This preparation avoids that portion capsules having

no appropriate weakening can be used in such a coffee machine. Consequently the weakening represents another kind of identifier.

[00017] According to a further subject matter of a preferred development of the present invention, the portion capsule has an edge region, which is preferably attached to the base element. Preferably, the edge is located opposite of the base element's bottom area. After the raw material has been filled in the portion capsule, a membrane can be attached to this edge region, for instance. Moreover the edge can also designed for guiding the portion capsule into the chute in order to position the portion capsule in the brewing chamber properly. Simultaneously it is possible to use the surface of the edge for stopping and/or sealing.

[00018] Preferably provision is made for the portion capsule to have means for fit locking, friction locking and/or detection in the edge region. The means for fit locking and/or friction locking may be used to activate a complementary mechanism, which is located in the coffee machine, in order to allow inserting the portion capsule into the coffee machine and/or starting a sensor, like a gearwheel, that transmits a signal to a control unit depending on whether the portion capsule corresponds to the coffee machine or not. Alternatively or additionally, a detector may identify the mean for fit locking, friction locking and/or detection in order to check that the portion capsule is suitable to the respective coffee machine.

[00019] Preferably the means for fit locking, friction locking and/or detection is a gearwheel or a gearwheel' segment, which are located, in particular, in the outer area of

the edge region. The teeth of the gearwheel or the gearwheel' segment may be shaped in any commonly used form, which is known, for example, by an expert from gear manufacturing. Preferably it is provided that these teeth are triangular, rectangular, square or wavy.

[00020] Preferably there is a sealing surface, that is arranged on the interior side relative to the gearwheel or the gearwheel' segment.

[00021] Another and preferred state-of-the-art technology is a portion capsule for producing a beverage, comprising a base element substantially designed frustoconically or cylindrically, having a cavity in which a beverage raw material is provided and which is closed by a membrane fastened to the base element with the base element having a wall region and the base element having a bottom area, which is preferably located opposite to the membrane, with the wall region having several grooves and the grooves which are located between membrane and bottom area covering the wall region along its height at least partially. The grooves may be also located in the edge region, in particular on the outer area of the edge region.

[00022] This portion capsule has the advantage over the portion capsule according to the state-of-the-art technology that, for instance, the grooves reinforce the base element's wall region. On the one side these grooves make the portion capsule more stable towards mechanical forces and prevent the portion capsule from deformation and buckling, in particular. The arrangement of the grooves, which are located at the wall region, additionally improves the performance of the portion capsule while the

extraction liquid flows through it in the brewing chamber, since the arrangement of the grooves, in particular those partially expending over the wall region between membrane and bottom area, increase quality and reliability of the extraction process significantly. According to the invention another advantage is that the base element's thickness can be reduced, because the use of grooves improves the physical stability. The production of the portion capsule is therefore much less expensive and more environmentally friendly. On the other side the grooves reduce or avoid the contact between the portion capsule's wall region and the wall of the brewing chamber. As a result ejecting or removing the portion capsule from the brewing chamber is made easier. Another advantage of using a plurality of grooves is that the stream of the extraction liquid, which flows along the base element in the cavity, can be optimized by choosing a grooves' structure that is able, for example, to generate on the one hand a better or stronger turbulence in the extraction liquid or on the other hand a more uniform (laminar) flow of the extraction liquid, in the wall region. The control of the liquid may be obtained by the structure of the grooves itself or by using simple means additionally. A stronger turbulence compared to the one known in the state-of-the-art has the advantage that no unintended and casual main streams are formed in the raw materials. Instead the extraction liquid equally flows through the raw material in all of the volume. Thus the extraction process is much more efficient and can be controlled more precisely and reproducibly.

[00023] In particular the raw material may be coffee powder (especially ground roasted coffee), chocolate powder, milk powder, tea or the like. Alternatively, it is conceivable that the raw material is a beverage's extract, such as instant coffee for

example.

[00024] In particular, the grooves are recesses and bulges, which are preferably directed along a main extension and are preferably extended along the wall portion or the periphery of the edge region. More preferably, the grooves are formed as webs and/or notches. A gearwheel, for instance, may be obtained by the grooves. Therefore the grooves are part of the base elements' wall, optionally located on the inner side facing to the cavity and/or on the outside facing away from the cavity.

[00025] According to a preferred embodiment of the present invention, it is provided that the grooves form an identifier that allows individualizing the portion capsule. In the context of this invention individualizing preferably means that the respective portion capsule can be assigned to a group of capsules that are suitable for the respective coffee machine or the machine producing a beverage. It is not necessary that the coffee machine or the device for producing a beverage is able to specify and/or identify the portion capsule. It is more important that the device for producing a beverage, in particular a coffee machine, associates the portion capsule with a group of portion capsules, which is appropriate for the respective device for producing a beverage, in particular a coffee machine. In particular, individualizing means that those portion capsules that are not appropriate for the coffee machine (or the device producing the beverage) cannot be inserted into and/or directly fall through the holder, which is designed for the portion capsules in the coffee machine (or the device producing the beverage), and/or the coffee machine (or the device producing the beverage) operates only with corresponding portion capsules ("proper portion capsule"). In particular, individualizing

means that the coffee machine or the device producing the beverage will not operate properly in the intended use, if the used portion capsule is not customized according to the invention. Preferably a sensor/detection system, attached to the coffee machine or the device producing the beverage, records the identifier and substantially compares it with a stored reference. In particular, it is possible that such an identification process is based on a mechanical fitting, especially a fitting of a gearwheel or of a contour comparable with a gearwheel, which is attached to the device producing the beverage or the coffee machine and interacts with the portion capsule. It is preferred that the device for producing the beverage or the coffee machine only will operate, if the identifier matches to the reference or the mechanical fittings match with each other. In this case the device for producing the beverage particularly starts to operate, especially activates a pressure or water pump. The mean for detection or mechanical fitting is preferably located in the region of the media chute or in the region of the device for producing the beverage. Alternatively the identifier or the mechanical fitting may avoid that an unsuitable portion capsule is inserted into the device for producing the beverage. A portion capsule, which is designed in accordance with the invention, makes it possible that a portion capsule that is not designed for the device for producing a beverage cannot be inserted into it. Additionally the identifier allows that the device for producing the beverage, especially the coffee machine, may specify the sort of the portion capsule and thereby control the production process of beverage and food by adapting, for example, the pressure, the temperature and/or the amount of water.

[00026] According to a further preferred embodiment of the present invention, it is provided that at least a part of the grooves and at least in a subarea parallel to the main

plane of the membrane is gearwheel shaped.

[00027] According to the present invention it is an advantage that it is possible to increase the stability of the portion capsule's wall region, to realize improved turbulences of the extraction liquid and thereby to improve the extraction's process under the same conditions, for example, such as material thickness and the like. Another advantage is that it is easy to generate a mechanical identifier or a mechanical fitting that matches with a fitting tool that belongs to the device for producing a beverage. According to the invention it is an further advantage that, for example, a gearwheel, which is attached to the device for producing a beverage and is, for example, located in the region of the media chute or similar, can possibly interacts with the gearwheel's contour of the portion capsule. In this way it is possible to generate a mechanical fitting that allow to individualize the portion capsule as a proper one and/or to specify the sort of portion capsule and/or to rotate the portion capsule about an axis of rotation, that is perpendicular to the membrane's main plane, by using the gearwheel's arrangement. Such an embodiment of the invention makes it possible that the portion capsule is always opened with the device for producing a beverage on the same spot (with respect to its angular position) and therefore the raw material is extracted on the same manner. Moreover the grooves prevent the portion capsule from being inserted into the coffee machine.

[00028] In a preferred version of the invention, it is provided that there is a flange/edge region being averted from the bottom region, for fixing the membrane to the base element, where in the wall region between flange/edge region and bottom region preferably has a border and the grooves are being preferably extended to this border.

[00029] Because of this it is another advantage according to the invention that on the one hand the wall region can be constructed in a stable and reinforced manner and on the other hand the gearwheel shaped contour of the grooves, located at the wall region, is able to absorb a relative high load. With that it is possible that the portion capsule can be rotated easily and without any damaging of the portion capsule within the device for producing a beverage.

[00030] Preferably the base element's diameter is enlarged in the border's region compared to the wall region, which range from the border to the bottom region.

[00031] This gives rise to the advantageous possibility to stack portion capsule or portion capsules' base elements easily and robustly.

[00032] Moreover it is preferred that at least a part of the grooves are gearwheel shaped and at least a plane, which is at least partially gearwheel shaped, is parallel to the membrane in such a way that the gearwheel shaped contour expands over the borders or the flange/edge region.

[00033] Further preferred versions of the present invention relate to portion capsules that implement one or more of the following characteristics:

- the base element tapers in the direction of the flange in the border's region,
- the grooves directed toward the bottom region expand over the border's region,

- the grooves approximately cover 20% -80%, preferably 40% - 60% of the wall region, which is placed between the border and the bottom region,
- the grooves are constructed in such a way that the wall region is reinforced and/or the grooves causes an extraction liquid's turbulence in the cavity.

[00034] Other preferred versions of the present invention relate to portion capsules that are manufactured in such a way that the ratio of the diameter of that wall region of the base element which adjoins the flange to the diameter of the flange is between 0.85 and 0.89, and in particular substantially 0.87.

[00035] In a preferred version, the wall region's diameter, which is adjacent to the flange, is 39 millimeters ~~millimeter~~ and the flange's diameter is 45 millimeters~~millimeter~~. Another advantageous version of the invention prefers a base element having a thicker wall region in the border's region compared to the wall region between bottom region and flange. Since the portion capsule's design, which contains grooves in the wall region, ~~improve~~ improves its stability, it is possible to save material by manufacturing the portion capsule and therefore to reduce cost and energy required for manufacturing the portion capsules.

[00036] According to the invention it is further provided that a filter element is arranged into the cavity. Such a filter element divides the cavity into a first region for accommodating the beverage raw material and into a second region for accommodating a beverage extract. In particular, it is provided that the filter

element is made of a non-woven material.

[00037] According to a further subject matter or a preferred development of the present invention the portion capsule according to the invention is intended for the preparation of a hot beverage. In the following the invention is explained based on the Figures 1 - 22. These explanations do not restrict the general idea of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[00038] **Figures 1**A and 1B show ~~shows~~ a portion capsule containing sections that differs optically.

[00039] **Figures 2**A and 2B show ~~shows~~ a portion capsule containing a barcode.

[00040] **Figure 3** shows a portion capsule with recesses and bulges.

[00041] **Figure 4** shows a portion capsule containing sections that differs optically.

[00042] **Figure 5** shows a portion capsule with a key function.

[00043] **Figure 6** shows a portion capsule's wall that is electrically conductive.

[00044] **Figure** 7 shows a portion capsule's wall containing sections that differs optically.

[00045] **Figure 8** shows an enlarged pot construction of the portion capsule's wall.

[00046] **Figure 9** shows an edge region that is electrically conductive.

[00047] **Figure 10** shows a portion capsule containing a bottom that is electrically conductive.

[00048] **Figure 11** shows an embodiment containing a layer that can be detected by a metal detector.

[00049] **Figure 12** shows a metallic strainer.

[00050] **Figure 13** shows a portion capsule containing a ferromagnetic section.

[00051] **Figure 14** shows a portion capsule containing a barcode.

[00052] **Figure 15** shows a portion capsule containing a section, which is electrically conductive, in the wall.

[00053] **Figures 16**A and 16B ~~show~~ shows a portion capsule with a gearwheel placed in the brewing chamber.

[00054] **Figures 17 a-c** show different embodiments of the portion capsule according to ~~Figure 16~~Figures 16A and 16B.

[00055] **Figure 18** shows the portion capsule according to the Figures 16 A and 16B and Figures 17 a-c, when the portion capsule is fit locking with a gearwheel.

[00056] **Figures 19 and 20** show a schematic view of a portion capsule according to an embodiment of the presented invention.

[00057] **Figures 21 and 22** show two sectional views of the portion capsule according to an embodiment of the presented invention.

DETAILED DESCRIPTION

[00058] ~~The view illustrated on the right side of~~ **Figures 1**A and 1B ~~show~~ shows a portion capsule 1 comprising a base element 2 that has a wall region 2.1 and a bottom area 2.2. The wall region 2.1 and the bottom area 2.2 define a cavity 3, which may include the raw material and perhaps a built-in element. After filling, the cavity 3 is sealed by a membrane 4, which is preferably attached to the edge region 2.4 of the base element using seal or glue. This portion capsule can be inserted into a brewing chamber ~~12shown in Figure 13~~, with a liquid, in particular water, flowing through it. During this

process, the raw material is extracted or dissolved and therefore the beverage is produced. According to the invention the portion capsule has only one identifier that allows to ~~determinate~~ determine whether the respective portion capsule goes with the coffee machine's brewing chamber and the parameters for processing are chosen properly. If it is not the case, significant security issues arise. Inserting the wrong portion capsule, for example, endangers the brewing chamber's tightness. In this case hot water can be discharged under high pressure and therefore compromise the user's safety. Otherwise it is also possible that inserting the wrong portion capsule damages the coffee machine. In this example the identifier is represented by several raised areas 8, which differ in reflection properties from the sections between the raised areas. As shown by the arrows the bulges are passed by a mean for detection 13 (here: an optical detector) that is able to differentiate between the unequal sections 5, 6 having different optical properties such as, for example, reflection. Switching between the different sections or the number of bulges represents the identifier. After the identifier has been read out the identifier is compared to a stored reference. If the identifier agrees with the reference, the coffee machine will start operating. Particularly the pump, which is for example responsible for pushing hot water through the brewing chamber, will not start operating, if the identifier does not agree with the reference.

[00059] All the remarks concerning the identifier apply to all the examples.

[00060] **Figures** **2**A and 2B ~~show~~ shows another embodiment of the portion capsule 1 according to the invention. The portion capsule 1 comprises a base element 2 that has a wall region 2.1 and a bottom area 2.2. Here the portion capsule 1 has a barcode

50 placed in the area of the membrane's 4 top surface. This ~~bar-code~~barcode may be printed by material removal or may be generated by a medium that is integrated in the foil and can be detected optically such as a fluorescence agent. Alternatively, metal rings may be part of the foil or attached to the foil. The barcode's ~~bar-code's~~ section may be made of a ferromagnetic material. As shown by the arrow 15 the ~~bar-code~~ barcode 50 alternatively can be attached to the base element's edge region being averted from the membrane 4. Such a ~~bar-code~~ barcode is read out by a detector 13 placed, for example, in the media chute. The ~~bar-code~~ barcode represents the identifier according to invention.

[00061] **Figures 3**A and 3B ~~show~~ shows another embodiment of the portion capsule 1 according to the invention. In the present case the identifier comprises recesses and bulges 7, 8, which result from material removal or reshaping the portion capsule as shown here by the example of the portion capsule's wall 2.1. In the present case, recesses and bulges interact with a means for detection 13, which operates like a key, wherein the coffee machine only start operating, when all elements ~~13~~ 14 are placed in the respective recess 7. Therefore, an electric circuit may be changed or especially closed.

[00062] **Figure 4** shows an embodiment of the portion capsule being substantially identical to the embodiment illustrated in Figure 1. As an alternative version of the invention, the figure additionally shows that the unequal sections 5, 6 differing in terms of optical properties can be attached to the cover foil, for example in the form of a ~~bar-code~~barcode.

[00063] **Figure 5** shows an embodiment of the portion capsule being substantially

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identical to the embodiment illustrated in Figure 3 that includes recesses 7 and bulges 8. Again, the recesses represent the key bit. The coffee machine only will start operating, if the recesses interact with the corresponding bulges and therefore an electric circuit is changed respectively. The placement of such a system is not restricted to the brewing chamber. For instance, the system may be placed in the portion capsule's media chute.

[00064] **Figure 6** shows a version of the invention that includes a base element 2 and an electric material forming a surrounding ring 23, which preferably has a raised form. The electrically conductive material is scanned by means for detection 13 having electric sliding contacts, which are placed in the media chute and form electric contacts of an electric circuit, while the portion capsule is inserted.

[00065] **Figure** 7 shows an embodiment of the portion capsule being substantially identical to the embodiment illustrated in Figure 6, in which it is provided that the ring area has reflective 21 or mat 22 sections, for example in form of a covering, and allows a read-out by means for detection 13 for optical detection, which are placed in the media chute and are part of a control current, while the portion capsule is inserted.

[00066] **Figure 8** shows a relative broad and raised ring 23 which represents the identifier. The media chute is equipped with a corresponding vacancy that tests whether the portion capsule has the proper identifier. The broad ring is scanned, for example, by means for detection 13 having mechanical sensors, which are placed in the media chute and close the contacts of an electric circuit, while the portions capsule is inserted.

[00067] **Figure 9** shows another embodiment of the portion capsule according to the invention. In the present case an electrically conductive coat 10 is integrated in the edge region's back and is scanned by electric sliding contacts, which are placed in the media chute and form electric contacts of an electric circuit, while the portion capsule is inserted.

[00068] **Figure 10** shows another embodiment of the portion capsule according to the invention. In the present case the portion capsule has an electrically conductive coat 10 at the bottom area 2.2 such as a conductive varnish layer or an aluminum foil. The coat is scanned by means for detection 13 having electric sliding contacts, which form electric contacts of an electric circuit, while the portion capsule is inserted.

[00069] **Figure 11** illustrates a version of the portion capsule having also an electrically conductive coat 10 that is placed on its bottom 2.2 and is identified by a means for detection 13 having a metal sensor, which is placed in the chute and, for example, detects inductively, while the portion capsule is inserted.

[00070] The embodiment of the invention shown in **Figure 12** has a build-in element made of metal (here a strainer 19) that is recognized as identifier by a means for detection 13 having a metal detector.

[00071] The version of the invention shown in **Figure 13** includes a ferromagnetic material 20 placed at the portion capsule' bottom. The identifier is scanned, by means for detection 13 for example, by a magnet, which is placed in the chute, while the portion

capsule is inserted. The ferromagnetic material acts as identifier.

[00072] **Figure** ~~10~~ 14 shows another embodiment which includes a ~~bar-code~~barcode placed in the region of the cover foil. The portion capsule includes a flange 17.

[00073] According to the embodiment shown in **Figure 15** a metallic ring 11 is integrated in the wall region 2.1 and closes means for detection 13 having an electric circuit placed in region of the brewing chamber.

[00074] **Figure**s **16**A and 16B show ~~shows~~ another embodiment of the portion capsule 1 according to the invention. The illustrated portion capsule features a base element 2 that is basically conical- shaped in the present case and has a bottom region 2.2 and a wall region 2.1. It is provided that the base element contains the raw material and, if necessary, build-in elements like a filter as illustrated here. The expert knows that the build-in element may also include other build-in elements. A flange 17 /edge region 2.4, which is preferably circular and, for example, may be used for sealing a cover foil 4 to it, is attached to the end of the base element, which is placed opposite to the bottom. The flange/edge region has means for fit locking, friction locking and/or detection 2.4.2 in the outer area (outer circumference). As especially shown in the Figures 17a - 17c the means for fit locking, friction locking and/or detection ~~mean~~ 2.4.2 is, in the present case, a gearwheel that is formed by several recesses/bulges evenly arranged in the edge region. Preferably, it is provided that the edge region has a sealing surface 2.4.1, which sealingly interacts with the ~~sealing 21~~seal 31 attached to the brewing chamber 27, on the interior side of the gearwheel. The sealing ~~21~~ 31 makes sure that the water coming from a water

inlet 28 flows ~~rather~~ through the portion capsule by passing an opening, which has been made by a mandrel 29, than around it.

[00075] **Figures 17a - 17c** show different embodiments of the means for fit locking, friction locking and/or detection ~~mean~~ 2.4.2. According to the version shown in Figure 17a, the gearwheel has forty-five teeth. According to the version shown in Figure 17b or 17c, the gearwheel has twenty-two or twenty-nine teeth, respectively. The expert knows that the manufactured teeth can be shaped arbitrarily. All Figures 17a - 17c demonstrate how the portion capsule 1 can be ~~hold~~ held by a part of the brewing chamber 27 using two holding arms 30. The holding arms interacts with the means for fit locking, friction locking and/or detection ~~mean~~ 2.4.2. If they are not available, the holding arms will not hold the portion capsule and the portion capsule will not be inserted into the brewing chamber and will fall through it into a dropping box instead. The portion capsule has a base element 2, a wall region 2.1, a bottom area 2.2, a sealing surface 2.4.1, and an edge region 2.4.

[00076] **Figure 18** shows the ~~mean 2.4.2~~ means for fit locking, friction locking and/or detection 2.4.2 along with ~~an~~ mean for fit locking 24, which is attached to the coffee machine and is represented by a pinion here. It is provided that the mean for fit locking 24 is placed in the media chute or insertion shaft 26 of an insertion shaft housing 23 having a port for inserting the portion capsule in the coffee machine. The distance between the inner wall 25 of the portion capsule ~~25~~ 1 and the mean for fit locking 24 represented by the pinion ~~23~~ 24 are designed in such a way that the portion capsule only will pass the port, if the means for fit locking, friction locking and/or detection 2.4.2

~~mean for fit locking~~ is formed complementary to the teeth of the mean for fit locking 24 represented by the pinion ~~27~~. Only in this case the portion capsule rotates the mean for fit locking 24 represented by the pinion 24 while it falls. Both rotating and falling are represented by arrows in the figure. The portion capsule needs the rotation for passing the media chute's port and falling in the intended position afterwards. If the portion capsule has no or wrong mean of fit locking, it will be impossible to place the portion capsule by passing the media chute in the intended position. Additionally or alternatively, it is provided that the mean for fit locking 24 represented by the pinion ~~24~~ has a pick-up that detects the rotary movement and transmits it to a control unit. If the rotation at least corresponds a defined rotating element, the control unit will activate, for example, the brewing unit. The expert knows that the portion capsule's border may include means for friction locking that interacts with a mean, for example an edge, and shift it in such a way that the shift is detected and therefore the brewing chamber is activated. The portion capsule 1 has a cover foil 4 and a sealing surface 2.4.1.

[00077] The expert moreover knows that a sensor, being for example a camera, which detects the form of the ~~mean~~ means for fit locking, friction locking and/or detection 2.4.2., may be installed in the media chute. In the present case the form and/or the distance between the teeth may be detected. If the proper portion capsule was inserted, a resulting signal could be transmitted to a control unit, which activates the brewing chamber.

[00078] **Figure 19** schematically shows a view of another portion capsule's version according to an embodiment of the present invention. **Figure 20** illustrates the same portion capsule from a different point of view schematically. Figure 19 shows the front

view of the portion capsule. Figure 20 shows the portion capsule viewed from an angle below. In all figures the portion capsule is labeled with the reference sign 1. The portion capsule substantially has a frustoconically shaped base element 2, which is formed similar to a pot and encloses a cavity 3. The cavity 3 is sealed by a membrane 4. Since the viewing direction of ~~Figure 1~~Figure 19 is essentially parallel to the plane, in which the membrane is located, ~~the figure just adumbrate~~ the membrane is at the upper edge of the portion capsule. In particular, the base element 2 comprises a soft, semi-rigid or rigid plastic material which is deep-drown, preferably. The membrane comprises a foil made of plastic material or aluminum. Preferably the base element has a circumferential mounting flange 17 in the region of the membrane, with the membrane and the mounting flange 17 being firmly bonded, in particular by welding or gluing. Preferably a filter element, which is not specifically depicted in the figures, is placed within the base element 2. For instance, the filter element is made of thermoplastic resin such as, for example, polypropylene. The filter element could also be made of a non-woven material such as, for example, thermoplastic resin. Preferably the filter element divides the cavity 3 in two sections. It is provided that the first section can be filled with a raw material and the second section can be filled with and particularly collect a beverage's extract, which is not shown, during the extractions process. Both sections are not illustrated individually.

[00079] The portion capsule is intended for inserting into a brewing chamber or a device for producing a beverage, which is not shown here. In particular such a device for producing a beverage is a coffee machine. The device for producing a beverage could be also a machine that produces a tea drink, a chocolate drink or any other beverage. Preferably an extraction liquid, which is particularly water or hot water, is brought under

high pressure into the brewing chamber of the device for producing a beverage. The extraction liquid interacts with the raw material of the beverage in such a way that an extract of a beverage or a beverage is generated. In particular the filter element is utilized as a strainer for the extract of a beverage.

[00080] According to the invention, the base element 2 has a wall region ~~12~~ 2.1 and a bottom area ~~11~~ 2.2. The wall region ~~12~~ 2.1 basically ranges from the flange 17 to the bottom region ~~11~~ 2.2. Several grooves ~~15~~ 32 are placed in the wall region. In particular these grooves are keyways that are integrated in the wall region ~~12~~ 2.1 and are facing the cavity 3 and range from the flange 17 to the bottom region ~~11~~ 2.2 (i.e. they run perpendicular according to Figure 19). According to the invention provision is made for the grooves ~~15~~ 32 to be extended vertically across the wall region, i.e. they run straight from the flange 17 to the bottom region ~~11~~ 2.2, in which it is not necessary that they are extended over the whole length. The grooves are formed according to the invention in such a way that the wall region is reinforced or stiffened due to the grooves ~~15~~ 32. Moreover, the plurality of the grooves ~~15~~ 32, which are distributed over the wall region ~~12~~ 2.1, realize an adhesion between wall region ~~12~~ 2.1 and the brewing chamber's wall of the device for producing a beverage after the extraction process. This makes it easier to eject the portion capsule from the brewing chamber automatically. The portion capsule's version represented in Figure 19 comprises a circumferential border 16 that is placed at the wall region ~~12~~ 2.1 ranging from the flange 17 to the bottom area ~~11~~ 2.2, namely adjacent to the flange 17 facing towards the bottom area ~~11~~ 2.2. The border 16 has an enlarged diameter (parallel to the membrane 4) compared to the wall region's ranging from the border 16 to the bottom area ~~11~~ 2.2. It is provided that the border's contour 16

is designed in such a manner that the border's diameter tapers towards the flange ~~3~~ 17.

[00081] It is provided according to the portion capsule's embodiment, which is represented in Figure 19 and is in accordance with the invention, that the grooves ~~15~~ 32 are placed in the border's region in the first part, partially range from the border 16 to the bottom area ~~11~~ 22 across the wall region ~~12~~ 21, in the second part and then finally end. All in all the grooves cover, for example, around 50 % of the extension of the wall region ~~12~~ 21, which ranges from the flange ~~3~~ 17 to the bottom area ~~11~~ 22, wherein one-third of the grooves' extension is placed in the border's region and two-thirds of the grooves' extension is placed in the remaining wall region ~~12~~ 21 that range from the border 16 to the bottom area ~~11~~ 22.

[00082] A portion capsule 1 according to the invention is shown as sectional view along the portion capsule's extension regarding its height in **Figure 21,** i.e. the section's plane is perpendicular to the membrane's main plane. **Figure 22** also shows a portion capsule according to the invention in a sectional view portraying the sectional plane, which is parallel to the membrane's main plane. It is noticeable that the interior of the portion capsule's cavity is shown in Figure 21. The portion capsule's material or the base element's material is so thin that the implementation of grooves 32 at the exterior shown in Figure 19 leads to corresponding convexities 34 and impressions at the interior. Figure 22 particularly illustrates the gearwheel shaped contour 36 resulting from insertion of grooves in the portion capsule's 1 wall region.

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For: PORTION CAPSULE HAVING AN IDENTIFIER

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SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Applicant submits this statement in accordance with its duty of disclosure under 37 C.F.R. §§ 1.56, 1.97, and 1.98. The submission made herewith is in no way intended as an admission that the cited items constitute material prior art or otherwise would render the claims unpatentable in any way. The submission also is in no way intended to substitute for the Examiner's own independent investigation.

Copies of foreign patent documents and non-patent literature, together with a listing on form PTO/SB/08a are submitted herewith. Applicant includes English translations from the European Patent Office website and are subject to the caveat expressed on the translations. This Information Disclosure Statement is being submitted after the mailing of a first Office Action and before a Notice of Allowance. A fee of $240.00 is believed to be due; however, if any additional fee is due with the filing of this paper, please charge the amount to Deposit Account 50-1097.

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U.S. PATENTS					
Examiner Initials*	Cite No.	Patent Number	Kind Code	Issue Date	Name of Patentee or Applicant of cited Document
	1.	4,389,925		06/28/1983	Piana
	2.	5,194,553	A	03/16/1993	Freeburne et al.
	3.	6,213,326	B1	04/10/2001	Denner et al.
	4.	6,289,643	B1	09/18/2001	Bonar
	5.	6,299,926	B1	10/09/2001	Balakrishnan et al.
	6.	6,817,538	B2	11/16/2004	Afzali-Ardakani et al.
	7.	6,861,086	B2	03/01/2005	Buckingham et al.
	8.	7,444,925	B2	11/04/2008	Mahlich
	9.	8,101,928	B2	01/24/2012	Hill et al.
	10.	9,969,564	B2	05/15/2018	Krüger

U.S. PATENT APPLICATION PUBLICATIONS					
Examiner Initials*	Cite No.	Publication Number	Kind Code	Publication Date	Name of Patentee or Applicant of cited Document
	1.	2004/0188459	A1	09/30/2004	Halliday et al.
	2.	2006/0010784	A1	01/19/2006	Lee
	3.	2006/0215978	A1	09/28/2006	Choy et al.
	4.	2007/0144355	A1	06/28/2007	Denisart et al.
	5.	2008/0122217	A1	05/29/2008	Rancien et al.
	6.	2008/0116105	A1	05/22/2008	Statham
	7.	2008/0187638	A1	08/07/2008	Hansen
	8.	2008/0245236	A1	10/09/2008	Ternite et al.
	9.	2009/0205747	A1	08/20/2009	Lillard, JR.
	10.	2009/0220650	A1	09/03/2009	Ozanne
	11.	2009/0249961	A1	10/08/2009	Cheng
	12.	2010/0147872	A1	06/17/2010	Saxton et al.
	13.	2012/0024160	A1	02/02/2012	Van Os et al.
	14.	2012/0207895	A1	08/16/2012	Rivera
	15.	2013/0099597	A1	04/25/2013	Perentes et al.
	16.	2014/0302204	A1	10/09/2014	Evers et al.
	17.	2019/0359418	A1	11/28/2019	Kruger

FOREIGN PATENT DOCUMENTS							
Examiner Initial*	Cite No.	Foreign Document Number	Country Code	Kind Code	Publication Date	Name of Patentee or Applicant of cited Document	T[5]
	1.	2436389 (also published as US 6,861,086)	CA	A1	08/22/2002	Buckingham et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16/438,818
	Filing Date	June 12, 2019
	First Named Inventor	Marc Krüger
	Art Unit	1792
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	2.	3432339	DE	A1	03/13/1986	Gesen et al.	X
	3.	569230 (also published as US 5,194,553)	EP	A1	11/10/1993	Freeburne et al.	
	4.	1722398 (also published as US 8,101,928)	EP	A1	11/15/2006	Downer et al.	
	5.	2957525 (also published as US 2019/0359418)	EP	A1	12/23/2015	Kruger	
	6.	2004-500199 (also published as US 7,444,925)	JP	A	08/26/2004	Mahlich	
	7.	2007-525385 (also published as US 2014/0302204)	JP	A	09/06/2007	Evers et al.	
	8.	2008-0070654 (also published as US2009/0220650)	KR	A	07/30/2008	Ozanne	
	9.	2008-0088444 (also published as US2008/0245236)	KR	A	10/02/2008	Rudiger et al.	
	10.	100481892	KR	B1	04/11/2005	Unknown	X
	11.	2009/112291	WO	A1	09/17/2009	Eichler et al.	
	12.	2010/099806	WO	A1	09/10/2010	Rossi	
	13.	2010/076761	WO	A1	07/08/2010	Giua et al.	
	14.	2010/076048	WO	A1	07/08/2010	Campiche	
	15.	2011/047836	WO	A1	04/28/2011	Rapparini	

NON-PATENT LITERATURE DOCUMENTS

Examiner Initial*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1.	Notice of Opposition for Application No. 19165223.9 dated February 24, 2020.	
	2.	Notice of Opposition for European Patent No. EP3521208 granted February 19, 2020.	
	3.	Opposition against European Patent No. EP3521208; Application No. 19165223.9 granted February 19, 2020.	

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	Art Unit	1792
	Examiner Name	Smith, Chaim A
	Attorney Docket Number	1859.029USC4 (KRÜ0022-WO-US-T4)

	4.	Communication of Notice of Opposition dated January 27, 2020 for Application No. 19165219.7	
	5.	English Translation of JP2003235733	
	6.	Wikipedia definition of "Deep Drawing" http://en.wikipedia.org/wiki/Deep_Drawing	
	7.	Wikipedia definition of "Tiefziehen" http://de.wikipedia.org/wiki/Tiefziehen	
	8.	Wikipedia definition of "Stamping (metalworking)" https://en.wikipedia.org/wiki/Stamping_(metalworking)	
	9.	Wikipedia definition of "Barcode"	
	10.	Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004" Official of the European Union	
	11.	Brief Communication for Opposition Proceedings for Appl. 15197336.9, dated March 19, 2020	
	12.	Oral Letter regarding the opposition Procedure dated March 16, 2020 for EP 3023362	
	13.	Opposition oral letter regarding the opposition procedure dated March 16, 2020 for EP 023362	
	14.	Annex to the Communication Opposition Appln No. 15197336.9; 2020	
	15.	Brief Communication-Opposition Proceedings for Appl. No. 15197336.9 dated January 8, 2020	
	16.	Letter regarding Opposition Procedure for EP Patent No. 3023362 dated December 23, 2019	
	17.	Brief Communication for Appl No 15197336.9 dated October 15, 2019	
	18.	"Information technology – Automatic identification and data capture techniques – EAN/UPC bar code symbol specification" Second Edition: December 15, 2009	
	19.	Letter accompanying subsequently filed items for EP3023362, KRO-44; October 10, 2019.	
	20.	Brief Communication – Opposition Proceedings for Appl No. 15197336.9 dated July 23, 2019	
	21.	Letter accompanying subsequently filed items for EP3023362 1038-CMS-O; July 17, 2019	
	22.	Brief Communication – Opposition proceedings for Appln No. 15197336.9 dated July 12, 2019	
	23.	Opposition Procedure for EP Patent No. EP 3023362 dated July 1, 2019	
	24.	Miscellaneous requests concerning client data EPO – June 12, 2019	
	25.	Letter regarding the Opposition Procedure KRO-44/FWJPL dated March 20, 2019	
	26.	Ralf Jesse, "Barcode" Gutachten zur Frage Begriffle, Bitcode/Binacode; Patents EP 3023362; May 19, 2019	

IPR2023-00502
Nespresso USA, Inc. Ex. 1002 Part 3
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16/438,818
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	First Named Inventor	Marc Krüger
	Art Unit	1792
	Examiner Name	Smith, Chaim A
	Attorney Docket Number	1859.029USC4 (KRÜ0022-WO-US-T4)

	27.	"Information technology – Automatic identification and data capture techniques – Bar code verifier conformance specification – Part 1: Linear symbols" May 20, 2019 10:12	
	28.	"Information technology – Automatic identification and data capture techniques – Bar code print quality test Spec Linear Symbols" German Version: EN ISO/IEC 15416:2001: 1998-02	
	29.	Declaration under 27 C.F.R. for Appl No. 13/697,297; August 15, 2016	
	30.	Wikipedia "Binarcode" https://de.wikipedia.org/wiki/Binarcode	
	31.	Rosenbaum, Jessie, "Bar-Code" Theorie Lexikon Software; 2000	
	32.	Potter Mathia, "BARCODE" Euinfuhrung und Andwendungen; 1993	
	33.	Oliver Rosenbaum "Das Barcode-Lexicon" edition advanced: cbhv; 1997	
	34.	Fairley Michael "Codes and Coding Technology" LCGS, FIP3 and FLOM3: A Labels & Labeling Publication 2015	
	35.	Claims – Amended Claims with annotations-2	
	36.	Claims – 2019-05-20 Amended Claims with Annotations	
	37.	Auxiliary request during Opposition procedure – 2019-05-20	
	38.	Letter regarding opposition procedure for EP 3023362 dated March 4, 2019	
	39.	Definition of Barcode by Merriam-Webster https://www.meriam-webster.com/dictionary/barcode	
	40.	Barcode-Wikitionary "Barcode" https://de.wikitionary.org/wiki/Barcode_2018	
	41.	Strichcode – Wikipedia "Strichcode" https://de.wikiepdia.org/wiki/strichcode	
	42.	Reply of the patent proprietor to the notice of opposition 2019-02-11; Appln No. 151973366.9	
	43.	Notice of Opposition against European Patent No. EP 3023362 dated July 30, 2018	
	44.	Notice of Opposition to a European patent, Patent No. EP3023362 dated July 24, 2018.	

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

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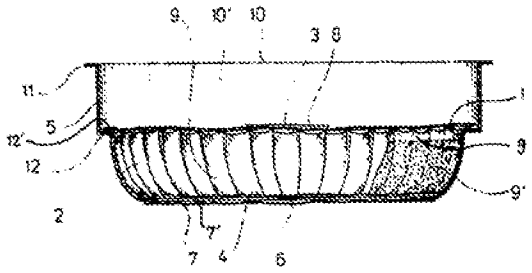
(72) Erfinder:

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(54) Kaffee-Kompaktfilter

Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, wobei zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist, und Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10), die eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.



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Patentansprüche:

1. Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist,
dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist.

2. Kaffee-Kompaktfilter nach Anspruch 1, dadurch gekennzeichnet, daß der randseitig angeordnete Filterpapiereinsatz (2) aus geriffeltem, gewelltem, zickzack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht, so daß zwischen dem randseitig angeordneten Filterpapiereinsatz (2) und der Innenseite des Gehäuses (10') ein Ringkanal bzw. mehrere etwa parallele Kanäle (13) mit einer im wesentlichen vertikalen Achse gebildet werden, die nach unten offen sind.

3. Kaffee-Kompaktfilter nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die das Kaffeemehl (9') abdeckende obere Filterpapierlage (1) eine automatische Entlüftung (3) aufweist, die sich unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet.

4. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die automatische Entlüftung (3) durch wenigstens einen Schnitt, eine Perforation oder ähnliches in der oberen Filterpapierlage (1), die mit wenigstens einem Klebestreifen (8) oder

ähnlichen abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Wasserdampf wenigstens teilweise ablöst, gebildet wird.

5. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß das Filtergehäuse 10' einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen (1 und 4) und den gemahlenen Kaffee (9') gelaufenem Wasser ausreichend hohen Rand (5) oberhalb der oberen Filterpapierlage (1) des Kompaktfilters (10) aufweist.

6. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß die untere Filterpapierlage (4) des Kompaktfilters (10) durch ein darunterliegendes, mit dem Filtergehäuse (10') verbundenes oder einstückiges Trag- und Abstandselement (6) in Form eines Kreuzes, eines Sterns, eines Gitters oder ähnliches unterstützt wird.

7. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 6, dadurch gekennzeichnet, daß das Filtergehäuse (10') unterhalb des Trag- und Abstandselementes (6) eine weitere Filterlage (7) in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches aufweist, die durch das Trag- und Abstandselement (6) von der unteren Filterpapierlage (4) des Kompaktfilters (10) auf Abstand gehalten wird.

8. Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10) nach den Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die Maschine (14) eine bewegbar mit dem Gehäuse der Maschine (14) verbundene Aufnahmevorrichtung (15) mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.

9. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Maschine (14) eine Führung (15') zum Einschieben oder Einlegen des Filters (10) aufweist.

10. Kaffee-Maschine nach Anspruch 9, dadurch gekennzeichnet, daß sie unterhalb der Führung (15') eine mit dieser verbundene oder einstückige, etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den aus dem Kaffee-Kompaktfilter (10) austretenden Kaffeesud aufweist.

11. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) in ihrem unteren Bereich, d. h. bei eingelegtem Kompaktfilter (10) unter diesem, eine etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den austretenden Kaffeesud aufweist, die mit der Aufnahmevorrichtung (15) verbunden oder einstückig ist.

12. Kaffee-Maschine nach den Ansprüchen 8 bis 11, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) eine nur geringfügig größere Höhe als der Kaffee-Kompaktfilter (10) selbst aufweist.

Kaffee-Kompaktfilter

Die Erfindung bezieht sich auf ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, sowie aus einer Kaffee-Maschine für die Aufnahme des Kaffee-Kompaktfilters.

Neben herkömmlichen Filtertüten, die in ein etwa trichterförmiges Filtergefäß eingesetzt und von Hand mit gemahlenem Kaffee gefüllt werden, sind schon seit längerem sogenannte Kaffee-Kompaktfilter gebräuchlich, die aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage bestehen, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist und die als Einsatz in speziellen, dafür geeigneten Kaffeemaschinen verwendet werden und nach einmaligem Gebrauch komplett fortgeworfen werden. Kompaktfilter werden vor allem dort verwendet, wo größere Mengen Kaffeesud in kurzer Zeit erzeugt werden sollen, d. h. vor allem im gastronomischen Bereich.

In der Praxis haben derartige Kompaktfilter jedoch einige Nachteile, sowohl aus der Sicht des Verbrauchers als auch des Herstellers, gezeigt.

Als wirksame Filterfläche steht nur die untere Filterpapierlage zur Verfügung, was zur Folge hat, daß der Filtriervorgang, vor allem bei feiner gemahlenem Kaffee, relativ lange dauert, obwohl gerade auch eine kurze Zubereitungszeit gefordert ist.

Ein weiteres Problem stellt das ungleichmäßige Eindringen des aufgegebenen heißen Wassers in die Kaffeemehlfüllung dar. Bei Aufgabe des heißen Wassers wird zuerst die obere Filterpapierlage durchfeuchtet und dadurch sehr wenig durchlässig für gasförmige Stoffe. Während des weiteren Eindringens des Heißwassers in die Kaffeemehlfüllung werden die zwischen den Kaffeepartikeln verbliebene Luft und der entstehende Wasserdampf verdrängt und sammeln sich in einer Blase unterhalb der oberen Filterpapierlage. Die Folge ist eine unerwünschte Verringerung der Fläche, durch die das Heißwasser in die Kaffeemehlfüllung eintritt und damit sowohl eine Verlangsamung des Filtriervorganges als auch eine Verschlechterung der Auslaugung der Kaffeemehlfüllung. Im schlimmsten Fall kann es sogar zum Überlaufen von heißem Wasser und dadurch zu einer Verbrühungsgefahr für den Benutzer kommen, wenn das heiße Wasser nicht schnell genug durch den Filter abfließen kann.

Nachteilig aus der Sicht des Herstellers ist, daß solche Kompaktfilter, die für einmaligen Gebrauch gedacht sind, mehrmals verwendet werden können, indem für die untere Filterpapierlage handelsübliche Filterpapiere eingelegt werden und Kaffeemehl von Hand aufgegeben wird. Häufig sind derartige Kaffee-Maschinen Teil eines sogenannten "Service-Paketes", d. h. für die Maschine selbst entstehen dem Verbraucher keine Kosten, er ist jedoch verpflichtet, regelmäßig eine bestimmte Mindestmenge an Kaffee-Kompaktfiltern eines bestimmten Herstellers zu kaufen. Der Bedarf, der über diese Mindestmenge hinausgeht, wird aber oft nicht bei dem Hersteller des Kom-

paktfilters gedeckt, sondern in Form von preiswerterem Fremd-Kaffee in handelsüblichen Verpackungsformen gekauft. Hierdurch entstehen dem Kompaktfilter-Hersteller bzw. Lieferanten des "Service-Paketes" nicht zu unterschätzende Umsatzverluste.

Es stellt sich daher die Aufgabe, ein Kaffee-Kompaktfilter sowie eine Kaffee-Maschine für die Verwendung des Kompaktfilters zu schaffen, die die oben genannten Nachteile vermeiden, und einerseits insbesondere eine schnelle Zubereitung, eine gute Auslaugung des Kaffeemehls und eine sichere Handhabung für den Verbraucher bieten und andererseits eine Mehrfachverwendung des Kompaktfilters ausschließen.

Die Lösung dieser Aufgabe gelingt erfindungsgemäß durch ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer fest darin angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees angebracht ist, dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage randseitig entlang der Innenseite des Filtergehäuses ein Filterpapiereinsatz angeordnet ist, der mit der Innenseite des Gehäuses nicht oder nur teilweise in Berührung steht.

Durch einen derartigen zusätzlichen Filterpapiereinsatz wird die Fläche, durch die der Kaffeesud austreten kann, wesentlich vergrößert. Dies gilt insbesondere dann, wenn der Einsatz aus geriffeltem, gewelltem, zick-zack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht. Zwischen der Innenwand des Filtergehäuses und dem Filterpapiereinsatz wird bei einem z. B. glatten Einsatz ein Ringkanal gebildet, bei z. B. gewelltem Einsatz ergibt sich eine Anzahl von etwa parallelen Kanälen mit im wesentlichen vertikalen Achsen, die nach unten offen sind und den austretenden Kaffeesud ableiten. Der rand-

seitige Filtereinsatz ist, um ein unerwünschtes Austreten von Kaffeemehl zu verhindern, mit der unteren Filterpapierlage verbunden oder einstückig.

Das Problem der Luft- und Dampfblasenbildung im Inneren des Filters wird dadurch gelöst, daß der erfindungsgemäße Kompaktfilter eine automatische Entlüftung aufweist, die sich erst unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet. Sie besteht beispielsweise aus wenigstens einem Schnitt oder einer Perforation in der oberen Filterpapierlage, die mit einem Klebestreifen oder ähnlichem abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Dampf wenigstens teilweise ablöst und so die darunter befindlichen Öffnungen freigibt. Durch diese entweichen zunächst die vom eindringenden Wasser aus dem Kaffeemehl verdrängte Luft und der dort entstehende Wasserdampf. Nach dem Entlüftungsvorgang fließt dann das aufgegebene Heißwasser außer durch die obere Filterpapierlage selbst zum Teil auch durch die darin befindlichen Öffnungen in das Kaffeemehl. Dieser so vergrößerte Durchfluß trägt ebenfalls zu einer kurzen Zubereitungszeit bei, während gleichzeitig durch das vorherige Entlüften das Kaffeemehl gleichmäßiger und intensiver ausgelaugt wird, was nach ersten praktischen Erfahrungen mit dem erfindungsgemäßen Kompaktfilter zu einer Kaffeemehlersparnis von etwa 20 % bei gleichbleibender Qualität des Kaffeesuds führt. Auch das Überlaufen des Filters bei Aufgabe von Heißwasser ist durch den verbesserten Durchfluß praktisch ausgeschlossen, zumal das Kompaktfiltergehäuse nach dieser Erfindung einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen und den gemahlenen Kaffee gelaufenem Wasser ausreichend hohen Rand oberhalb der oberen Filterpapierlage aufweist.

Die Reißfestigkeit von Filterpapier im feuchten Zustand ist relativ gering. Um die Zugspannungen in der unteren

Filterpapierlage, die das Gewicht von Kaffeemehl und aufgegebenem Wasser aufnehmen muß, gering zu halten, wird diese durch ein darunterliegendes Tragelement, das beispielsweise die Form eines Kreuzes, eines Sterns oder eines Gitters hat und mit dem Filtergehäuse verbunden oder einstückig ist, unterstützt. Ein Einreißen der unteren Filterpapierlage ist so nicht mehr möglich.

Das Tragelement dient gleichzeitig als Abstandselement, das eine unterhalb dieses Trag- und Abstandselementes befindliche weitere Filterlage in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches von der unteren Filterpapierlage des Filters zur Sicherung der vollen Durchlässigkeit auf Abstand hält. Durch diese weitere Filterlage werden über die randseitige Filterpapierlage eventuell übergetretene oder durch Beschädigung der unteren Filterpapierlage ausgetretene Kaffeemehlpartikel zurückgehalten, so daß der Kaffeesud sicher fei bleibt von Kaffeemehlanteilen, was sowohl dem Geschmack als auch der Bekömmlichkeit des Getränkes zugute kommt.

Eine Kaffee-Maschine für die Verwendung des erfindungsgemäßen Kaffee-Kompaktfilters weist eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters auf. Hierdurch wird sowohl ein einfaches Einlegen und Herausnehmen des Kompaktfilters wie auch eine sichere Handhabung gewährleistet, da keine Manipulationen des Benutzers in unmittelbarer Nähe des Heißwasseraustrittes der Maschine erforderlich sind. Die Öffnung in der Aufnahmevorrichtung ist so bemessen und gelegen, daß der Kompaktfilter beispielsweise auf einem vorstehenden Kragen oder einem Vorsprung seines Gehäuses rundum- bzw. allseitig aufliegt.

Um den aus dem Kompaktfilter austretenden Kaffeesud zu sammeln und in ein darunter befindliches Auffanggefäß zu leiten, weist die Kaffee-Maschine nach der Erfindung eine etwa trichterförmige Sammel- und Ableitvorrichtung auf, die beispielsweise unterhalb der Führung zum Einschieben oder Einlegen des Filters mit der Führung verbunden oder einstückig ist oder mit der Aufnahmevorrichtung in deren unterem Bereich, d. h. bei eingelegtem Kompaktfilter unter diesem, verbunden oder einstückig ist. Mit dieser Sammel- und Ableitvorrichtung wird erreicht, daß der Kaffeesud auch in Auffanggefäße, wie z. B. Glaskannen, mit relativ kleiner Einfüllöffnung eingeleitet wird, ohne daß ein Teil des Kaffeesuds neben die Einfüllöffnung gerät.

Eine Mehrfachverwendung des Kompaktfilters bzw. Verwendung von Fremdprodukten wird durch folgende Merkmale des erfindungsgemäßen Kompaktfilters und der Kaffee-Maschine weitgehend ausgeschlossen:

Filterpapiereinsätze, bestehend aus einer flachen Filterpapierlage mit einem daran anschließenden randseitigen Filterpapierteil, sind nicht im Handel, d. h. der Filterpapiereinsatz kann nicht durch einen mehr oder weniger ähnlichen handelsüblichen Einsatz ersetzt werden. Wird lediglich die untere Filterpapierlage durch einen z. B. handelsüblichen Papierrundfilter ersetzt, kommt es wegen des verringerten Durchflusses infolge verkleinerter Filterfläche zu einem Überlaufen des aufgegebenen Heißwassers aus dem Filtergehäuse, was, wenn es mehrmals geschieht, den Benutzer von dieser Mehrfachverwendung abbringen wird.

Bekannte, im Handel befindliche Kompaktfilter, wie eingangs beschrieben, scheiden ebenfalls für einen Einsatz in der erfindungsgemäßen Kaffeemaschine aus, da diese Filter keinen erhöhten Rand für noch nicht durch Filter-

papierlagen und Kaffeemehl gelaufenes Wasser aufweisen und auch die Schublade für die Aufnahme des Kompaktfilters keinen entsprechenden Raum für die Wasseraufnahme bietet.

Die Verwendung schließlich von Kompaktfiltern, die eine größere Höhe aufweisen als der erfindungsgemäße Kompaktfilter, ist wegen der begrenzten Höhe der Schublade unterbunden, da die Schublade mit einem solchen höheren Kompaktfilter nicht mehr in die Kaffeemaschine einschiebbar ist.

Die Erfindung wird im folgenden anhand der Zeichnung eines bevorzugten Ausführungsbeispieles des erfindungsgemäßen Kaffee-Kompaktfilters sowie der erfindungsgemäßen Kaffee-Maschine für die Aufnahme des Kompaktfilters näher erläutert. Es zeigen im einzelnen:

Figur 1 einen erfindungsgemäßen Kaffee-Kompaktfilter, teils in Seitenansicht, teils in Vertikalschnitt,

Figur 2 eine Draufsicht auf einen Querschnitt in horizontaler Ebene des Kompaktfilters,

Figur 3 eine Seitenansicht einer Kaffeemaschine für die Aufnahme des Kompaktfilters.

Wie aus den Figuren 1 und 2 zu entnehmen ist, besteht das hier dargestellte Ausführungsbeispiel des Kompaktfilters 10 aus einem Filtergehäuse 10', das einen vorstehenden Kragen 11 im oberen Bereich, einen erhöhten Rand 5 und eine zurückspringende Stufe 12 aufweist. Im Inneren des Filtergehäuses 10' ist auf der durch die zurückspringende Stufe 12 gebildeten Fläche 12' eine obere Filterpapierlage 1 angebracht, was durch Kleben oder Verschweißen oder ähnliches erfolgt. Die obere

Filterpapierlage 1 weist einen Schnitt bzw. eine Perforation 3 auf, die mit einem Klebestreifen 8 abgedeckt ist. Unterhalb der oberen Filterpapierlage 1 befindet sich randseitig angeordnet ein Filterpapiereinsatz 2, der zur Vergrößerung der Filterfläche gewellt oder gefaltet oder ähnlich geformt ist. Unterhalb des Einsatzes 2 liegt die untere Filterpapierlage 4, die mit dem Einsatz 2 verbunden oder einstückig ist. Der Raum 9, der durch obere und untere Filterpapierlage 1 und 4 und den Filterpapiereinsatz 2 gebildet wird, ist wenigstens teilweise mit Kaffeemehl 9' gefüllt. Durch die randseitige Lage des oberflächenvergrößernd geformten Einsatzes 2 in dem Filtergehäuse 10' entstehen Kanäle 13 mit etwa parallelen und vertikalen Achsen. Die untere Filterpapierlage 4 wird von Trag- und Abstandselementen 6 unterstützt, die mit dem Filtergehäuse 10' verbunden oder einstückig sind. Gleichzeitig halten die Trag- und Abstandselemente 6 eine weitere Filterlage 7, vorzugsweise ein Kunststoffgazefilter, von der unteren Filterpapierlage 4 auf Abstand, so daß zwischen beiden ein Raum 7' gebildet wird, in den der durch die Kanäle 13 abgeleitete Kaffeesud vor dem Durchströmen der Filterlage 7 zunächst einströmt und wo eventuell ausgetretene Kaffeemehlpartikel zurückgehalten werden.

Figur 3 zeigt eine Seitenansicht einer Kaffeemaschine 14, die für die Aufnahme des erfindungsgemäßen Kompaktfilters 10 ausgerüstet ist. Eine bewegbare Aufnahmevorrichtung 15, im Ausführungsbeispiel eine Schublade, enthält den Kompaktfilter 10, der eine nur geringfügig kleinere Höhe als die Aufnahmevorrichtung 15 selbst hat. Gestrichelt eingezeichnet ist die Lage der Schublade in herausgezogenem Zustand. Unterhalb des Kompaktfilters 10 bzw. der Aufnahmevorrichtung 15 ist ein trichterförmiges Sammel- und Ableitelement 16 vorhanden, das den aus dem Kompaktfilter 10 austretenden Kaffeesud in ein Auffanggefäß 17 leitet.

Nummer: 34 32 339
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Fig.1

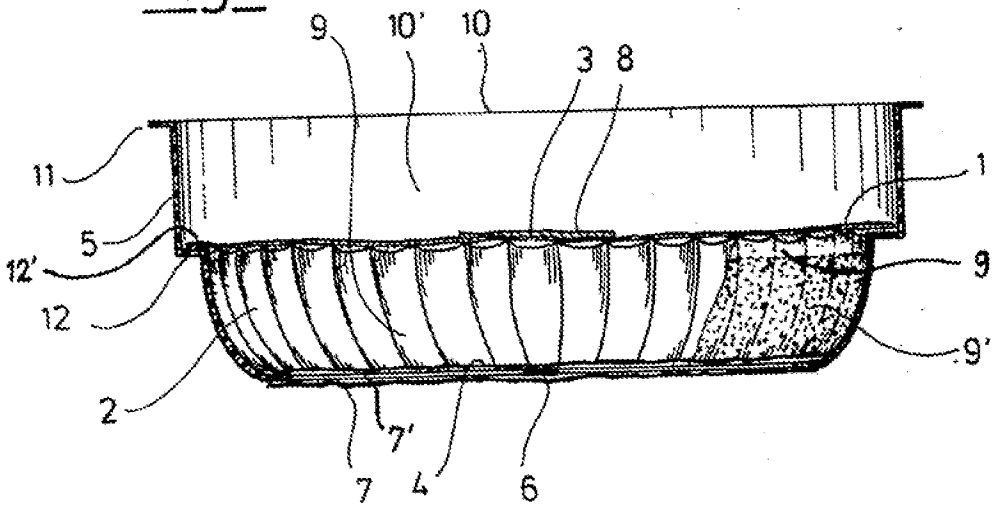
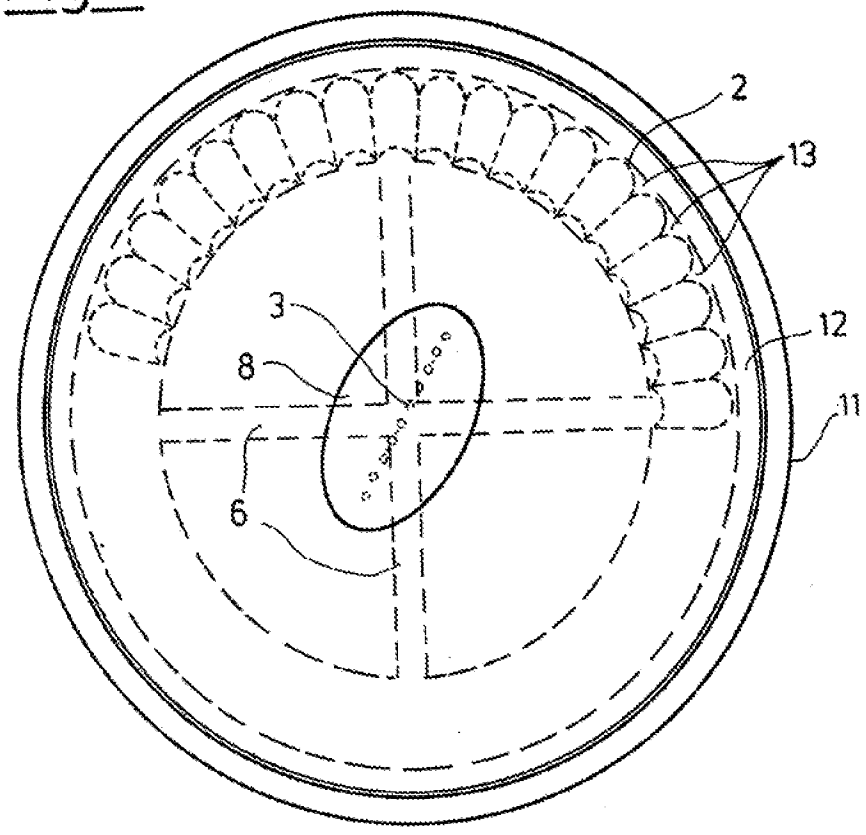


Fig.2



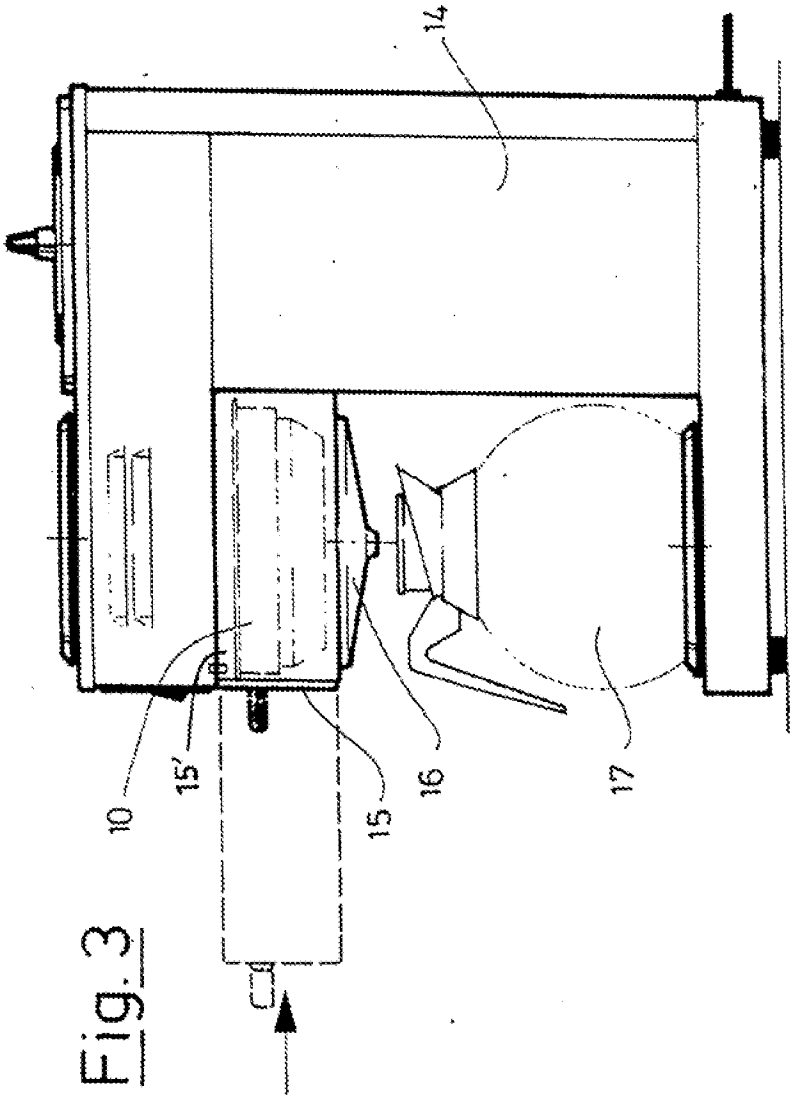


Fig.3

Espacenet

Bibliographic data: DE3432339 (A1) — 1986-03-13

Compact filter for coffee

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Classification: - **international:** ***A47J31/057; A47J31/06; A47J31/08; A47J31/40; B65D81/00; B65D85/804;*** (IPC1-7): A47J31/06
- **cooperative:** **A47J31/057; A47J31/0642; A47J31/08; B65D85/8043**

Application number: DE19843432339 19840903

Priority number(s): DE19843432339 19840903

Also published as: DE3432339 (C2)

Abstract of DE3432339 (A1)

A compact filter for coffee, consisting of a filter housing which is open at the top and bottom having in each case an upper and lower layer of filter paper arranged firmly therein, between which layers of filter paper a particular quantity of ground coffee is introduced, a filter paper insert (2) being arranged between the upper and lower layers of filter paper (1 and 4) at the edge along the inside of the filter housing (10'), which filter paper insert does not contact or only partially contacts the inside of the housing (10') and is connected to or is integral with the lower layer of filter paper (4), and a coffee machine for using the compact filter (10) for coffee, which machine has a receiving device, connected movably to the housing of the machine, with an opening for receiving the compact filter (10) for coffee.

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DESCRIPTION DE3432339

Coffee compact filter

The invention relates to a coffee compact filter, consisting of a top and bottom open filter housing, each with a fixed upper and lower filter paper layer between which a certain amount of ground coffee is inserted, as well as from a coffee machine for receiving the coffee compact filter.

In addition to conventional filter bags, which are inserted into an approximately funnel-shaped filter vessel and filled with ground coffee by hand, have been used for some time so-called coffee compact filter consisting of a top and bottom open filter housing, each with a firmly mounted upper and lower filter paper layer between which a a certain amount of ground coffee is used and used as an insert in special suitable coffee machines and completely discarded after a single use. Compact filters are mainly used where larger amounts of coffee are to be generated in a short time, d. H. especially in the gastronomic area.

In practice, however, such compact filters have shown some disadvantages, both from the consumer's and the manufacturer's point of view.

Only the lower filter paper layer is available as an effective filter surface, with the result that the filtering process, especially with finely ground coffee, takes a relatively long time, although a short preparation time is also required.

Another problem is the uneven penetration of the abandoned hot water in the coffee grounds filling. Upon application of the hot water, first the upper filter paper layer is moistened and thereby very little permeable to gaseous substances. During the further penetration of the hot water into the coffee grounds filling, the air remaining between the coffee particles and the resulting water vapor are displaced and collect in a bubble below the upper filter paper layer. The result is an undesirable reduction in the area through which the hot water enters the coffee grounds filling and thus both slowing down the filtering process and worsening the leaching of the ground coffee filling. In the worst case, it can even lead to overflowing of hot water and thereby to a risk of scalding for the user, if the hot water can not drain fast enough through the filter.

It is disadvantageous from the manufacturer's point of view that such compact filters intended for single use can be used several times by placing commercially available filter papers for the lower filter paper layer and hand-feeding coffee meal. Frequently such coffee machines are part of a so-called "service package", i. H. for the machine itself, the consumer does not incur any costs, but is obliged to regularly purchase a certain minimum amount of coffee compact filters from a particular manufacturer. However, the demand that goes beyond this minimum quantity is often not covered by the manufacturer of the compact filter, but bought in the form of cheaper foreign coffee in commercial packaging. This results in the compact filter manufacturer or Suppliers of the "service package" should not be underestimated.

It is therefore an object to provide a coffee pop-filter and a coffee machine for the use of the compact filter, which avoid the above-mentioned disadvantages, and on the one hand, in particular a quick preparation, a good leaching of the ground coffee and safe handling for the consumer and on the other hand exclude a multiple use of the compact filter.

The solution of this object is achieved according to the invention by a coffee compact filter, consisting of a top and bottom open filter housing, each with a fixed therein upper and lower filter paper layer between which a certain amount of ground coffee is attached, characterized in that between upper and lower filter paper layer edge along the Inside the filter housing a filter paper insert is arranged, which is not or only partially in contact with the inside of the housing.

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Such an additional filter paper insert significantly increases the area through which the coffee sud can escape. This is especially true when the insert is made of corrugated, corrugated, zig-zag folded or similar shaped filter paper.

Between the inner wall of the filter housing and the filter paper insert is at a z. B. smooth use an annular channel formed at z. Corrugated insert results in a number of substantially parallel channels having substantially vertical axes which are open at the bottom and divert the escaping coffee sud. The edge-side filter element is connected to the lower filter paper layer or in one piece in order to prevent unwanted escape of ground coffee.

The problem of air and vapor bubble formation inside the filter is solved by the fact that the compact filter according to the invention has an automatic vent which opens only under the influence of hot water or steam. It consists, for example, of at least one cut or perforation in the upper filter paper ply, which is covered with an adhesive strip or the like, which at least partially peels away under the action of hot water or steam and thus releases the openings underneath. Through this, the air escaping from the ground coffee and the steam arising therefrom first escape. After the deaeration process, the abandoned hot water then flows partly through the openings therein into the ground coffee except through the upper filter paper layer itself.

This thus increased flow also contributes to a short preparation time, while at the same time leaching the ground coffee more evenly and more intensively, resulting in first practical experience with the compact filter according to the invention to a coffee flour savings of about 20% with constant quality of Kaffeesuds. Also, overflow of the filter when hot water is dispensed is virtually eliminated by the improved flow, especially since the compact filter housing of this invention has a sufficiently high edge above the upper filter paper layer to accommodate hot water not yet running through the filter paper layers and ground coffee at the start of filling.

The tear strength of filter paper in the wet state is relatively low. In order to minimize the tensile stresses in the lower filter paper layer, which must absorb the weight of ground coffee and added water, it is assisted by an underlying support member having, for example, the shape of a cross, a star, or a grid and connected or integral with the filter housing , A tearing of the lower filter paper layer is no longer possible.

The support element also serves as a spacer which keeps a further filter layer beneath this support and spacer element in the form of a plastic gauze filter, a paper filter or the like away from the lower filter paper layer of the filter to ensure full permeability. Through this filter layer further more filtered over the marginal filter paper layer or leaked by damaging the lower filter paper layer ground coffee particles are retained, so that the coffee remains safe fei of coffee grounds shares, both the taste and the digestibility of the beverage benefits.

A coffee machine for use with the coffee compact filter of the present invention includes a receptacle movably connected to the housing of the machine and having an opening for receiving the coffee compact filter. This assures easy insertion and removal of the compact filter as well as safe handling since no manipulation of the user is required in the immediate vicinity of the hot water outlet of the machine. The opening in the receiving device is sized and located so that the compact filter, for example, on a protruding collar or a projection of its housing all-round or

rests on all sides.

In order to collect the escaping coffee from the compact filter and to guide it into a receptacle located underneath, the coffee machine according to the invention comprises an approximately funnel-shaped collecting and discharging device, which is connected or integral with the guide, for example below the guide for insertion or insertion of the filter with the receiving device in its lower area, d. H. with inserted compact filter under this, connected or einstückigigist. With this collecting and discharging device is achieved that the coffee dregs also in collecting vessels, such.

B. glass cans, is introduced with a relatively small filling opening without a part of the Kaffeesuds next to the filling opening.

A multiple use of the compact filter or Use of foreign products is largely ruled out by the following features of the compact filter and the coffee machine according to the invention: filter paper inserts consisting of a flat filter paper layer with a subsequent filter paper edge part are not commercially available, i. H. the filter paper insert can not be replaced by a more or less similar commercial use. If only the lower filter paper layer is replaced by a z. For example, as commercial paper round filters are replaced, because of the reduced flow due to reduced filter area, overflow of the discontinued hot water from the filter housing will occur, which, if it happens several times, will divert the user from this reuse.

Known commercially available compact filters, as described in the beginning, are also ruled out for use in the coffee machine according to the invention, since these filters do not have a raised edge for water not yet passed through filter paper layers and coffee grounds and also the drawer for receiving the compact filter does not have a corresponding space for water absorption offers.

Finally, the use of compact filters having a greater height than the compact filter according to the invention is prevented because of the limited height of the drawer, since the drawer with such a higher compact filter is not inserted into the coffee

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machine.

The invention will be explained in more detail below with reference to the drawing of a preferred embodiment of the coffee compact filter according to the invention and the coffee machine according to the invention for receiving the compact filter. 1 shows a coffee compact filter according to the invention, partly in side view, partly in vertical section, FIG. 2 shows a plan view of a cross section in the horizontal plane of the compact filter, FIG. 3 shows a side view of a coffee machine for receiving the compact filter.

As can be seen from Figures 1 and 2, the illustrated embodiment of the compact filter 10 consists of a filter housing 10 ', which has a protruding collar 11 in the upper region, a raised edge 5 and a recessed level 12. Inside the filter housing 10 '. On the surface 12 'formed by the recessed step 12, an upper filter paper sheet 1 is attached, which is done by gluing or welding or the like. The upper filter paper layer 1 has a cut or perforation 3 which is covered with an adhesive strip 8. Below the upper filter paper layer 1, there is arranged on the edge side a filter paper insert 2, which is corrugated or folded or similarly shaped to enlarge the filter surface. Below the insert 2 is the lower filter paper layer 4, which is connected to the insert 2 or 'one piece. The space 9 formed by upper and lower filter paper layers 1 and 4 and the filter paper insert 2 is at least partially filled with ground coffee 9 '.

The edge-side position of the surface-enlarging shaped insert 2 in the filter housing 10 'creates channels 13 with approximately parallel and vertical axes. The lower filter paper ply 4 is supported by support and spacer elements 6 connected or integral with the filter housing 10 '. At the same time support and Abstandseemente6 hold another filter layer 7, preferably a Runststoffgazefilter, from the lower filter paper layer 4 at a distance, so that between the two a space 7 'is formed, in which the coffee 13 derived by the channels 13 coffee flows before flowing through the filter layer 7 first and where any leaked coffee flour particles are retained.

Figure 3 shows a side view of a coffee machine 14, which is equipped for receiving the compact filter 10 according to the invention. A movable receiving device 15, in the exemplary embodiment a drawer, contains the compact filter 10, which only has a slightly smaller height than the receiving device 15 itself.

The position of the drawer in the extracted state is indicated by dashed lines. Below the compact filter 10 or the receiving device 15 funnel-shaped collecting and diverting element 16 is present, which directs the coffee from the compact filter 10 escaping into a collecting vessel 17.

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CLAIMS DE3432339

Claims: 1. Coffee compact filter, comprising a top and bottom open filter housing, each having a fixed therein upper and lower filter paper layer, between which a certain amount of ground coffee is inserted, characterized in that between the upper and lower filter paper layers (1 and 4) along the inside of the filter housing (10 ') a filter paper insert (2) is arranged, which is not or only partly in contact with the inside of the housing (10') and connected to the lower filter paper layer (4) or in one piece.

2.

Coffee compact filter according to claim 1, characterized in that the filter paper insert (2) arranged at the edge consists of corrugated, corrugated, zigzag-shaped or similarly shaped filter paper, so that between the filter paper insert (2) arranged at the edge and the inside of the housing (10 ') Ringkanalbzw. a plurality of approximately parallel channels (13) are formed with a substantially vertical axis, which are open at the bottom

3.

Coffee compact filter according to claims 1 and 2, characterized in that the upper filter paper layer (1) covering the ground coffee (9 ') has automatic ventilation (3) which opens under the influence of hot water or steam.

4.

A coffee pop-filter according to claims 1 to 3, characterized in that the automatic vent (3) is covered by at least one cut, perforation or the like in the upper filter paper ply (1) covered with at least one adhesive strip (8) or the like is formed under the action of hot water or water vapor at least partially peel off.

5.

Compact coffee filter according to claims 1 to 4, characterized in that the filter housing 10 'has a sufficiently high edge (5) for receiving hot, not yet filled by the filter paper layers (1 and 4) and the ground coffee (9')) above the upper filter paper layer (1) of the compact filter (10).

6.

Coffee compact filter according to claims 1 to 5, characterized in that the lower filter paper layer (4) of the compact filter (10) by an underlying, with the filter housing (10 ') connected or integral support and spacer element (6) in the form of a cross , a star, a grid or the like supported.

7.

Coffee compact filter according to claims 1 to 6, characterized in that the filter housing (10 ') below the supporting and spacer element (6) has a further filter layer (7) in the form of a plastic gauze filter, a paper filter or the like, through the support and Distance element (6) from the lower filter paper layer (4) of the compact filter (10) is kept at a distance.

8.

Coffee machine for using the coffee compact filter (10) according to claims 1 to 7, characterized in that the machine (14) has a receiving device (15) movably connected to the housing of the machine (14) and having an opening for receiving the coffee machine. Compact filter (10).

9.

Coffee machine according to claim 8, characterized in that the machine (14) has a guide (15 ') for insertion or insertion of the filter (10)

10.

Coffee machine according to claim 9, characterized in that it has, below the guide (15 '), a connected or integral therewith, approximately funnel-shaped collecting and discharging device (16) for the coffee brew emerging from the coffee compact filter (10).

11.

Coffee machine according to claim 8, characterized in that the receiving device (15) for receiving the coffee compact filter (10) in its lower area, i. H. with inserted compact filter (10) underneath, a sorter funnel collecting and diverting device (16) for the escaping Kaffeesudaufweist has, connected to the receiving device (15) or in one piece.

12.

Coffee machine according to claims 8 to 11, characterized in that the receiving device (15) for receiving the coffee compact filter (10) has only a slightly greater height than the coffee compact filter (10) itself.

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Espacenet

Bibliographic data: KR100481892 (B1) — 2005-04-11

BEVERAGE FILTER CARTRIDGE

Inventor(s):

Applicant(s):

Classification:	**- international:** ***A47J31/06;*** (IPC1-7): A47J31/06 **- cooperative:**	
Application number:	KR20027010735 20020817	Global Dossier
Priority number(s):	KR20027010735 20020817	

Abstract not available for KR100481892 (B1)

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DESCRIPTION KR100481892

Beverage Filter Cartridge (BEVERAGE FILTER CARTRIDGE)

The present invention relates to a disposable single serve beverage filter cartridge.

This application claims priority to U.S. Provisional Application No. 60 / 183,708, filed Feb. 18, 2000, and U.S. Patent Application (Application No., unknown), filed Feb. 13, 2001, and incorporated herein by reference. have.

Known single use beverage filter cartridges are disclosed in US Pat. No. 5,325,765 and US Pat. No. 5,840,189, issued July 5, 1994 and November 24, 1998, respectively, Sylvan et al.

Such beverage filter cartridges basically consist of an outer container in the form of a non-permeable yielding piercable cup which is internally divided into first and second chambers by a permeable cone shaped filter. For example, particles or powdered dry beverage media, such as roasted ground coffee, are stored in a first chamber and the container is closed by a lid that can be perforated with a non-permeable yield.

During the processing cycle, the lid and vessel bottom are perforated by tubular inlet and outlet probes, respectively. The inlet probe allows the heated liquid under pressure into the first chamber to inject into the beverage medium, and the resulting beverage passes through the filter into the second chamber and exits through the outlet probe to be transported from there into the lower cup.

Such known beverage filter cartridges have been increasingly widely used, despite some problems that have been obtained quickly and have continued since the initial introduction. One such problem is that the container sidewalls tend to bend under the force exerted by the outlet probe as the outlet probe punctures the container bottom. This sometimes results in damage to the outlet probe to achieve bottom perforation, which stops the brewing process because no brewed beverage is transferred to the lower cup. The bowing of the container sidewalls can also cause the perforated orifices in the bottom of the container to bend and damage the seal, resulting in leakage of the beverage made.

In addition to securing the bottom of the filter element at the center of the container bottom, the problem arises also in reliably sealing the rim of the filter component to the inner sidewall of the container. Failure to achieve proper rim sealing causes the unsealed portion of the filter to collapse by cooking pressure, resulting in contaminated beverages being contaminated by beverage media residues escaping from the collapsed filter. Evidence shows that if the filter bottom is not centered, contamination may be produced in the produced beverage, and the filter is punctured by the exit probe as the exit probe projects upward through the container bottom. Contamination of the produced beverage often occurs when the filter element is ruptured by the pressure generated by the heated liquid infused with the beverage medium.

Another problem arises when heat sealing the upper rim of the filter in the upper rim or closely adjacent the upper rim of the container side wall. This increases the unfilled so-called "dead space" between the exterior of the filter and the container wall surrounding it, and also limits the maximum amount of beverage media that can be stored in a cartridge that can be contained within the filter. In some cases, this impairs the strength of the final beverage. Beverage strength is optimized by filling the filter to full capacity, but this results in a beverage medium of erroneous particles spilled onto the container rim. This also breaks the seal between the cover and the container rim.

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It is an object of the present invention to reinforce the vessel sidewalls thereby suppressing warping when the vessel bottom is perforated by the outlet probe of the brewer.

Another object is to increase the storage capacity of the beverage medium, the lower end of the filter is located and fixed at the cartridge bottom, and the filter element is sealed and radially supported by the container side wall.

According to the present invention, the container sidewall is provided with peripherally spaced grooves strategically positioned to improve resistance to warpage without compromising or impairing the integrity of the seal between the sidewall and the filter component. The position at which the filter part is coupled to the inner sidewall of the container is lowered to achieve an advantageous increase in the beverage medium storage capacity. This position is formed by a tapered circular ledge in which the tapered filter part is reliably sealed against it.

Channels formed between the circumferentially spaced grooves effectively guide the beverage made downwards towards the perforated container bottom, with an advantageous increase in turbulence in the head space formed between the filter element and the container sidewalls.

In a second embodiment of the invention, the vessel bottom is configured to provide a downwardly projecting centered boss that forms an inner sump of reduced diameter supported by the annular planar bottom region. An annular bottom area is provided for puncturing by the outlet probe. The filter protrudes downward into the sump and is secured therein at a position that is safely off the damage path with respect to the puncturing action of the outlet probe. An advantageous reduction in dead space is also realized by placing the lower end of the filter in the sump of the reduced diameter.

In a third embodiment of the invention, the peripherally spaced grooves project sufficiently inwardly into the container to radially contact the filter element at positions spaced in the peripheral direction. This radial contact advantageously guides the filter element to its central position during assembly of the cartridge part and provides radial support against possible rupture and twisting of the filter element during the processing cycle.

These and other features, objects, and advantages of the present invention will be described in detail with reference to the accompanying drawings.

1 is a perspective view of a disposable beverage filter cartridge according to an embodiment of the present invention.

FIG. 2 is an exploded perspective view of the basic parts of the beverage filter cartridge shown in FIG.

3 is a side view of the beverage filter cartridge shown in FIG.

4 and 5 are vertical and horizontal cross-sectional views taken along lines 4-4 and 5-5 of FIG. 3, respectively.

6 is an enlarged cross-sectional view of the rim portion of the filter cartridge as shown in FIG.

7 is an enlarged view of a portion of the side wall of the beverage cartridge.

8 is a cross-sectional view taken along the line 8-8 of FIG.

9 is a bottom perspective view of the disposable filter cartridge according to the second embodiment of the present invention.

FIG. 10 is a side view of the filter cartridge shown in FIG.

FIG. 11 is a bottom view of the filter cartridge shown in FIGS. 9 and 10.

12 is an enlarged sectional view taken along line 12-12 of FIG

Figure 13 is a perspective view of a disposable beverage filter cartridge according to a third embodiment of the present invention.

FIG. 14 is an exploded perspective view of parts of the beverage filter cartridge shown in FIG.

FIG. 15 is a side view seen from the direction indicated by arrow "X" in FIG.

FIG. 16 is another side view seen from the direction indicated by arrow "Y" in FIG.

Figure 17 is an enlarged bottom view of the beverage filter cartridge shown in Figures 13-16.

18 is an enlarged vertical sectional view taken along line 18-18 of FIG.

FIG. 19 is a vertical sectional view taken along line 19-19 of FIG.

20 is a horizontal cross sectional view taken along line 20-20 of FIG.

Figure 21 is an enlarged cross sectional view of the rim of the cartridge as shown [illegible]

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1 to 5, a beverage filter cartridge according to a first embodiment of the present invention is shown generally at 10. As shown in FIG. 2, the beverage filter cartridge includes an outer cup container 12, a generally conical filter element 14 and a flat circular lid 16. The cup-shaped container 12 has a bottom 18 and a side wall 20 extending upward from the bottom to a circular rim 22 surrounding the top opening 24. 6-8, the side wall 20 extends downwardly from the rim 22 into an intermediate section defined by an inwardly tapered ledge 20b (ledge) and a ledge (It can be seen that it has a tapered lower section 20c extending downward to the bottom 18 in 20b). Upper section 20a is preferably subdivided into upper and lower segments 20a 'and 20a ". Moving the cup down, the segment 20a 'expands outward, the segment 20a "tapers inward and has a connection defining a laminated shoulder 20d therebetween. The bottom portion 18 optionally and preferably has an upwardly projecting center boss 18a. The tapered bottom wall section 20c provides a plurality of circumferentially spaced grooves 20e, a top end terminated below an intermediate section defined by the ledge 20b and a bottom end terminated as a recess in the bottom wall 18. It is configured to. It can be seen from FIG. 8 that the depth "d" of the groove 20e gradually increases from the minimum at its upper end to the maximum at its lower end. Likewise, as can be seen in FIG. 7, the width "w" of the groove also gradually increases from the minimum at its upper end to the maximum at its lower end. Cup-shaped containers have a nominal thickness of 0.79 mm (0.031 ") and are non-permeable, yieldable heat perforated, including polyethylene / EVOH / polystyrene, supplied from, for example, Curwood Packaging, Oshkosh, Winsconsin, USA. The sealable material is preferably thermoformed vacuum cast.

The filter element 14 is, for example, Jay. egg. It is molded from a flexible, permeable heat sealable material such as cellulose polypropylene supplied from J. R. Crompton, Ltd. The bottom of the filter element is supported on the center boss 18a and fixed by heat sealing to the center boss 18a. The lid is, for example, Winpak Heat Seal Packaging, Inc. of Montreal, Canada. Cut or blank from any suitable non-permeable heat sealable and yieldable perforated material such as metal / polymer thin plates supplied from As best seen in Figure 6, the filter element is heat sealed at 26 with an intermediate wall section defined by tapered ledge 20b. The taper angle of the ledge 20b is approximately close to the taper angle of the filter element 14, thus facilitating the work of firmly and reliably heat sealing the two together. The filter element serves to subdivide the interior of the vessel 12 into the first and second chambers A, B. Dry granular or powdered beverage medium "M", typically ground roasted coffee, is stored in chamber A, and the container opening 24 is closed by heat sealing the lid 16 to the rim 22. At the beginning of the processing cycle, lid 16 and vessel bottom 18 are perforated by tubular inlet and outlet probes 28, 30, respectively. The inlet probe 28 allows the heated liquid, typically hot water, to enter the chamber A where the beverage medium M is combined and combined to produce a beverage. The beverage moves into the chamber through the filter element 14 and into the chamber B, from which it exits via the outlet probe 30. The second embodiment shown in Figs. 9 to 11 is similar in many respects to the first embodiment described above. Similar features of the second embodiment are identified by 200 similar reference numerals. Thus, for example, reference numeral 10 denotes the filter cartridge of the first embodiment, and reference numeral 210 denotes the filter cartridge of the second embodiment.

In a second embodiment, the container bottom 218 is formed with a downwardly projected and centered reduced diameter boss 218a defining an internal sump 218b (sump) surrounded by an annular substantially planar bottom area. It is configured to provide. The bottom of the conical filter element is received and secured to the bottom of the sump as in reference numeral 218c. The third embodiment shown in Figs. 13 to 21 is also similar in many respects to the first embodiment. In other words, similar components are indicated by like reference numerals in the 300s. The main difference between the first and third embodiments is that the third embodiment has fewer and deeper grooves 320e. As best shown in FIG. 19, the deeper groove 320e contacts and provides radial support for the filter element 314. In view of the foregoing, it is understood by those skilled in the art that the present invention provides significant advantages over the known beverage filter cartridges described in the previously referenced patents. For example, the circumferentially spaced grooves 20e, 220e, 320e reinforce the container sidewalls against buckling when the bottom is drilled by the outlet probe 30. The deeper groove 320e of the third embodiment provides the added advantage of supporting the filter element radially when the filter element is pressurized by injecting a pressurized heated liquid into the beverage medium, which is particularly advantageous during processing cycles. Can be. In all embodiments, branching downwards and deepening the grooves serves to promote the downward flow of the beverage made in the chamber B while advantageously promoting turbulence. Bosses 18a, 318a projecting upward on the bottom of the container of the first and third embodiments provide an easily accessible support platform for the bottom of the filter element. Fixing the bottom of the filter element to the bosses 18a, 218a ensures that the filter element is not perforated by the outlet probe 30. The small diameter sump 218b formed by the downwardly projecting boss 218a of the second embodiment further helps to reduce head space and further protect and actively position the filter from being damaged in contact with the outlet probe. The lower end of the filter part is accommodated in a limited space.

The tapered ledges 20b, 220b, 320b of all embodiments provide clear and easily accessible lands through which the filter elements can be easily joined by heat sealing. The upper ends of the grooves 20e, 220e, 320e terminate below the ledges 20b, 220b, 320b to ensure that the ledges are not interrupted by discontinuities that may be harmful to the critical seal of the filter element against the container sidewalls. Upper container sections 20a, 220a, 320a above the filters provide an advantageous increase in the storage capacity available for the beverage medium. This increased storage capacity makes it unnecessary for the inner chamber A to fill its maximum capacity, thereby protecting the rim of the [illegible]

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particles of the beverage medium. Although the outer container and cover have been described as being formed of a non-permeable material, it will be understood by those skilled in the art that in general, a permeable material can be used for one or both of these parts. If a permeable material is used, the finished cartridge is preferably sealed in a non-permeable package, either individually or in batches. Such packaging materials are well known and include, for example, EVOH films, aluminum foils and the like. Although the present invention has been described with reference to some embodiments, various changes, modifications and additions can be made without departing from the scope and spirit of the appended claims.

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CLAIMS KR100481892

1.

A bottom wall and a side wall extending from the bottom wall to a circular rim surrounding an upper opening, the side wall extending downward from the rim to an inwardly tapered ledge, and downward from the ledge to the bottom wall; A cup-shaped outer container having an extended lower section, a filter element received in the container and configured to be held on the ledge and repartitioned the interior of the container into a first chamber and a second chamber, and to the first chamber. A stored beverage medium and a cover coupled to the rim and closing the upper opening, the cover being perforated to facilitate injection of liquid into the first chamber for combination with the beverage medium to produce a beverage. And the filter element is permeable to facilitate the flow of the beverage from the first chamber to the second chamber, the outer The beverage filter cartridge of claim 1, wherein the container can be perforated to facilitate spillage of the beverage from the second chamber out of the cartridge.

2.

The beverage filter cartridge of claim 1, wherein the filter element is cone shaped and the upper rim of the filter element is supported on and coupled to the ledge.

3.

delete

4.

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5.

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6.

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7.

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8.

3. The beverage filter cartridge of claim 1 or 2, wherein the taper angle of the ledge is greater than the taper angle of the lower section.

9.

The top and bottom segments of claim 1, wherein the upper section has an upper segment extending downward from the circular rim and a lower segment extending upward from the ledge, the upper segment extending outwardly and the lower segment tapering inwardly, the upper and lower segments. Wherein the connection portion forms an outer laminated shoulder.

10.

3. A beverage filter cartridge according to claim 1 or 2, wherein the bottom wall has a boss projecting upwardly and centered.

11.

11. The beverage filter cartridge of claim 10, wherein the lower end of the filter is supported on the boss.

12.

delete

13.

3. The beverage filter cartridge of claim 2, wherein the bottom wall has a downwardly projected and centrally arranged boss defining an internal sump, wherein a lower end of the filter element is received in the sump.

14.

14. The beverage filter cartridge of claim 13, wherein said filter element is secured to the bottom of said sump.

15.

The beverage filter cartridge of claim 1, wherein the outer container is impermeable.

16.

16. The beverage filter cartridge of claim 1 or 15, wherein the cover is impermeable.

17.

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18.

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19.

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20.

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21.

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22.

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(54) Title: CAPSULE WITH FLOW CONTROL AND FILTERING MEMBER

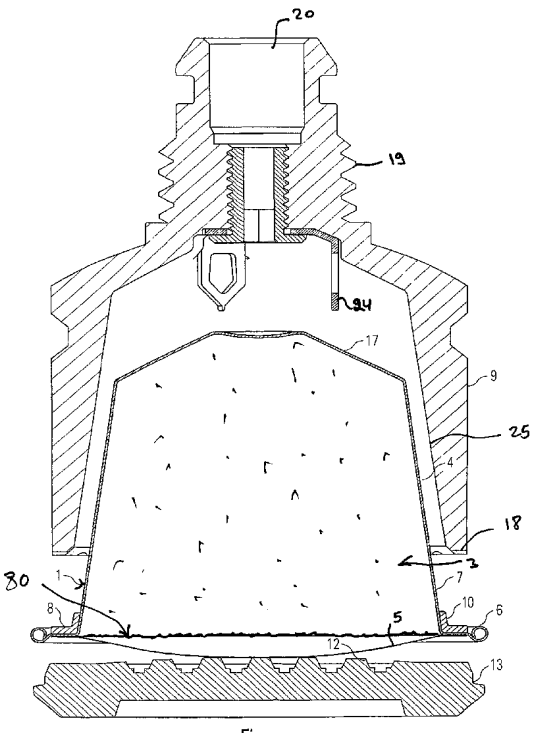


Fig. 2

(57) Abstract: A sealed capsule contains a beverage ingredient in powder form, in particular, ground coffee. The capsule comprises a base body (4) and a foil member (5) tightly attached to the base body (4), the foil member (5) being made from a material allowing the production of a multitude of perforations in the foil member (5) when the foil member (5) is thrust, via the pressure caused by injecting a liquid or a liquid/gas mix into the capsule, against a relief plate of a beverage production machine, wherein the capsule is provided with a flow control porous member (80), the flow control porous member (80) being positioned between at least a portion of ingredients (3) and the foil member (5). The flow control porous member provides a faster and more consistent flow of the liquid extract through the capsule and significantly reduces the resurgence of non-soluble solids.

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

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Capsule with flow control and filtering member

The present invention generally relates to capsules for containing beverage ingredients, to a beverage producing system for use in connection with such capsules as well as to methods for producing beverages on the basis of ingredients contained in such capsules.

The background of the present invention is the field of capsules which contain beverage or other comestible (e.g. soup) ingredients. By means of an interaction of these ingredients with a liquid, a beverage or other comestibles, such as for example soups, can be produced. The interaction can be for example an extraction, brewing, dissolution, etc. process. Such a capsule is particularly adapted to contain ground coffee in order to produce a coffee beverage by having hot water under pressure enter the capsule and draining a coffee beverage from the capsule.

FR 1537031 does not show separated capsules, but a blister pack containing coffee powder. As two foil members are sealed together at the top foil member in an area between two adjacent compartments, these compartments can not be separated from each other without loosing the tight seal between the foil members. A filter is arranged at the bottom of each compartment and thus opposite of the area where the two foil members are sealed. The outlet side of the compartment is opened by actively moving a perforation

member, via a spring force, against the lower face of the compartment. Due to the blister pack technology the top face of the compartments has to be flat.

Also according to CH605293 a filter is, at its rim portion, sandwiched between the foil member and the capsule base body wall. The foil member is additionally provided with a weakened area and is not designed to be perforated by being thrust against a relief plate. The filter is used as a screen to avoid coffee grains from being delivered in the liquid.

EP0507905B1 relates to an apparatus and cartridge for preparing a liquid product. An internal filtering membrane is placed in the bottom of the cartridge for retaining solid particles in the cartridge and prevent clogging of the flow channels provided in the perforating members.

EP-A-512468 relates to a capsule for the preparation of a beverage wherein a filter paper is welded between the peripheral area of the cup and the tearable membrane. The filter paper is used only to ensure no coffee grains can exit the membrane when torn.

US2006/0236871A1 relates to a single portion cartridge which is suitable in particular for brewing a portion of a coffee beverage wherein a distributing and/or supporting structure is provided with at least one opening which is covered by a textile fabric forming a screen between the enclosure and the large outlet. The essential object of this invention is to minimize the escape of particles of the beverage substance from the cartridge during the brewing operation because a

large opening is made in the bottom of the capsule body and the particles would be washed out in absence of such distributing structure. The textile fabric has a pore size in the range from 10 to 500 microns, preferably from 30 to 150 microns.

Systems and methods for obtaining fluid comestibles from substances containing isolated capsules are for example known from EP-A-512470 (counterpart of US 5,402,707).

The capsule 200 as shown in Fig. 1 has a frustoconically-shaped cup which may be filled e.g. with roasted and ground coffee 300 and which is closed by a foil-like tear face cover 400 welded and/or crimped to a flange-like rim 140 which extends laterally from the side-wall of cup. A capsule holder 130 comprises a flow grid 120 with relief surface element members.

The capsule holder 130 can be accommodated in a larger support 150 which has a lateral wall 240 and a beverage outlet 270 for the passage of extracted coffee beverage.

As can be seen from Fig. 1 the extraction system further comprises a water injector 700 having water inlet channel(s) 201 and an annular element 800 with an internal recess of which the shape substantially corresponds to the outer shape of the capsule. On its outer part, the annular member 800 comprises a spring 220 holding a ring 230 for releasing the capsule on completion of extraction.

In operation, a capsule 200 is placed on the capsule holder

130. The water injector 700 perforates the upper face of the cup. The lower tear face 400 of the capsule rests on the radially arranged members of the capsule holder 130.

The water is injected through the channel 201 of the water injector 700 and impinges on the bed 300 of coffee. The pressure in the capsule increases and the tear face 400 increasingly follows the shape of the radial opening relief members. Such radial opening relief members could be replaced by pyramid-shaped reliefs or other shapes of relief. When the constituent material of the tear face reaches its breaking stress, the tear face tears along the relief members. The extracted coffee flows through the orifices of the flow grid 120 and is recovered in a container (not shown) beneath the beverage outlet 270.

The principles of this extraction process as far as it can be maintained in connection with the present invention can be summarized as follows:

- An initially gastightly sealed capsule is inserted in capsule holder means.
- The capsule holder means is then introduced associated to the water injection means of the machine such that an annular element surrounds the sealed capsule. In a first wall of the capsule at least one opening is generated.
- Water entering the capsule through the opening in the first wall is interacting with the ingredients contained in the capsule while traversing the interior of the ingredient contained in the capsule and is then made to leave the capsule through at least one

opening/perforation created in the second wall under the effect of the pressure building up in the capsule.

The perforations in the second face, especially when cooperating with the relief members, filter the beverage leaving the interior of the capsule so that non-soluble coffee particles remain in the capsule. It has been considered in the prior art that such filtering is sufficient (see e.g. column 4 of EP512470B1).

EP 512468B1 teaches to have a capsule with a flat perforable foil member for delivery of the coffee. A filter paper can be sealed between the foil member and the rim of the base body. The capsule, i.e., the membrane opens under the sole effect of the pressure in the capsule.

Also according to CH605293 a filter is, at its rim portion, sandwiched between the foil member and the capsule base body wall. The foil member is additionally provided with a weakened area and is not designed to be perforated by being thrust against a relief plate.

The invention has found that, according to the teaching of the prior art, when a sealed gastight capsule with a simple perforable foil member is placed against a capsule holder with a multitude of small reliefs, and in particular, small squared or rectangular perforation elements, one may have the following problems:

- The extraction process may be slowed down, in particular for capsules containing a larger dose of coffee designed for delivering coffee beverages,
- The extraction process may flow at inconsistent flow times from one capsule to another,
- The extraction is not clean enough and coffee particles can escape the capsule through the small perforations created through the foil member after extraction, when the capsule is removed from the machine in particular, due to the presence of fine grinding outside the typical range designed for the current system (e.g., below an average grind size of 200 microns).

These problems are targeted at by the present invention and is remedied by means of the features of the independent claims. The dependent claims further develop the central idea of the invention.

According to a first aspect, the invention relates to a capsule for use in a beverage production machine comprising:
- means for perforating an inlet side of the body of the capsule opposed to the foil member and the flange-like rim and injecting a liquid or a liquid/gas mixture into the capsule,
- a relief plate with a multitude of relief elements which relief plate is arranged in the machine such that the injection pressure thrusts the foil member against the relief plate,
the capsule comprising:
- a base body sealed off by a foil member tightly attached

to the flange-like rim of the base body, the foil member being made from a material which is then perforated by the relief plate to form a multitude of openings when the pressure of the injected liquid or liquid/gas mixture reaches a value of at least 4 bar, wherein the capsule further comprises a flow control porous member arranged between at least a portion of ingredients in the capsule and the foil member.

The capsule is thus provided with a flow control and filtering member called "flow control porous member" in the rest of the description. The flow control porous member is positioned between at least a portion of ingredients and the foil member.

As a result, the flow was significantly faster and more consistent than for the flow of a capsule of the prior art, i.e., comprising no such flow control porous member.

In particular, it was measured that the flow time could be up to 25% shorter of the mean flow time without significantly changing the quality of the coffee liquid extract. A four times smaller flow time standard deviation was also surprisingly noticed when comparing the mean flow time of a plurality of capsules. Finally, the ground coffee was successfully retained in the capsule with reduced coffee solid resurgences through the perforated membrane.

The flow control porous member may be positioned between the ingredients and the plane defined by the ring-shaped sealing area between the foil member and the rim of the base body.

The base body of the capsule may comprise a rim onto which the foil member is sealed at an annular sealing area. The rim of the base body may further extend outwardly by a curled end.

The base body and/or the foil member can be made from aluminum or aluminum alloy or a laminate of aluminium or aluminium alloy and polymer

The flow control porous member may be connected to the capsule in being sandwiched, in the sealed area, between the rim of the base body and the foil member.

The flow control porous member may have a higher rigidity in flexure than the foil member so that the member deforms less under pressure than the foil member against the relief elements. A lower deformation (or a differential of deformation) provides space between the member and the foil member during extraction allowing the beverage, e.g., liquid coffee extract to better flow between the perforated openings and the relief elements. This results in a faster flow of the liquid through the foil member without affecting significantly the strength of the liquid extract (i.e., total solid content, yield). A higher rigidity can be obtained by a porous member being thicker than the foil member and/or being made of more rigid material.

In particular, the flow control porous member thickness may be between 0.1 microns and 1.5 mm. Preferably, the flow

control porous member thickness is between 0.4 microns and 1.0 mm.

The foil member of the capsule is configured to be successfully torn against a multitude of relief elements by a relief plate of the beverage production device. The foil member must be designed to tear in a consistent manner, in particular, when a predetermined threshold of pressure in the capsule is reached. Therefore, the design of the foil member and the design of the relief plate of the device are determined in such a way that the opening/tearing of the foil member is reliably and consistently carried out.

Therefore, preferably, the foil member has a thickness of between 10 and 100 microns, more preferably between 15 and 45 microns. Most preferably, the foil member thickness is of about 30 microns plus or minus the typical manufacturing tolerances (e.g., +/- 5 microns). Furthermore, the foil member is preferably made of aluminium or aluminium alloy.

Preferably, the ratio of flow control porous member thickness to the foil member thickness is comprised between 1.5:1.0 and 50:1, most preferably between 5:1 and 20:1.

The flow control porous member may be positioned in the capsule in a manner separate from the capsule walls, i.e., disconnected from the walls. For instance, the flow control porous member may be loosely inserted between the ingredients and the foil member.

The flow control porous member can cover at least 62% of the total inner surface of the foil member to ensure that it covers most of the openings created through the foil member when torn under pressure and thus prevents a flow bypass effect and so a reduction of the efficiency of the flow control.

In an advantageous mode, the flow control member has a square or rectangular shape. Hence, the cost of production of the flow control member can be significantly reduced with significantly less material scraps during cutting in the sheet or laminate.

In another mode, the flow control porous member may be connected to the walls of the base body of the capsule and/or to the foil member. The flow control porous member can be connected to the wall by sealing or other connection modes such as mechanical engagement e.g., clipsing.

In certain modes, the flow control member is a thin porous membrane of polymeric material.

In other modes, the porous member comprises essentially polymeric fibre-containing material.

The flow control porous member may be made from a non-woven material. The flow control porous member may also be made from a woven material. The porous member can be formed of food-grade meltable polymeric fibres.

In a preferred mode, the porous member comprises microfibres of diameter of less than 20 microns.

In a mode, the porous member comprises a melt blown (MB) microfibres-containing material.

The porous member can be selected within the group consisting of: polypropylene, polyethylene, polybutyleneterephtalate (PBT), polycarbonate, poly(4-methyl pentene-1), polyurethane, polyethyleneterephtalate (PET), polyethersulfone, polyamide, resin bonded- glass fibres and combinations thereof.

The porous member can also comprise fibres of a diameter higher than 20 microns. For example, blends of microfibres and larger diameter fibres can form the porous member. For example, a porous member can be formed of melt blown (MB) and/or spunbond (SB) material.

In possible modes, the flow control porous member may be a solid injected plastic plate with small flow control openings.

Preferably, the flow control porous member has a pore size (i.e. average opening diameter) comprised between 0.4 and 100 microns. Particularly good results on flow time reduction were obtained with a flow control porous member with a pore size of between 0.4 and 25 microns. The pore size may be lower than 10 microns, even lower than 2 microns, i.e., between 0.4 and 2 microns. Flow time reduction was also obtained with ground coffee having a particle size ($D_{4,3}$) comprised between 190 and 400 microns.

A flow time of less than 40 seconds, with a standard deviation of less than 15 seconds, was successfully obtained, from a capsule containing about 5.5 grams of ground coffee, for delivering a coffee liquid extract of 40 g corresponding to an espresso coffee with a total solid content between 2.7 and 3.8% in weight. Similarly, a flow time of less than 30 seconds, with a standard deviation of less than 5 seconds, was successfully obtained, from a capsule containing about 6 grams of ground coffee, for delivering a coffee liquid extract of 110 g corresponding to a lungo coffee with a total solid content between 1.1 and 1.5% in weight.

It was also observed that the flow time was significantly lowered when the ground coffee particle size is increased.

The flow control porous member may be, at its rim, sandwiched between the foil member and the capsule walls.

The flow control porous member may be distanced from the foil member. In a possible mode, the flow control porous member may transversally separate two portions of ingredients, in particular, two portions of ground coffee.

In a possible mode, the two portions of ground coffee have different brewing characteristics. The brewing properties may refer, in relation to each of said portions, to the mass, the volume, the tap density, the average particle size ($D_{4,3}$), the type of blend, the degree of roasting and combinations thereof. In one mode, the upstream portion of ground coffee portion comprises a mass of ground coffee which has a lower

average particle size $D_{4,3}$, than the downstream portion of ground coffee. The upstream portion of ground coffee may be of a higher volume or smaller volume than the downstream portion. In another mode, the upstream portion of ground coffee portion comprises a mass of ground coffee which has a higher average particle size $D_{4,3}$, than the downstream portion of ground coffee. Again, the upstream portion of ground coffee may be of a higher volume or smaller volume than the downstream portion. These variations enable to tune the flow characteristics in the capsule and also to tailor different characteristics (TC, yield, crema) of the delivered coffee extract to the various consumer's preference.

The flow control porous member may be placed adjacent to the foil member in the capsule. A small space may be allowed between the porous member and the foil member due to the deformation differential between the two elements. Indeed, due to its lower rigidity the foil member deforms more to a convex shape under the pressure of gas (e.g., carbon dioxide) inside the sealed capsule and a small gap may form between the foil member and the porous member.

The flow control porous member may be attached to the inner side of the foil member. In particular, the flow control porous member may be welded to the inner surface of the foil member. In another mode, in order to reduce the thickness of the flow control, the porous member may be printed directly on the inner surface of the foil member.

The flow control porous member may be thicker than the foil member, preferably at least 1.5 times thicker than the foil member.

In possible modes, the flow control porous member may be flat or corrugated. The flow control porous member may also comprise, for example, channels and/or protruding zones that promote a collection gap for the beverage between the foil member and the flow porous member.

The foil member may be free of weakened areas before being inserted in a beverage production machine.

The foil member may be a continuous sheet of metal or polymer or a laminate of metal and polymer.

The flow control porous member may be positioned and arranged such that it is not sandwiched between the foil member and the rim of the base body. For instance, the flow control porous member may be placed loosely in the capsule or may be attached in a localized area onto the inner surface of the foil member and with the edge of the flow control porous member being at a distance from the sealing area of the foil member and base body.

The outer edge of the flow control porous member may end at a position radially inwards from the sealing area of the foil member and the rim of the base body.

In another embodiment, the flow control porous member and the tearable foil member form a multilayer laminate.

The multilayer laminate preferably comprises:
- a tearable flexible layer of aluminium or of another metal or of polymer or a multilayer of aluminium and polymer or a multilayer of polymers and,
- at least one porous polymeric layer.

The porous polymeric layer forms the flow control porous member of the capsule. The metal layer preferably forms a gas barrier of the laminate. One or more additional non-porous layers can be associated to the metal layer in order to reduce the thickness of the metal layer and/or form a gas barrier. The gas barrier can also be obtained by a polymer layer of the tearable foil member such as EVOH when it is made of a multilayer of polymers.

Preferably, the flow control porous member resists to the tearing by the relief member when the foil member is torn by the relief member under the pressurized extraction condition.

Therefore, in the laminate, the porous polymeric layer, e.g., the thin membrane, has preferably greater elastic properties than the tearable layer.

Hence, during extraction, the multilayer laminate has the ability to deform against the relief plate causing tearing of the non-porous layer(s) to form a multitude of small openings and stretching or deforming without tearing of the porous layer(s). As a result, the flow control properties of the non-porous layer(s) are maintained when the liquid is allowed to pass through the delivery foil member of the capsule.

The porous polymeric layer is preferably a thin membrane or a non-woven layer. The layer can be made of a material chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone and polyamide.

The porous layer has a pore size between 0.4 and 25 microns, more preferably between 0.4 and 2 microns.

The flexible layer for the laminate can be aluminium or another metal depending on the mechanical properties suitable for opening the capsule, on the gas barrier properties of the material and on the laminating technique.

A multilayer laminate facilitates the handling of the membrane during the production of the capsule. In particular, it reduces the risk for the fragile membrane of the porous member, to be damaged during handling, filling and/or sealing the capsule.

The laminate may be produced by any suitable method such as thermal lamination such as multilayer extrusion (co-extrusion), extrusion lamination, lamination moulding using heat rolls or heat press.

In another aspect, the invention relates to a capsule for use in a beverage production machine comprising:
- a base body,
- a perforable, non-porous foil member tightly attached to the base body,

- at least one porous layer between the ingredients in the capsule and the foil member;
wherein the porous layer forms with the perforable, non-porous foil member a multilayer laminate.

The multilayer laminate can comprise:
- a layer of aluminium or of another metal or of polymer or a multilayer of aluminium and polymer and,
- at least one porous polymeric layer.

The metal layer preferably forms a gas barrier of the laminate.

One or more additional non-porous layers can be laminated to the metal layer in order to reduce the thickness of the metal layer and/or form a gas barrier. The gas barrier can also be obtained by a polymer layer of the tearable foil member such as EVOH when it is made of a multilayer of polymers.

Another aspect of the invention relates to a method using a capsule according to any of the aforementioned features.

In particular, the method is for producing a beverage on the basis of an ingredient in a capsule, the method comprising the steps of:
- providing a capsule comprising a preferably frusto-conical base body sealed off by a foil member tightly attached to the flange-like rim of the base body,
- inserting the sealed capsule in a beverage production machine,
- perforating an inlet side of the capsule opposed to the

foil member,
- injecting a liquid or a liquid/gas mixture into the capsule causing a pressure to build up in the capsule and the foil member to thrust against a fixed relief member of the beverage production machine,
the foil member being made from a material which is then perforated by a multitude of openings when the pressure of the injected liquid and liquid/gas mixture reaches a value of at least 4 bar,
- draining a beverage from the capsule, wherein the beverage passes between the multitude of openings and the relief member,
comprising the step of:
- filtering the beverage via a flow control porous member arranged between at least a portion of ingredients and the foil member.

In particular, said flow control porous member is effective for reducing the flow time and/or improve the flow time consistency, i.e., by reducing the flow time standard deviation of the mean flow time, when delivering a given volume of coffee extract compared to a capsule without said member. In particular, a standard deviation of less than 10% of the mean flow time can be obtained when delivering a coffee extract of 40 or 110 mL.

In general, the capsule contains a dose of between 5.5 to 6.5 grams of ground coffee. For short coffee, a dose of between 5.5 and 6.0 grams is preferred. For a lungo coffee, a dose of between 6.0 and 8.0 grams of coffee is preferred.

According to the method of the invention, a stronger lungo coffee can be obtained while maintaining an acceptable flow time, i.e., of less than about 40 seconds, more particularly, less than 35 seconds. In particular, a capsule for a stronger lungo contains above 6.0 grams of ground coffee, preferably between 6.2 and 7.0 grams.

Also, the capsule contains ground coffee having a particle size $D_{4,3}$ between 250 and 450 microns. The higher the particle size, the more reduced the flow time can be. Therefore, by tuning the particle size of the ground coffee, it is also possible to reach lower flow time while maintaining substantially the same strength of coffee or, alternatively, to increase the strength of the coffee (e.g., higher TC, Yield) without increasing the flow time.

According to the method of the invention, the flow time for delivering 40 mL of coffee extract is lower than 40 seconds, preferably lower than 30 seconds, most preferably lower than 25 seconds.

According to the method of the invention, the flow time for delivering 110 mL of coffee extract is lower than 40 seconds, more preferably lower than 30 seconds.

Preferably, the flow control porous member has a pore size comprised between 0.4 and 100 microns, preferably between 0.4 and 25 microns, most preferably, between about 0.45 and 2 microns.

Remarkable results have been obtained with a flow control porous member which is a thin porous membrane or a non-woven member. Remarkable results have also been obtained when the tearable foil member has a thickness of 15 and 45 microns, e.g., about 30 microns. The foil member is preferably in aluminium or aluminium alloy.

The fixed relief member of the beverage production device may comprise a tearing structure preferably configured to produce a grid-like perforation of the foil member.

For this, the fixed relief member of the beverage production device may comprise a tearing structure which has exclusively tearing edges forming angles of at least 80 degrees. In other words, the structure is free of sharp shape with angles formed of less than 80 degrees.

Preferably, the tearing structure comprises shapes of truncated pyramids and recesses forming a network of beverage collecting channels; which structure forms, as a result of thrust of the foil member against the fixed relief member, partial rectangular or squared imprints forming small discrete tears in the foil member. It is observed that the foil member tends to intimately deform to tear against the structure whereas the flow control porous member remains less deformed against such a structure and/or has a greater ability to elastically deform without tearing against said structure. The structure is also such (with no sharp edges like needles) that the risk of rupture of the porous member is low and that the porous member can be thin enough while providing its flow control properties.

Another aspect of the invention relates to the combination of a capsule and a beverage production machine according to any of the aforementioned features.

Further features, objects and advantages of the invention will become evident for the skilled person when reading the following detailed explanation of an embodiment of the invention when taken in conjunction with the figures of the enclosed drawings.

Figure 1 shows a known beverage production device encasing a capsule with beverage ingredient,

Figure 2 shows an example of a capsule and a beverage production machine according to the present invention,

Figure 3 shows a capsule according to the present invention with a removed foil member and a removed porous member,

Figure 4 shows a detail of a capsule according to the present invention,

Figure 5 shows a modification of the capsule of claim 4,

Figure 6 illustrates a photographic illustration of the effect of the present invention on a

perforated capsule after coffee extraction without flow control porous member,

Figure 7 illustrates a photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction, with flow control porous member (Invention),

Figure 8 illustrates another photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction without flow control porous member,

Figure 9 illustrates another photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction, with flow control porous member (Invention),

Figure 10 shows comparative curves of the cup concentration, in percentage, as a function of the flow time, in seconds, for a cup of espresso-type coffee weighting 40 grams,

Figure 11 shows the evolution of the flow time in seconds as a function of the coffee average particle size ($D_{4,3}$) for a long cup ("lungo") cup of coffee weighting 110 grams with capsules having no flow control porous members,

Figure 12 shows the evolution of the flow time in seconds as a function of the coffee average particle size ($D_{4,3}$) for a long cup ("lungo") cup of coffee weighting 110 grams with capsules having a flow control porous members (Invention),

Figure 13 shows the "crema" value as a function of the flow time for a lungo coffee cup with and without flow control porous member in the capsule and,

Figure 14 and 15 show views of a cut capsule according to variants of the capsule of the present invention,

Figure 16 shows a partial schematic view (Half view along a longitudinal median plane) of a capsule according to another embodiment,

Figure 17 shows a capsule holder of the device according to the system of the invention.

With reference to Fig. 2 now a first detailed embodiment of the capsule of the invention will be explained.

The "total solids" is defined as the weight of extracted solids contained in the extract divided by the total weight of the extract. This value is typically expressed in percentage.

The "extraction yield" refers to the character of the extract and it is defined as the weight of total solids in the liquid extract divided by the total weight of starting coffee ingredients in the cartridge (e.g., roast and ground coffee). This value is typically expressed as a percentage.

The average particle size "$D_{4,3}$" represents the mean volumetric diameter of the coffee grind as obtained by laser diffraction method using a Malvern® optical instrument and butanol as dispersing agent for the particles.

The "crema" is defined as the head of foam created on the coffee extract with a texture of substantially small bubbles. The crema attribute can be measured by an empirical sugar test which consists in arranging a well defined crystal sugar layer (i.e., crystal sugar of $D_{4,3}$ of 660 microns of particle size) on top of a freshly prepared cup of coffee and measuring the elapsing time between the start of overlaying and the main part of sugar's sinking. The "sugar test value" is thus a number of seconds.

The "pressure of liquid or liquid/gas mixture" is typically a measure of relative pressure above atmospheric pressure taken at the injection site in the capsule.

Typically the pressure of liquid or liquid/gas mixture according to the process of the invention is of at least 4 bar for providing the tearing of the foil member during extraction, preferably of at least 6 bar, most preferably of at least 8 bar.

Note that in the following the invention will be explained referring to a certain design of a capsule, i.e. a design according to which the capsule comprises a cup-like base body and a closing foil member. Generally a capsule according to the present invention comprises at least two opposing wall members which are connected to each other at the edges to form a sealed flange-like rim area, thus enclosing a sealed interior.

Comparable to the prior art also this embodiment shows a capsule holder 13 having relief elements 12 which are designed to tear and perforate a foil member 5 closing off a cup-like base body 4 of the capsule 1. This tearing of the foil member can e.g. occur as soon as the pressure inside the capsule exceeds a threshold value. Note that the relief elements can have any protruding shape able to cause a (partial) tearing of the foil member, preferably of grid-like design. As an example pyramids, bumps, cylinders, elongated ribs are cited as preferred examples.

Within the capsule 1 ingredients 3 are contained, wherein the ingredients 3 are selected such that a beverage can be produced when having a liquid entering the capsule in the region of the top wall 17 of the capsule 1 and then interact which such ingredients 3. Preferred ingredients are e.g. ground coffee, tea or any other ingredients from which a beverage or other liquid or viscous comestible (e.g. soup) can be produced.

Fig. 2 shows a state in which such a capsule has been placed on a capsule holder 13, the foil member 5 resting on the

relief element 12 side of the capsule holder 13 and the cup-like base body 4 of the capsule 1 being already partly surrounded by the circumferential wall 25 of an enclosing member 9 of the beverage production device. The shown enclosing member has the shape of a bell. Other shapes are viable, wherein the design of the interior contours (recess) of the enclosing member is generally adapted to substantially match the contours of the capsule 1.

Note that the foil member 5 as shown may not be exactly flat due to a defined over pressure inside the capsule, which over pressure is generated by introducing e.g. a protective gas when producing the filled capsule and/or by gas being released by the ingredients contained in the capsule. In particular with ground coffee, gas such as carbon dioxide is released after closure of the capsule at the production site which results in the foil member being deformed to a slightly convex shape.
According to invention, a flow control member 80 is placed between the ingredient 3 and the foil member 5.

The enclosing (bell) member 9 furthermore comprises a pressing surface 18 for applying a closure pressure on the rim area 8 of the capsule, an external thread 19 for mounting the bell member in a beverage production device and a water inlet opening 20 for feeding a liquid such as for example hot water under pressure to a water injector 14 which is releasably mounted (screwed) to the bell member 9.

Note that the thread 19 is just an example for connection means, be it releasable or permanent connection means.

The other components of the beverage production device, such as e.g. the mechanism for displacing the bell member and eventually also the capsule holder are known from the prior art in the field of capsule-based espresso machines.

The water injector comprises perforation element(s) (blade, pin, etc.) 24 designed to produce an opening in the top wall 17 of the capsule 1 when the capsule holder 13 and the bell member 9 are moved close together e.g. by a manually operated or an automatic mechanism. A channel (not shown in the drawings) traverses the perforation element 14 such that water can be fed to the interior of the capsule 1 once the perforation element 14 protrudes into the interior of the capsule 1.

The capsule 1 comprises said top wall 17, a sidewall 7 and a flange-like rim 6, wherein the foil member 5 is sealed to said flange-like rim 6 to close-off hermetically the cup-like base body 4 of the capsule 1. Again, other designs for the capsule are possible as long as the capsule can be sealed and contain the mentioned ingredients.

Fig. 3 shows a capsule 1 where the aluminum or aluminium alloy foil member 5 before it is sealed onto the base body 4, and the flow control porous member 80 inserted between the bed 3 of ingredient and the foil 5.

Also the flange-like rim 6 of the base body of the capsule 1 is visible.

Further on, a flow control porous member 80 is shown. The flow control porous member 80 is an example of a filtering web made out of a non-woven material. It is preferably made of polymer such as polypropylene, polyethylene, polybutyleneterephtalate (PBT), polycarbonate, poly(4-methyl pentene-1), polyurethane, polyethyleneterepthalate (PET), polyethersulfone, polyamide or any other meltable fibrous polymers. Its pore size may range of from 0.4 to 100 microns, more precisely of from 0.4 to 30 microns, more precisely of from 0.4 to 20 microns, even more precisely between 0.4 and 10 microns, even more precisely between 0.4 and 2 microns. The filter disk can be reinforced, e.g. by a non-woven or woven material such as polyester.

Fig. 4 shows a flow control porous member 81 which has been cut into the proper dimensions and which can then be sealed, together with the aluminum foil member, e.g. via ultrasonic welding, to the flange-like rim 6 of the capsule 1. Since the porous member is made of meltable polymer(s), its welding to the capsule is so made possible. Preferably the flow control porous member dimensions are such that the edge of the flow control porous member overlap the flange-like rim 6 of base body 4 of the capsule 1.

Fig. 5 shows the example of a flow control porous member 82 which has been cut into the proper dimensions, preferably slightly smaller diameter "D0" than the inner diameter "D" of the base body of the capsule. Therefore the edges of the flow control porous member do not reach to the walls of the capsule and the flow control porous member is then simply placed on the ingredients already filled in the capsule

beforehand. Finally the foil member 5 is attached, for example heat or ultrasonically sealed, to the flange-like rim 6 of the capsule 1.

The flow control porous member and the tearable member can also form a multilayer laminate to facilitate handling during production of the capsule. In this case, the flow control member is necessarily provided as the innermost layer or multilayer in the capsule relative to the tearable foil member. The flow control member can be formed of a porous mono- or multilayer membrane laminated to a mono- or multilayer non-porous tearable foil. The non-porous tearable foil member is hence chosen in a material which provides controllable and reproducible tearing conditions. A preferred material is aluminium. The thickness of the aluminium layer is preferably of from 20 to 50 microns. The aluminium may further be laminated with one or more layers of non porous polymer layer such as a thermofusible lacquer. The additional layer may be of lower thickness (e.g., less than 5 microns) and be suitable for sealing to the capsule's body and porous layer.

The flow control member is preferably chosen in a material having a higher tear strength than the one of the tearable foil member when the foil member is opened, i.e., torn by the relief member 12 under the effect of the internal pressure, the porous member stretches sufficiently to resist to tearing under the pressurized extraction conditions. In particular, the flow control member is resilient enough to deform without breaking or forming enlarged passages for the flow of liquid. The liquid is so forced under pressure to pass through the

many pores of the flow control member then to the perforations provided through the foil member as this one tears against the relief member.

As aforementioned, the porous member is preferably a mono-layer or a multilayer chosen among: polypropylene, polyethylene, PBT, polycarbonate, poly(4-methyl pentene-1), polyurethane, PET, polyethersulfone, polyamide, resin bonded-glass fibres and combinations thereof.

Fig. 6 and 7 illustrate the filtering effect of the present invention. As can be seen, the invention is particularly adapted to a grid-shaped perforation 205 of the foil member 5 of the capsule, wherein the grid is comprised by small essentially rectangular or squared imprints defining a plurality of perforations of the foil member obtained as a result of the brewing process. The perforation is provided by the relief elements 12 (Figures 2 or 17) onto which the foil member extends and tears under the effect of the internal pressure during extraction. The tearing structure is formed of surfaces which are free of sharp angles or edges, i.e., angles of less than about 80 degrees.

Figure 6 shows that there is resurgence of coffee particles through the perforation 205 in absence of the flow control member. Figure 7 shows a significant improvement with no resurgence at all of solids with capsules of the invention.

Surprisingly, figures 8 and 9 show also a neater perforation 205 for the capsule of the invention. In other words, the perforations seem to be more consistent and of a more well

defined profile. On figure 8, one can notice perforations of different size and depth.

It has been found out that the internal flow control porous member means according to the invention are particularly effective and suited in combination with an aluminium or aluminium alloy foil member 5 to be perforated in such a grid-like structure and with small openings 205.

In particular, the pressure drop during extraction under pressure of the coffee in the capsule is caused in the piping of the coffee machine, in the coffee bed, but primarily across the interface of the foil member and the puncture plate, i.e., the tearing structure.

The resulting time required to extract a certain amount of liquid depends therefore on the phenomena happening between the foil member and the puncture plate (i.e., "pyramid plate"). Without being bound by theory, the inventors think that the pressure drop occurring at the membrane-pyramid plate interface is mainly determined by the width of the gap between the membrane and "pyramid plate". The width of this gap is established at the beginning of extraction, particularly during the phase when the membrane ruptures. Very dynamic and to some extent chaotic phenomena can happen at this moment. Membrane physical strength (e.g. tensile strength, puncture resistance, elongation before rupture), rupture pressure and hydrodynamic behaviour of the water influence on how intense the membrane will be pressed against the pyramid plate and thus the gap width. Without the flow control porous member, these phenomena observed are more

chaotic, thus leading to a fairly high variation of pressure drop and consequently to a high standard deviation of flow time. Additionally, very fine particles may be transported to this very narrow gap and obtrude the outlet, thus creating an increase in pressure drop.

The addition of a flow control porous member between the coffee bed and the foil member is supposed to act on the following 3 main phenomena determining the pressure drop:

a) Fine particles (i.e., particles of less than about 90 microns), which can be washed out from the coffee bed and transported to the outlet of the capsule are withhold by the flow control porous member. Therefore, they do not accumulate at the very narrow gap between the foil member and the puncturing plate. An increase due to obstruction by fine particles is therefore avoided.

b) The flow control porous member reduces the dynamic water pressure acting on the foil member at the moment of rupture at the beginning of extraction. The foil member is pressed against the puncture plate less intensely. Therefore, the gap between membrane and pyramid plate will be wider than without flow control porous member.

c) As the coffee bed creates a pressure drop during extraction, the resulting force is transmitted to the foil member and puncture plate. This force will further reduce the gap width between the foil member and the puncture plate. Through the rigidity of the flow control porous member however, the force will be distributed differently on to the foil member and puncture plate. The force will be higher on the plateau of the puncturing elements of the plate and lower

in the grooves or channels of the plate. As the gap width relevant for pressure drop is mainly around the outlet holes located in the grooves, the reduction of the force transmitted by the coffee on the grooves will further reduce the pressure drop

In a mode, the flow control porous member is not sandwiched between the foil member 5 and the rim 6 of the base body 4. The outer edge of the flow control porous member may end at a position radially inwards from the sealing area 209 of the foil member 5 and the rim of the base body.

Fig. 14 and 15 show that the internal flow control porous member means 206 can be distanced from the foil member 5. The flow control porous member 206 are respectively sealed to the walls 7 of the base body of the capsule. The flow control porous member can thus separate transversally with respect of the brewing direction two portions of ingredients, e.g., two ground coffee portions. The flow control porous member can thus regulate the flow of liquid between the two portions. Also, the portions of ingredient may have different characteristics such as a different granulometry or be different coffee blends.

In the embodiment of Figs. 14 and 15, there are ingredients both above and below the flow control porous member 206.

The reference sign 207 designates the curled outer rim of the capsule. The foil member 5 and the rim flange of the base body can be sealed together in a ring-shaped area 209 inside and adjacent to the curled outer rim 207.

Figure 16 illustrates another possible mode for a capsule of the system of the invention. In this mode, the capsule comprises a cup-like base body 4, a closing foil 5 and a flange-like rim 6 of the body onto which is sealed an annular part of the closing foil. A flow control porous member 301 is placed in the capsule and is spaced from the inner surface of the foil member by a spacing element 302. The spacing element can be a grid with large holes or rigid member with channels and through holes providing significantly no pressure drop.

In view of figure 17, the relief elements of the capsule holder 13 are designed such that no angles of the relief element is below 80 degrees that could form sharp edges. Turning to figure 17, an example of a suitable capsule holder 13 is represented. The capsule holder 13 comprises a tearing structure 92 comprising a series of truncated pyramids 920 having substantially squared sections. The upper surface of the pyramids is basically a square surface 921 of smaller section than the base section 922 of the pyramids. The square surfaces 921 form the "plateau" of the tearing structure. The pyramid can comprise a lower base 923 of larger section than the base section 922. The number of pyramids can range of from about 25 to 50. The height of the pyramids can be of from about 0.5 to 3 mm. The tearing edges of the structure are mainly situated at the edge 924 of the upper surface 921 and at the edges 925 of the side walls of the pyramid. All the surfaces of the pyramids connect at the tearing edges by forming angles of more than 80 degrees. More preferably the upper tearing edges 924 are delimited by surfaces forming an angle of more than 90 degrees.

EXAMPLES:

Example 1 - Flow time for short coffee (40 grams):

Figure 10 shows comparative curves of the coffee cup concentration as a function of the flow time (in seconds) for delivery of 40 mL of coffee extract, for respectively capsules without flow control porous member and capsules according to the invention with a flow control porous member. The curves show the results on the standard deviation of flow times for different granulometries, respectively, 195, 267, 279 and 399 microns (Coffee ground in a Probat grinder). The capsule contained 5.5 grams of ground coffee and a porous member made of a microfibre-containing web, "Innovatec SAP489" (Specific weight of 50g/m2), made of polyurethane. The porous member of a diameter of about 33 mm was placed adjacent the foil member. The foil member of the capsule had a thickness of 30 microns. The capsules were extracted in a "Nespresso Concept®" machine.

The results show a relatively lower flow time and less standard deviation for the capsule of the invention compared to capsule having no such flow control and filtering member. Surprisingly, it is also possible to create a wider range in coffee concentration in the cup depending on the granulometry, for example, in this specific example, a concentration ranging from about 2.8 to 3.6% in weight.
The numerical results are also provided in the following table.

Flow times to obtain 40ml of coffee extract

		Without flow control porous member			With flow control porous member		
Capsule load (g)	Average particle size (microns)	Average flowtime (s)	Standard deviation (s)	Standard deviation (%)	Average flowtime (s)	Standard deviation (s)	Standard deviation (%)
5.5	195	74	24	32%	34	8	23%
5.5	267	60	18	29%	23	4	18%
5.5	279	43	15	35%	16	1	8%
5.5	399	40	16	40%	12	1	7%

Example 2 - Flow time for long coffee (110 grams):

Figures 11 and 12 show a comparative evolution of the flow time as a function of the particle size $D_{4,3}$ for delivering a lungo coffee extract of 110 grams from capsules containing about 6 grams of coffee and having a foil member of about 30 microns. The porous member of a diameter of about 33 mm was placed adjacent the foil member. It is surprisingly noticed that the flow time is significantly reduced below 30 seconds for particle size in the range of from 289 to 403 microns (More particularly, for respectively 289, 318, 347, 375 and 403 microns). It is also remarkable to note that the flow time standard deviation is significantly decreased to less than 5 seconds for all particles sizes. The capsules were extracted in a "Nespresso Concept®" machine.

The following table 1 provides results of the tests on capsules with or without flow control porous member (called "filter") corresponding to figures 11 and 12.

Coffee: VIVALTO - 6 g R&G per capsule **Capsule:** NC Al membrane 30 mi
Filter: diameter 33 mm **Extraction machine:** Pelican ref.
Cup: size110 g - 24 extractions (

Filter type	R&G D(4,3) [µm]	Flow type	Flow time [sec]	Flow rate [g/min]	TC extract %	Extraction yield %
no filter	289	slow	50	133	1.4	26.2
		fast	36	185	1.4	25.9
	318	slow	53	124	1.4	25.2
		fast	30	217	1.3	24.4
	347	slow	43	153	1.3	24.2
		fast	26	258	1.2	23.4
	375	slow	61	108	1.3	24.2
		fast	27	243	1.2	22.5
	403	slow	51	131	1.3	22.8
		fast	26	258	1.2	22.3
with filter	289	slow	30	220	1.4	26.1
		fast	28	236	1.4	26.1
	318	slow	28	236	1.3	24.4
		fast	26	252	1.3	24.7
	347	slow	26	259	1.2	23.5
		fast	25	267	1.2	23.4
	375	slow	25	262	1.2	22.7
		fast	25	268	1.2	22.6
	403	slow	25	263	1.2	22.5
		fast	25	269	1.2	22.0

table 1.

Example 3 – Crema results:

Figure 13 shows the results on the results on crema formation using capsules of the invention and comparatively capsules with no flow control porous member. The curves are comparative curves of the "crema" (time in seconds for "sugar test") as a function of the flow time for delivering 110

grams of coffee extract in seconds. The capsule contained 6 grams of ground coffee and a porous member made of microfibrous "Innovatec SAP489" web in polyurethane. The foil member had a thickness of 30 microns. The results clearly show that the flow control porous member does not affect the crema formation whereas the flow time is significantly reduced.

For the example of figure 13, crema is measured according to an empirical test called "sugar test". The procedure for this test is explained below.

Example 4 - Flow time for long coffee (110 grams) and higher mass of ground coffee (6.2 grams):

A comparative test was run for capsules with or without flow control member made of membrane of nylon 6,6, "Ultipor N6,6 Posydine" from PALL Company of 0.65 microns and 33 mm of diameter. The capsules contained 6.2 grams of ground coffee having particle size $D_{4,3}$ of 320 microns. The porous member of a diameter of about 33 mm was placed adjacent the foil member. For capsules with the Nylon membrane, the flow time was comprised between 33 and 37 seconds with an average flow time of 34 seconds. The coffee yield was measured between about 22 and 23%. Comparatively, capsules of the same characteristics but without flow control porous member exhibited a flow time between 24 and 72 seconds with an average flow time of 49 seconds. These results also show that for a higher mass of 6.2 grams, the flow time is reduced in average and the flow consistency is very much improved with capsules of the invention.

Example 5 – Flow time for different flow control porous members:

The following table provides results on flow time for different other porous member tested from PALL Company. The reference was a capsule with no porous member inside. This result shows that the flow time is improved for porous members of between 0.45 to 100 microns. The coffee yield was comprised between about 22 and 23%.

Porous member	Type	Pore size µm]	flow-time in sec/110 ml
HDC II	Polypropylene	0.60	26
HDC II	Polypropylene	20.00	20
Preflow UB	Resin-bonded glass fiber	0.45	28
Ultipor GF Plus	Resin-bonded glass fiber	1.00	29
Ultipor N6,6	Nylon 6,6	0.65	32
Ultipor N6,6 Posidyne	Nylon 6,6	0.65	27
Reference			42

Coffee Blend , D4,3 of 400 microns

Example 6: Sugar test for crema determination:

The mechanised sugar test device is composed of a small sugar-containing silo. The prismatic V-shape of this silo comprising a defined slit (2mm x 40mm) at the bottom edge can create a uniform sugar curtain as long as the slit is free and a minimum of sugar remains in the silo. This silo can be moved horizontally, with controlled speed (~40 mm/s) from one point "A" to a point "B" (distance between A and B is 20 cm). In the end position at both points a baffle prevents the sugar from flowing out if the device is in stand-by mode. When the silo is moved, the sugar curtain is produced all the way between the two points "A" and "B". The crema in a cup that is placed at 60 mm below this path within the two points will be topped with a uniform layer of sugar when the silo passes over it. The chronograph is started when the sugar layer is positioned on the foam's layer. The amount of sugar (a thickness of the layer to obtain a precise weight of 5 g of sugar) deposed in the cup is adjustable by varying the speed of the silo or the dimensions of the slit. The sugar is crystal sugar of $D_{4,3}$ equal to 660 microns. A precise waiting period (20 sec. for small cups) must be observed between the end of extraction and the start of the sugar test. The sugar layer remains some time on top of the crema. Later, when the main part of the sugar sinks suddenly the observing operator must stop the chronograph.

The "sugar test value" is the number of seconds shown by the chronograph. Additional information as to this test can be found in EP1842468B1.

Claims:

1. A capsule for use in a beverage production machine comprising:
- means for perforating an inlet side of the body of the capsule (1) opposed to the foil member (5) and the flange-like rim and injecting a liquid or a liquid/gas mix into the capsule (1),
- a relief plate with a multitude of relief elements which relief plate is arranged in the machine such that the injection pressure thrusts the foil member (5) against the relief plate,
the capsule (1) comprising:
- a base body (4) sealed off by a foil member (5) tightly attached to the flange-like rim (6) of the base body (4),
the foil member (5) being made from a material which is then perforated by the relief plate to form a multitude of openings when the pressure of the injected liquid or liquid/gas mixture reaches a value of at least 4 bar,
wherein the capsule further comprises a flow control porous member (201, 203, 204, 206, 208) arranged between at least a portion of ingredients in the capsule (1) and the foil member (5).

2. Capsule according to claim 1,
wherein the flow control porous member of the capsule has a pore size comprised between 0.4 and 25 microns.

3. Capsule according to claim 2, wherein the flow control porous member has a pore size lower than 10 microns.

4. Capsule according to claim 3, wherein the porous member (201, 203, 204, 206, 208) is made of at least one thin polymeric membrane.

5. Capsule according to claim 3, wherein the porous member (201, 203, 204, 206, 208) comprises essentially polymeric fibre-containing material(s) and made from a woven and/or non-woven material.

6. Capsule according to claim any of claims 1 to 5, wherein the material for the porous member is chosen among the list of: polypropylene, polyethylene, PBT, Nylon, polycarbonate, poly(4-methyl pentene-1), polyurethane, PET, polyethersulfone, polyamide, resin bonded- glass fibres and combinations thereof.

7. Capsule according to any of the preceding claims, wherein the capsule contains ground coffee having a particle size ($D_{4,3}$) comprised between 190 and 400 microns.

8. Capsule according to any of the preceding claims, wherein the foil member (5) has a thickness of between 15 and 45 microns.

9. Capsule according to any of the preceding claims, wherein the flow control porous member (201, 203, 204, 206, 208) has higher rigidity in flexure than the foil member.

10. Capsule according to any of the preceding claims, wherein the flow control porous member (201, 203, 204, 206, 208) is adjacent to the foil member (5).

11. Capsule according to claim 10, wherein the foil member (5) and the flow control porous member form a multilayer laminate.

12. Capsule according to any of claims 1 to 9, wherein the flow control porous member (201, 203, 204, 206, 208) is distanced from the foil member (5).

13. Capsule according to claim 12, wherein the flow control porous member (201, 202, 203, 204, 206, 208) is sealed to the side walls of the base body (4) of the capsule (1).

14. Capsule according to any of claims 1 to 9, wherein the flow control porous member (201, 203, 204, 206, 208) is free of connection relative to the body and foil member.

15. Capsule according to claims 14, wherein the flow control porous member (201, 203, 204, 206, 208) is loosely inserted between the ingredients (3) and the foil member (5).

16. Capsule according to claim 15, wherein the flow control porous member has a square or rectangular shape.

17. Capsule according to claims 14 or 15, wherein the outer edge of the flow control porous member (201, 203, 204, 206, 208) ends at a position radially inwards from the sealing area (209) of the foil member (5) and the flange-like rim (6) of the base body (4).

18. Capsule according to any of the preceding claims, wherein the flow control porous member comprises microfibres of diameter less than 20 microns.

19. Capsule according to any of the preceding claims, wherein the base body (4) is made from aluminum, aluminium alloy or a laminate of aluminium or aluminium alloy and polymer.

20. Capsule according to any of the preceding claims, wherein the foil member is made from aluminum, aluminium alloy or a laminate of aluminium or aluminium alloy and polymer.

21. A capsule for use in a beverage production machine comprising:
- a base body (4),
- a perforable non-porous foil member (5) tightly attached to the base body (4),

- at least one porous layer between the ingredients in the capsule (1) and the foil member (5);
wherein the porous layer forms with the perforable non-porous foil member, a multilayer laminate.

22. Capsule according to claim 21, wherein the tear strength of the porous layer, under the pressure extraction conditions, is higher than the one of the foil member.

23. Capsule according to claim 21 or 22, wherein the material for the porous layer is chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone, and polyamide.

24. Capsule according to claim 21, wherein the porous layer has a pore size between 0.4 and 100 microns, preferably between 0.4 and 2 microns.

25. A method for producing a beverage on the basis of an ingredient in a capsule, the method comprising the steps of:
- providing a capsule (1) comprising a base body (4) sealed off by a foil member (5) tightly attached to the flange-like rim (6) of the base body (4),
- inserting the sealed capsule (1) in a beverage production machine,
- perforating an inlet side of the capsule (1) opposed to the foil member (5),
- injecting a liquid or a liquid/gas mixture into the capsule causing a pressure to build up in the capsule

and the foil member (5) to thrust against a fixed relief member of the beverage production machine,
the foil member (5) being made from a material which is then perforated by a multitude of openings when the pressure of the injected liquid and liquid/gas mixture reaches a value of at least 4 bar,
- draining a beverage from the capsule, wherein the beverage passes between the multitude of openings and the relief member,
comprising the step of:
- Passing (201, 203, 204, 206, 208) the beverage via a flow control porous member (201, 203, 204, 206, 208) arranged between at least a portion of ingredients and the foil member (5); said flow control porous member being effective to reduce the flow time and/or improve the flow time consistency when delivering a given volume of coffee extract compared to a capsule without said member.

26. Method according to claim 25, wherein the capsule contains a dose of between 5.5 to 7.0 grams of ground coffee, the ground coffee has a particle size $D_{4,3}$ between 250 and 450 microns and the flow porous member has a pore size comprised between 0.4 and 100 microns, resulting in the beverage being drained from the capsule with a flow time for delivering 40 mL of coffee extract lower than 40 seconds.

27. Method according to claim 25, wherein the capsule contains a dose of between 6.0 to 7.0 grams of ground coffee, the ground coffee has a particle size $D_{4,3}$

between 250 and 450 microns, preferably 280 and 400 microns, and the flow porous member has a pore size comprised between 0.4 and 100 microns, resulting in the beverage being drained from the capsule with a flow time for delivering 110 mL of coffee extract lower than 30 seconds.

28. Method according to any of claims 25 or 27, wherein the flow control porous member has a pore size comprised lower than 10 microns.

29. Method according to any of claims 25 to 28, wherein the porous member comprises a thin membrane or non-woven and/or woven fibres.

30. Method according to any of claims 25 to 29, wherein the material for the porous member is chosen among the list of: Polypropylene, polyethylene, PBT, polycarbonate, poly(4-methyl pentene-1), polyurethane, PET, polyethersulfone, polyamide, resin bonded- glass fibres and combinations thereof.

31. Method according to any of claims 25 to 30, wherein the foil member and flow control porous member form a multilayer laminate.

32. Method according to claim 31, wherein the flow control porous member resists the tearing by the relief member when the foil member is torn by the relief member under the pressurized extraction conditions.

33. Method according to any of claims 25 to 31, wherein the foil member is made of aluminium or aluminium allow and has a thickness of 15 and 45 microns.

5

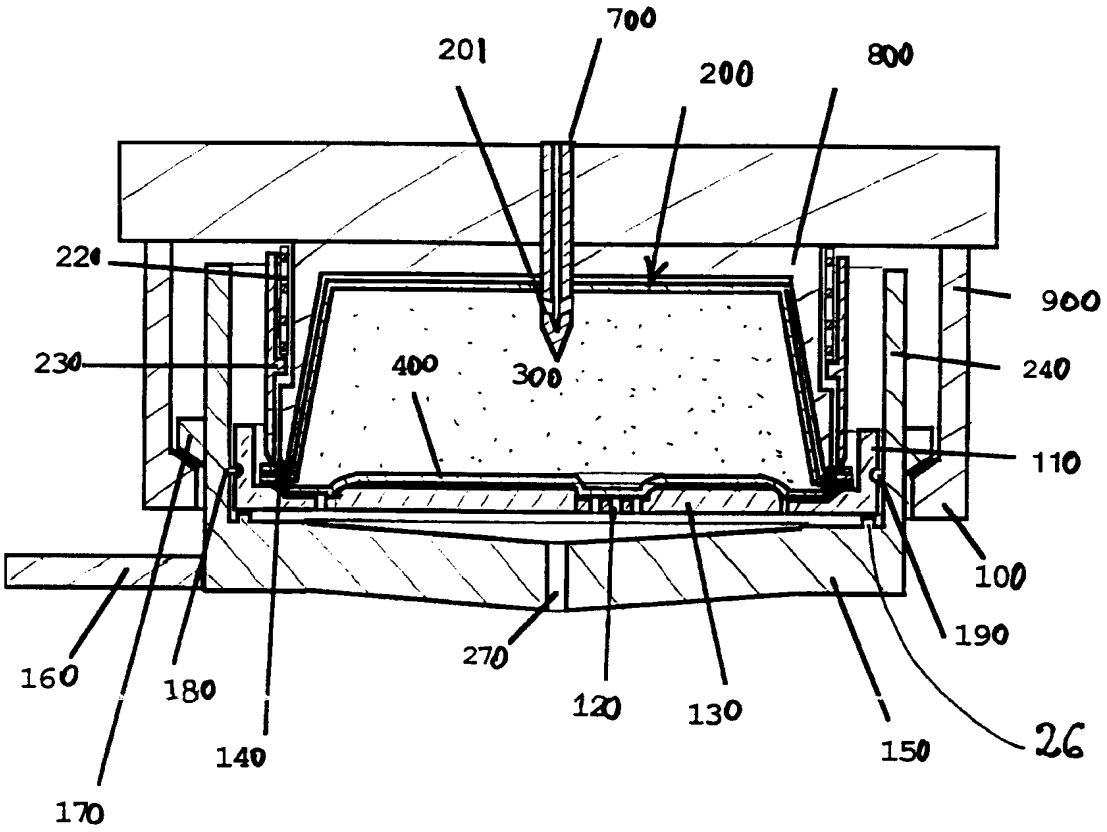

700
201
200
800
220
900
230
400
300
240
110
100
190
160
180
270
120
130
150
26
140
170

FIGURE 1

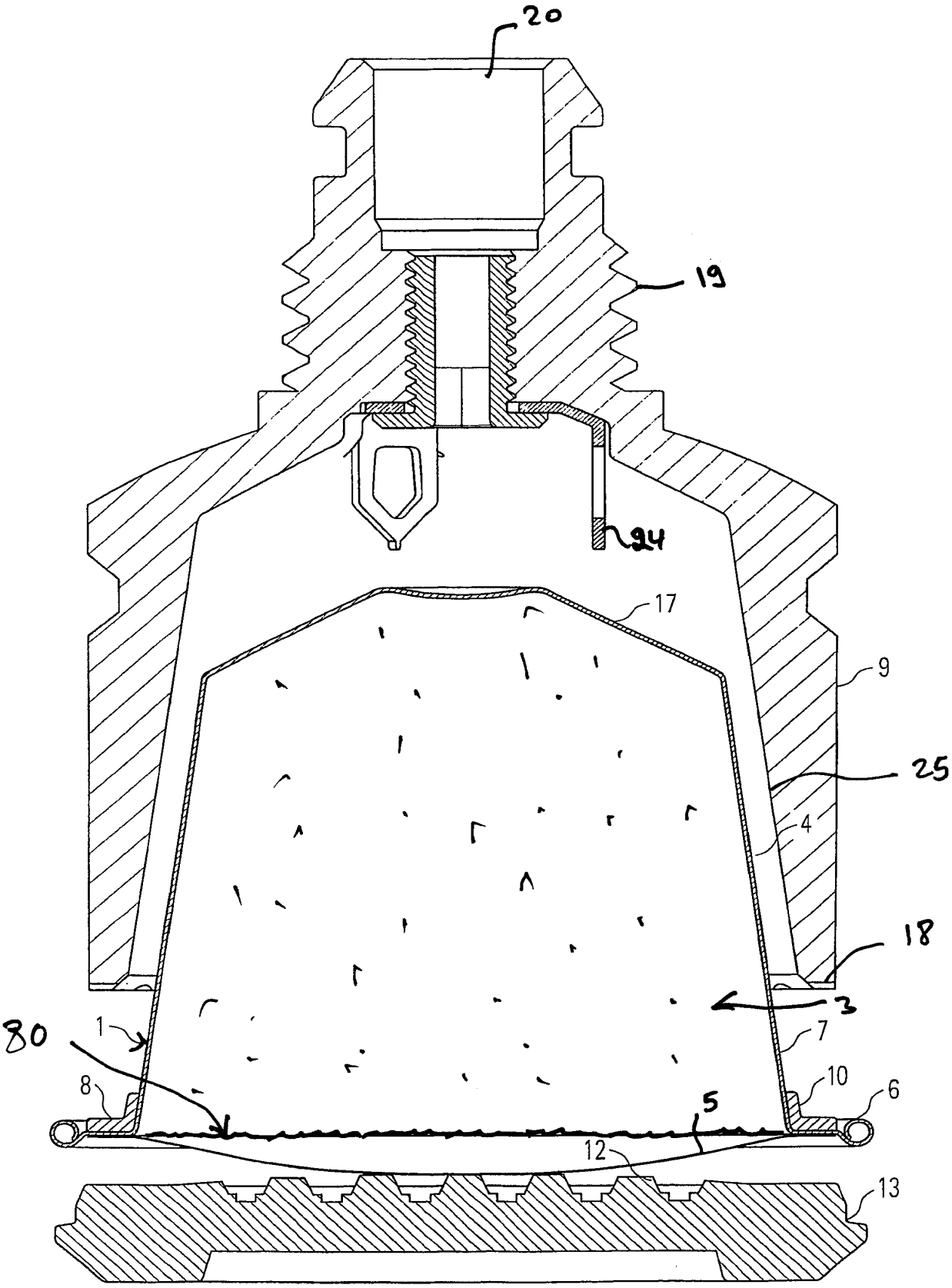


Fig. 2

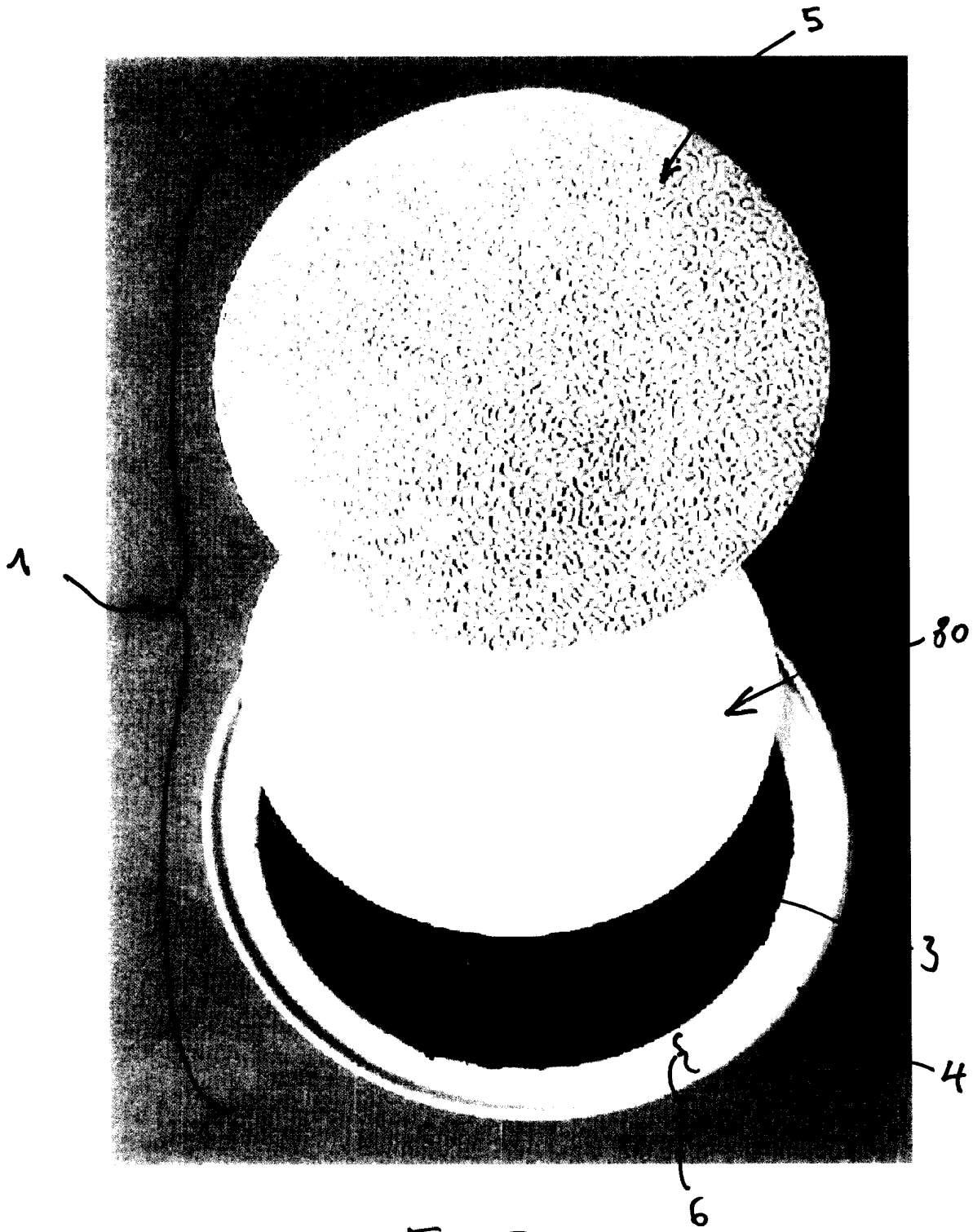


FIG. 3

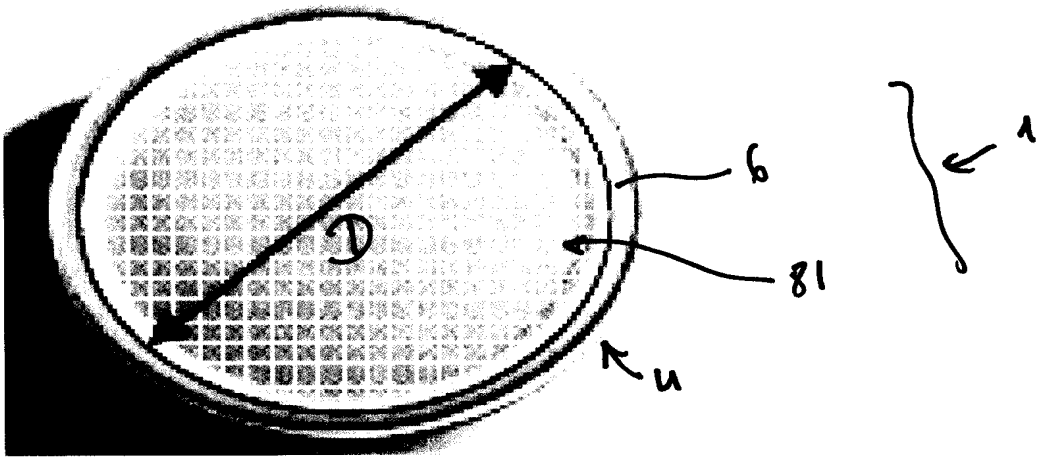


FIG. 4

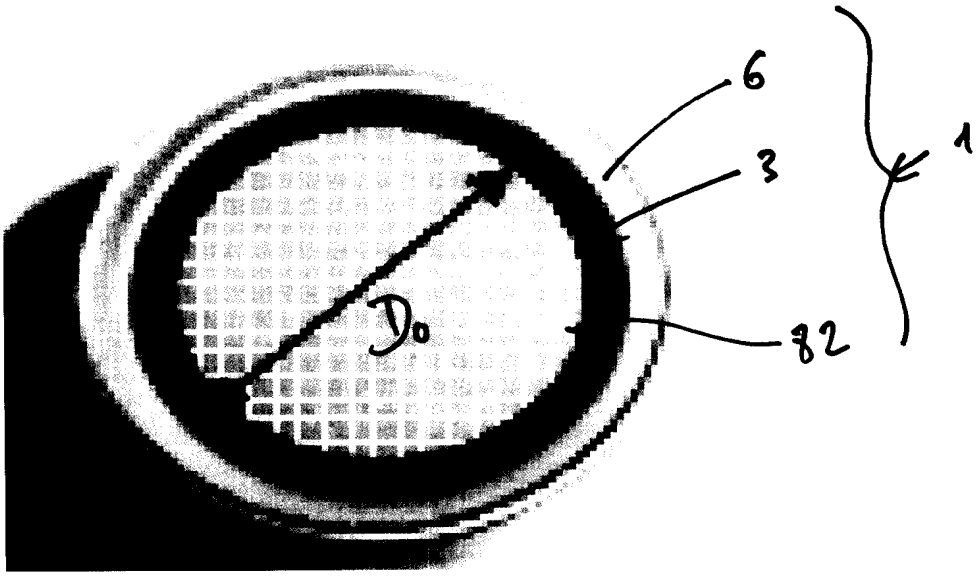


FIG. 5

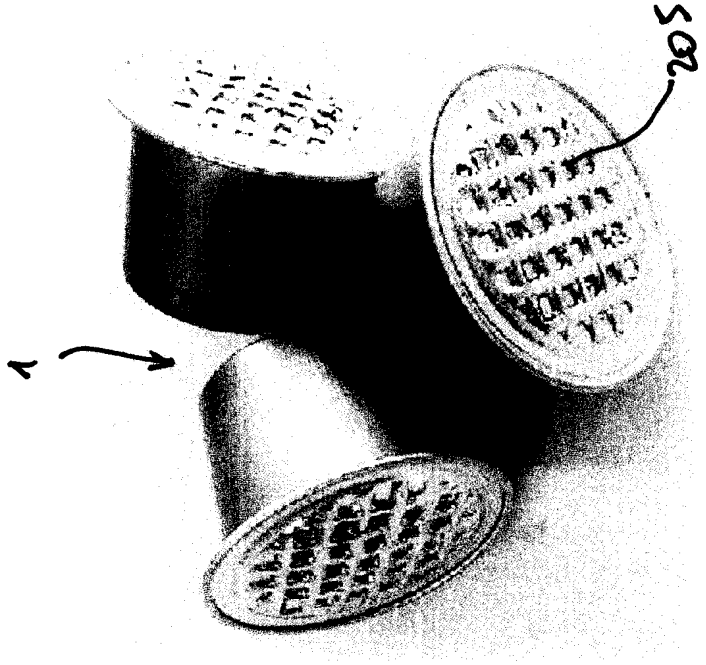


Fig. 7

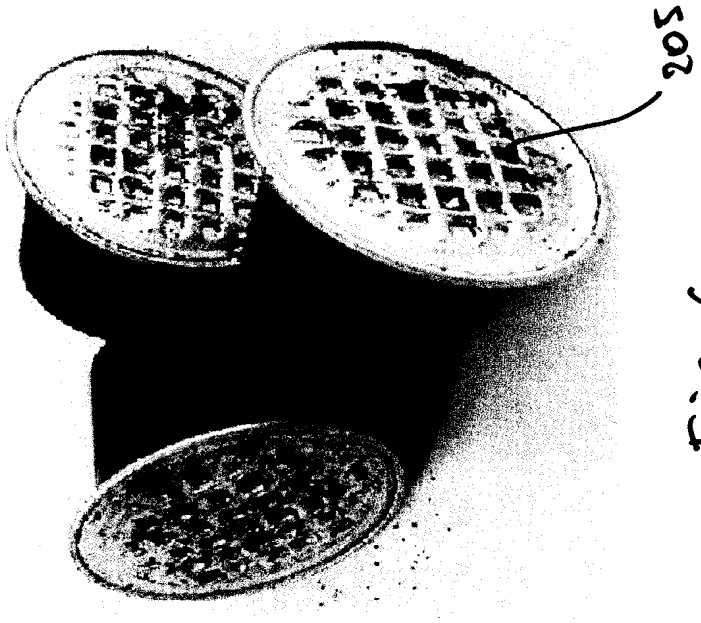


Fig. 6

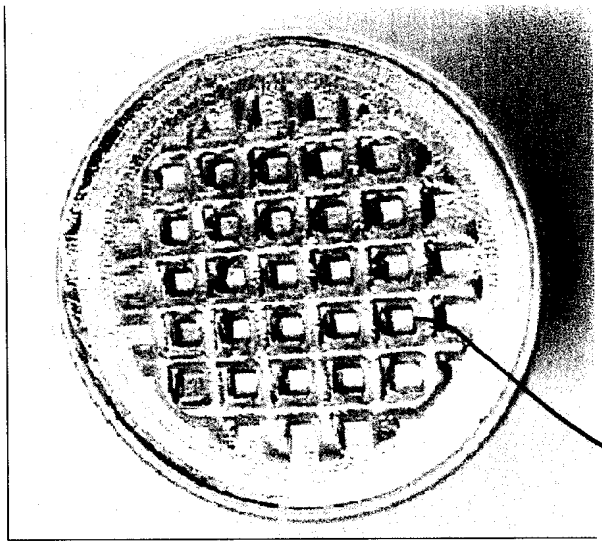


Fig. 9

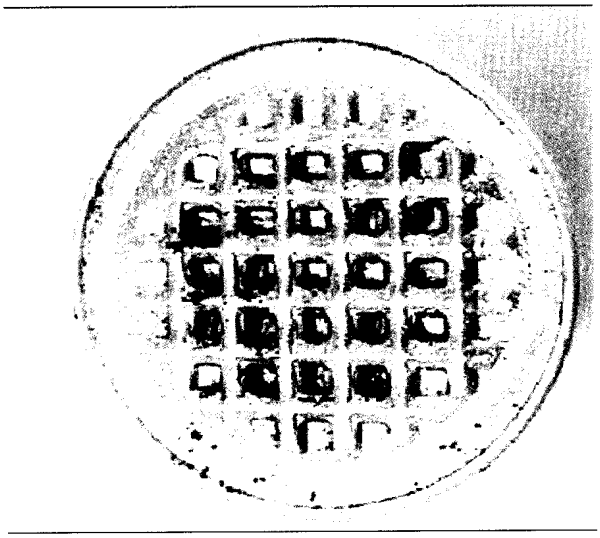


Fig. 8

Fig. 10

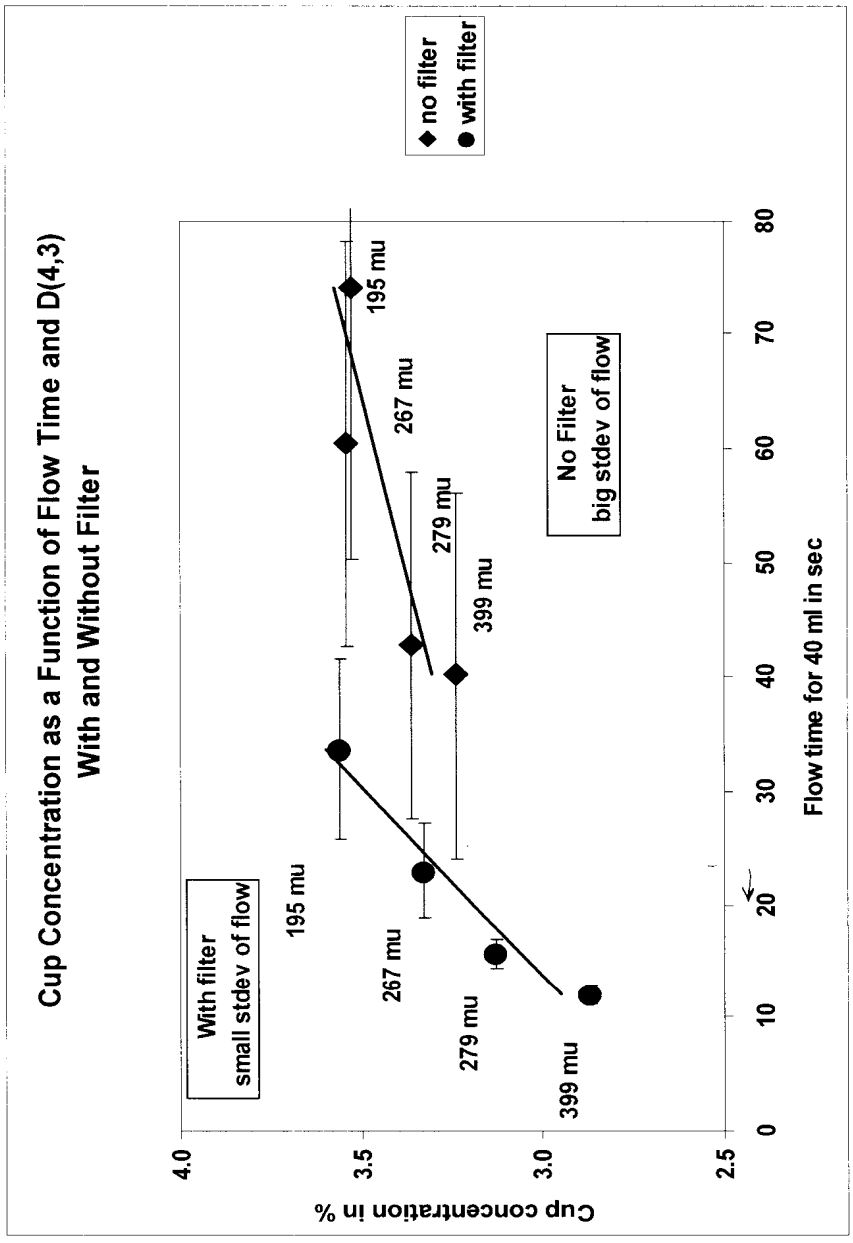

Cup Concentration as a Function of Flow Time and D(4,3)
With and Without Filter
no filter
with filter
With filter
small stdev of flow
No Filter
big stdev of flow
195 mu
267 mu
279 mu
399 mu
Cup concentration in %
Flow time for 40 ml in sec
4.0
3.5
3.0
2.5
0
10
20
30
40
50
60
70
80

FIG. 12

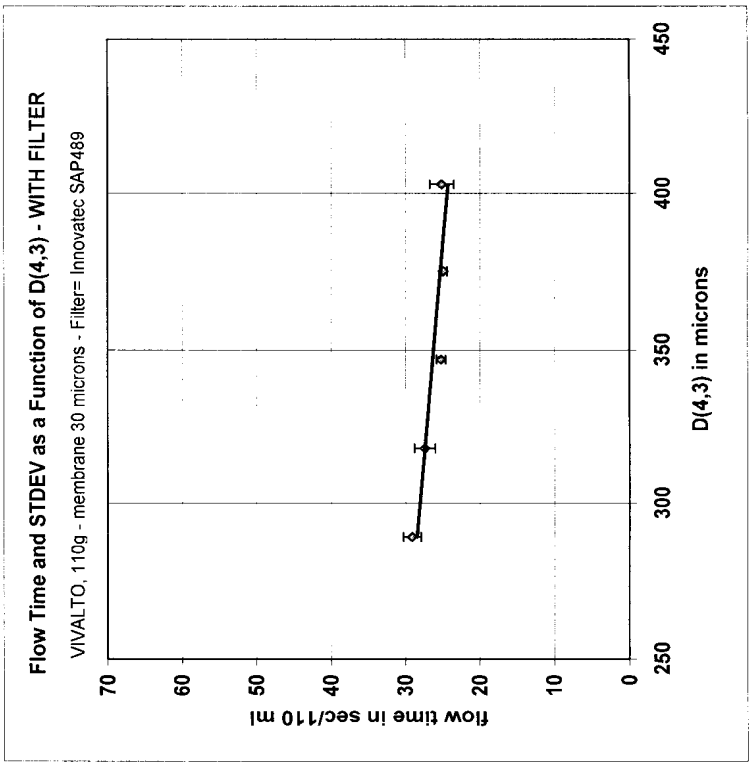

Flow Time and STDEV as a Function of D(4,3) - WITH FILTER
VIVALTO, 110g - membrane 30 microns - Filter= Innovatec SAP489
flow time in sec/110 ml
0
10
20
30
40
50
60
70
250
300
350
400
450
D(4,3) in microns

FIG. 11

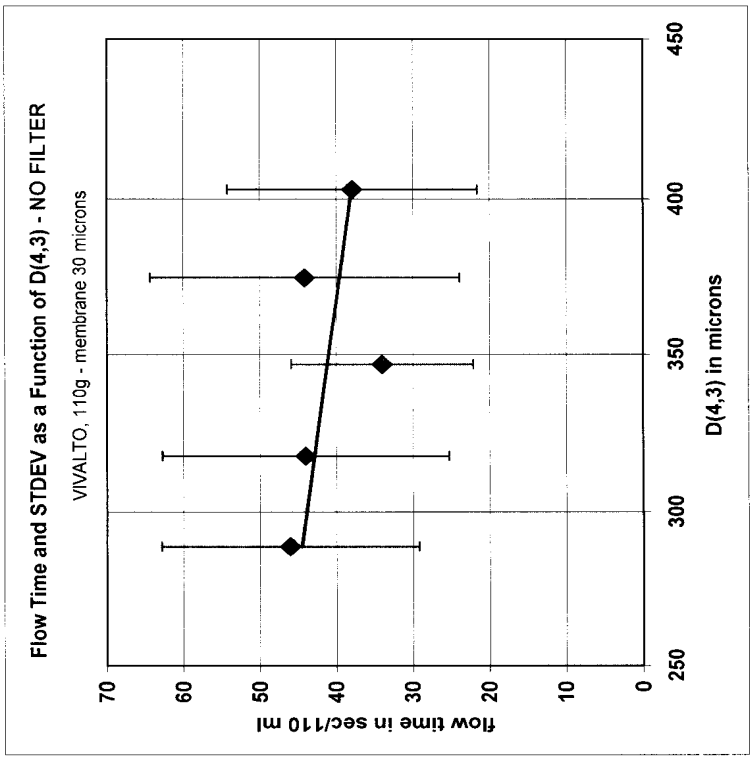
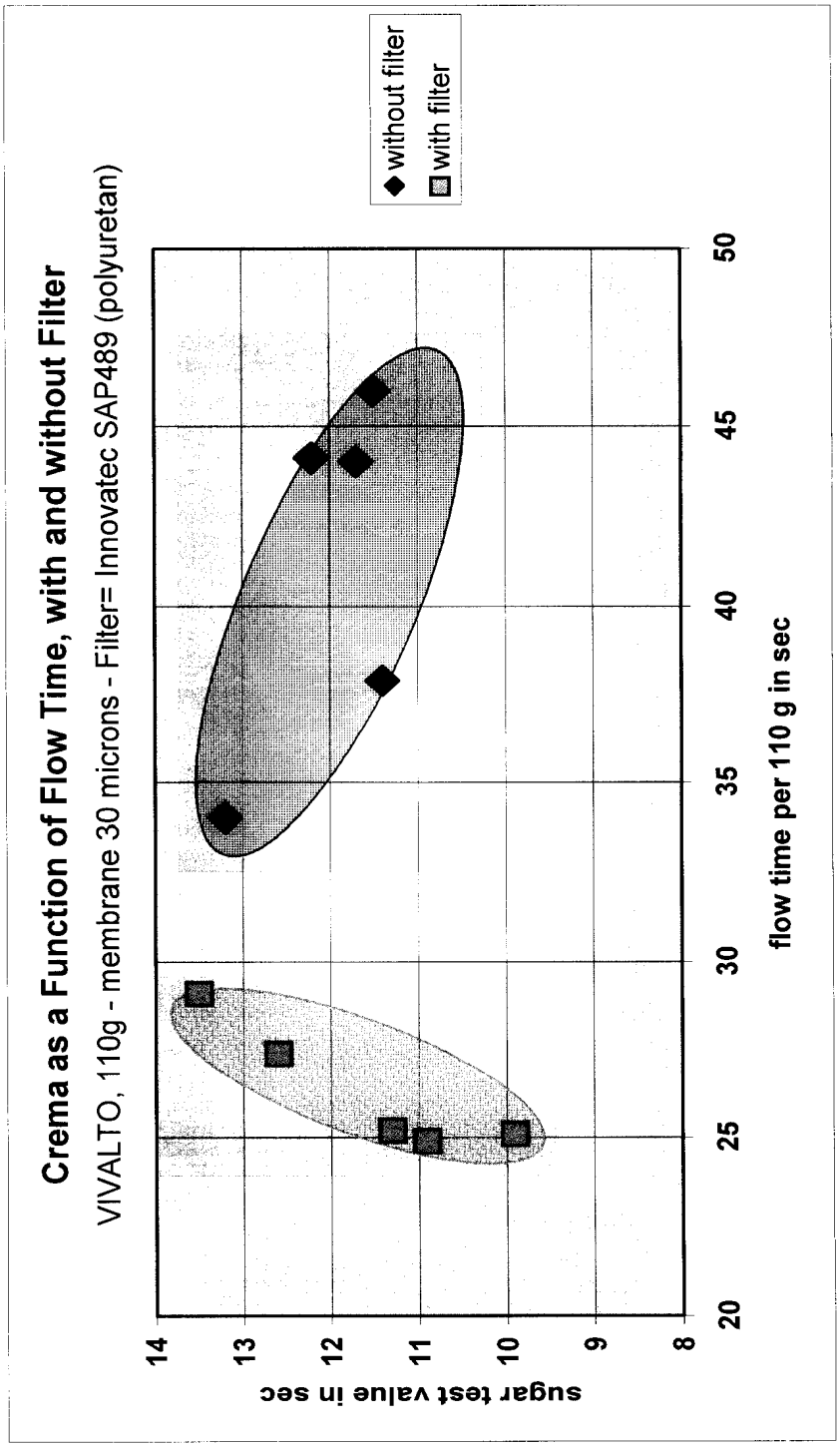

Flow Time and STDEV as a Function of D(4,3) - NO FILTER
VIVALTO, 110g - membrane 30 microns
flow time in sec/110 ml
0
10
20
30
40
50
60
70
250
300
350
400
450
D(4,3) in microns

Fig. 13


Crema as a Function of Flow Time, with and without Filter
VIVALTO, 110g - membrane 30 microns - Filter= Innovatec SAP489 (polyuretan)
without filter
with filter
sugar test value in sec
14
13
12
11
10
9
8
flow time per 110 g in sec
20
25
30
35
40
45
50

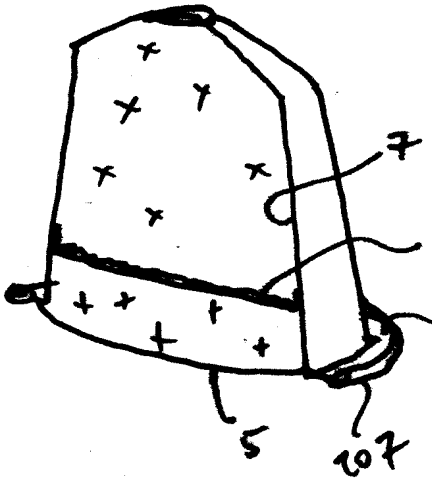


FiG. 14

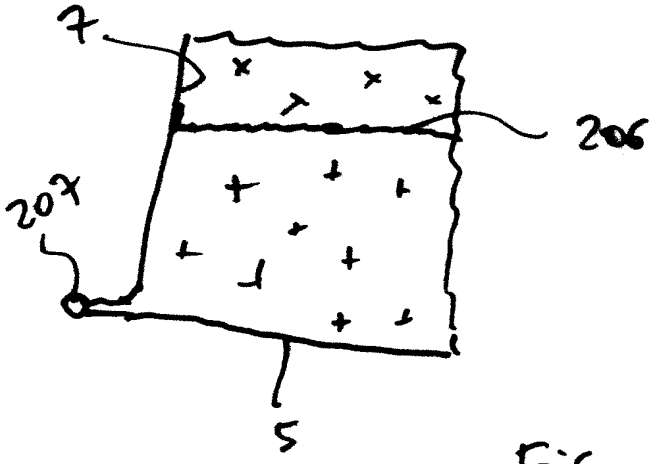


FiG. 15

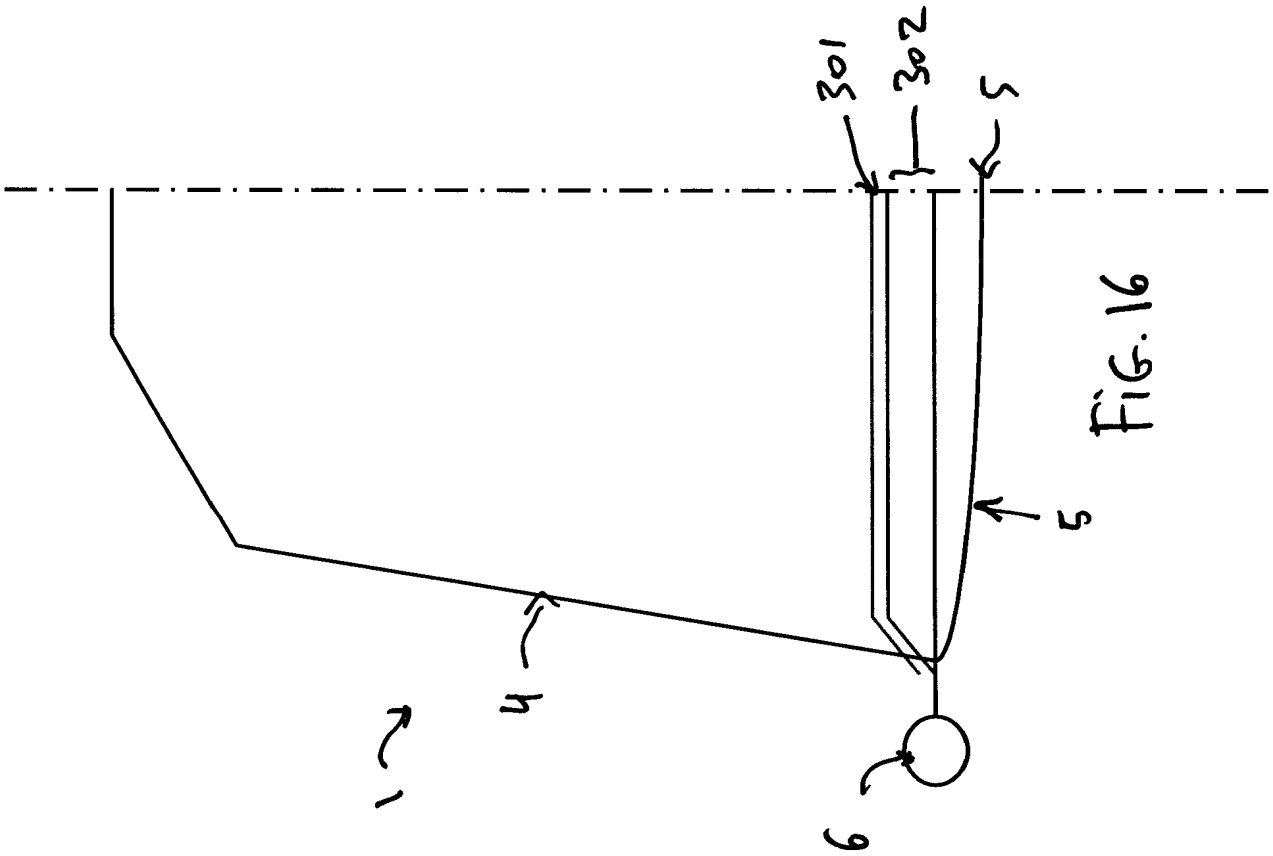


Fig. 16

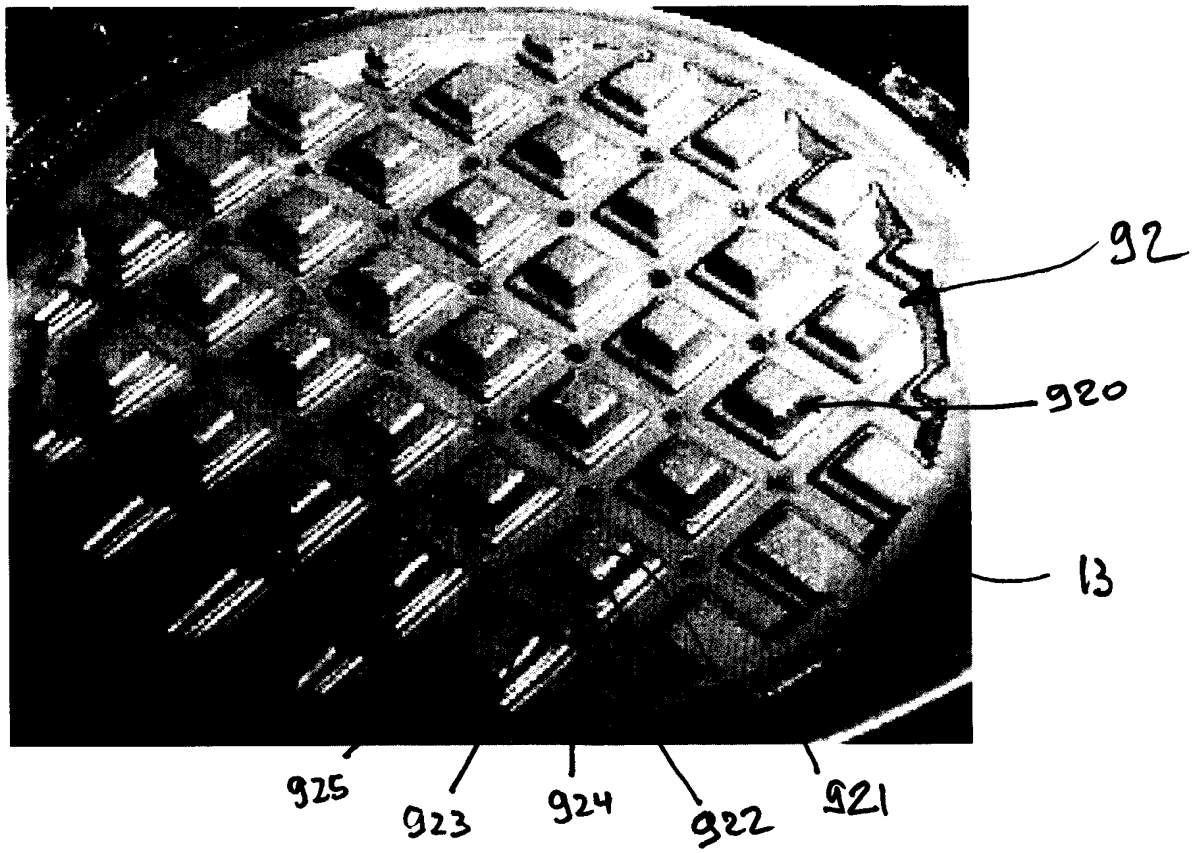


FIG. 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/050034

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804

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 A47J

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 5 242 702 A (FOND OLIVIER [CH]) 7 September 1993 (1993-09-07) column 1 - column 6; figure 5	1,9,10, 12,14, 15,19,20 2,6-8, 18, 25-27, 29,30,33 11,13, 16,17, 21,22, 28,31,32
X Y	EP 0 512 468 A (NESTLE SA [CH]) 11 November 1992 (1992-11-11) column 1, line 46 - column 3, line 25; figure 3	21-23 24

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

[X] See patent family annex.

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

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"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
24 March 2009	01/04/2009

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	Mans-Kamerbeek, M

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Nespresso USA, Inc. Ex. 1002 Part 3
Page 141 of 429

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 710 173 A (TCHIBO GMBH [DE]) 11 October 2006 (2006-10-11)	2,6-8, 18,24, 29,30,33
A	column 1, paragraph 1 - column 3, paragraph 14 column 4, paragraph 18 - paragraph 19 column 6, paragraph 31; figures 4-6	3-5,23
Y	EP 1 654 966 A (NESTEC SA [CH]) 10 May 2006 (2006-05-10) the whole document	25-27, 29,30,33
A	CH 605 293 A5 (NESTLE SA) 29 September 1978 (1978-09-29) cited in the application the whole document	
A	EP 0 554 469 A (NESTLE SA [CH]) 11 August 1993 (1993-08-11) the whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/050034

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5242702 A	07-09-1993	AT 93373 T	15-09-1993
		AU 645327 B2	13-01-1994
		BR 9102996 A	18-02-1992
		CA 2046557 A1	28-01-1992
		DE 69002945 D1	30-09-1993
		DE 69002945 T2	20-01-1994
		DK 0468078 T3	03-01-1994
		EP 0468078 A1	29-01-1992
		ES 2043196 T3	16-12-1993
		FI 913267 A	28-01-1992
		JP 2010682 C	02-02-1996
		JP 4236921 A	25-08-1992
		JP 7036801 B	26-04-1995
		MX 174039 B	15-04-1994
		NO 912906 A	28-01-1992
		NZ 238938 A	27-06-1994
		PT 98456 A	31-08-1993
		ZA 9105419 A	29-04-1992
EP 0512468 A	11-11-1992	AT 148419 T	15-02-1997
		AU 1505192 A	12-11-1992
		CA 2067515 A1	11-11-1992
		DE 69217113 D1	13-03-1997
		DE 69217113 T2	15-05-1997
		DK 0512468 T3	07-07-1997
		ES 2097831 T3	16-04-1997
		FI 922065 A	11-11-1992
		GR 3022936 T3	30-06-1997
		JP 2763987 B2	11-06-1998
		JP 5132056 A	28-05-1993
		MX 9202144 A1	01-11-1992
		NO 921812 A	11-11-1992
		NZ 242567 A	22-12-1994
EP 1710173 A	11-10-2006	DE 102005016297 A1	12-10-2006
		US 2006236871 A1	26-10-2006
EP 1654966 A	10-05-2006	AR 055279 A1	15-08-2007
		AT 347837 T	15-01-2007
		AT 419769 T	15-01-2009
		AT 399495 T	15-07-2008
		AT 369062 T	15-08-2007
		AU 2005298933 A1	04-05-2006
		AU 2005298954 A1	04-05-2006
		BR PI0517030 A	30-09-2008
		BR PI0517296 A	07-10-2008
		CA 2581293 A1	04-05-2006
		CA 2584884 A1	04-05-2006
		CN 101043835 A	26-09-2007
		CN 101048094 A	03-10-2007
		DE 602004003713 T2	18-10-2007
		DE 602004008113 T2	15-05-2008
		DE 602004010435 T2	16-10-2008
		DK 1654966 T3	19-02-2007
		DK 1816936 T3	08-09-2008
		DK 1700548 T3	17-09-2007
		DK 1702543 T3	07-01-2008
		EC SP077350 A	26-04-2007

IPR2023-00502
Nespresso USA, Inc. Ex. 1002 Part 3
Page 143 of 429

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1654966 A		EP 1816935 A2	15-08-2007
		EP 1816936 A1	15-08-2007
		EP 1700548 A1	13-09-2006
		EP 1702543 A2	20-09-2006
		WO 2006045515 A2	04-05-2006
		WO 2006045536 A1	04-05-2006
		ES 2277184 T3	01-07-2007
		ES 2309804 T3	16-12-2008
		ES 2292154 T3	01-03-2008
		ES 2297791 T3	01-05-2008
		HK 1091703 A1	30-05-2008
		HK 1112166 A1	20-02-2009
		JP 2008517639 T	29-05-2008
		JP 2008517838 T	29-05-2008
		KR 20070085287 A	27-08-2007
		SI 1654966 T1	30-04-2007
		SI 1700548 T1	31-12-2007
		SI 1816936 T1	31-10-2008
		US 2006110507 A1	25-05-2006
		US 2007224319 A1	27-09-2007
CH 605293 A5	29-09-1978	AR 218048 A1	15-05-1980
		AT 359423 B	10-11-1980
		AU 515875 B2	07-05-1981
		AU 3141877 A	14-06-1979
		BE 861543 A1	06-06-1978
		BR 7708403 A	08-08-1978
		CA 1089801 A1	18-11-1980
		DE 2752733 A1	22-06-1978
		DE 7736129 U1	24-02-1983
		DK 561177 A	18-06-1978
		ES 232747 Y	16-06-1978
		FI 773625 A	18-06-1978
		FR 2373999 A1	13-07-1978
		GB 1561188 A	13-02-1980
		IT 1133901 B	24-07-1986
		JP 1382008 C	09-06-1987
		JP 60045325 A	11-03-1985
		JP 61051882 B	11-11-1986
		JP 1338647 C	29-09-1986
		JP 53076171 A	06-07-1978
		JP 61002372 B	24-01-1986
		LU 78694 A1	17-04-1978
		NL 7713597 A	20-06-1978
		NO 774331 A	20-06-1978
		NZ 185867 A	27-05-1980
		PT 67339 A	01-12-1977
		SE 428917 B	01-08-1983
		SE 7714275 A	18-06-1978
		US 4136202 A	23-01-1979
		ZA 7707279 A	27-09-1978
EP 0554469 A	11-08-1993	AT 112227 T	15-10-1994
		DE 69200472 D1	03-11-1994
		DE 69200472 T2	02-02-1995
		DK 554469 T3	28-11-1994
		ES 2061284 T3	01-12-1994

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		JP 5253071 A	05-10-1993

IPR2023-00502
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Page 145 of 429

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(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: SYSTEM OF EDIBLE-PRODUCT MAKING MACHINE AND LOAD ELEMENT AND PROCESS FOR CONTROL OF MACHINE

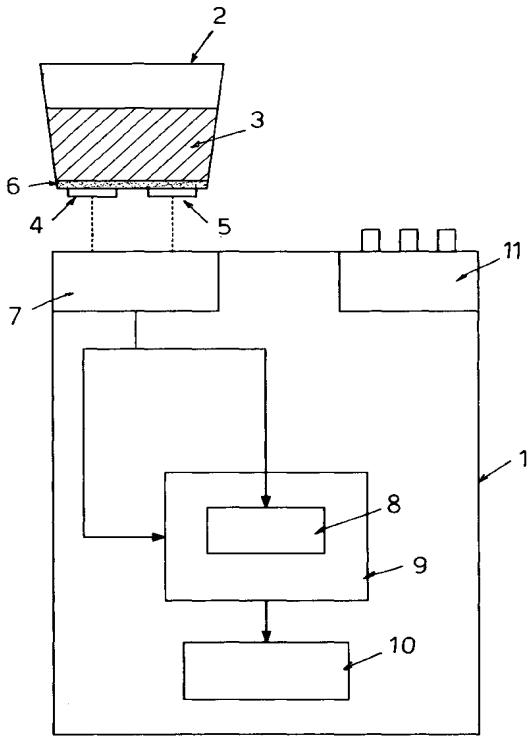


FIG.1

(57) Abstract: The process for controlling the operation of an edible-product making machine (1) of the type being fed with a single use load element (2) having a brewable or water soluble aromatic substance (3) for preparation of the edible product, comprises a first step of recognition wherein the edible-product making machine (1) recognises an identifying element (4) on the load element (2) allowing the edible-product making machine (1) to take further steps only if it also recognises on the load element (2) a validation element (5) to be validated, a second step of validation of the validation element (5), and a third step of activation wherein the edible-product making machine (1) automatically activates a cycle of production of the edible product only after having recognised on the load element (2) the identifying element (4) in combination with the validation element (5) as validated.

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— *of inventorship (Rule 4.17(iv))*

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SYSTEM OF EDIBLE-PRODUCT MAKING MACHINE AND LOAD ELEMENT AND PROCESS FOR CONTROL OF MACHINE

DESCRIPTION

The present invention relates to a system of an edible-product making machine and a load element, and a process for controlling the operation of the edible-product making machine.

Edible-product making machines of the type being fed with a single use load element having a brewable or water soluble aromatic substance for preparation of said edible product are often used for the preparation of coffee, tea, or other beverages, as well as for soups. The load element generally comprises a capsule containing coffee powder, instant coffee granules, tea leaves, freeze-dried soup granules or other substances designed to be put in contact with water within machine. The load element is usually sealed, and the element is inserted into the machine, without the user being in contact with the substance therein. Inside the machine, the load element is generally pierced to allow water to pass through it, or the contents of the load element are emptied out into a different container for the preparation of the edible product. The contents of the load element are brewed or dissolved in the water in order to make the edible product.

The necessary operating conditions of the machine vary depending on the substance within the load element. Such operating conditions may include the amount of water used for

each product, the temperature and pressure of the water supplied, as well as the time required for operation. For each substance or type of substance, the operating conditions affect the quality of the final edible product. In order to achieve a desired quality, the contents of the load element must be known and the appropriate operating conditions must be set.

In systems of the prior art which are capable of producing a variety of edible products, such as a variety of coffee beverages, the user must select the operating conditions of the machine. This requires time and effort and there is the potential risk of producing an edible product with incorrect qualities if the user is not familiar with the functioning of the machine or the operating conditions appropriate for the contents of the load element and therefore selects the wrong operating conditions.

The production of an edible product of the desired quality is also dependent on the user knowing the contents of the load element. Since load elements are generally sealed, it may not be possible to ascertain the contents thereof by visual inspection. Furthermore, if there is no indication on the load element of its contents, the user cannot be sure of the contents, thus potentially selecting the wrong operating conditions for the desired quality of product, or even producing the wrong product.

Furthermore, edible-product making machines of the prior art, such as coffee machines fed with capsules containing coffee powder, are usually designed so as to operate with a certain design or type of load element. Use of an incorrect load element may cause the machine to malfunction and can prejudice the safety and integrity of the machine and the may harm the user. These types of machines often involve the use of high pressure, high temperature water, which poses a potential health hazard if the machine is not used correctly or malfunctions. Alternatively, use of the wrong operating conditions with the correct load element may also lead to these consequences. For example, use of an insufficient amount of water could lead to the contents of the load element not being fully dissolved and blocking channels within the machine, thereby potentially causing accumulation and overflow of hot water.

The technical task proposed by the present invention is therefore that of providing a system of an edible-product making machine and load element and process for controlling the operation of the machine that overcome the noted technical drawbacks of the prior art.

Within the scope of this technical task is therefore that of providing a safe and simple system and process for ensuring that an appropriate load element is used.

A further technical task is that of providing a system and process for ensuring that operating conditions appropriate for the load element are used.

The technical task, as well as these and other objects, are achieved according to the present invention by a process for controlling the operation of an edible-product making machine of the type being fed with a single use load element having a brewable or water soluble aromatic substance for preparation of said edible product, characterised in that it comprises a first step of recognition wherein said edible-product making machine recognises an identifying element on said load element allowing said edible-product making machine to take further steps only if it also recognises on said load element a validation element to be validated, a second step of validation of said validation element, and a third step of activation wherein said edible-product making machine automatically activates a cycle of production of said edible product only after having recognised on said load element said identifying element in combination with said validation element as validated.

The present invention also relates to a system comprising a edible-product making machine and at least one single use load element having a brewable or water soluble aromatic substance to be fed into said edible-product making machine for preparation of said edible product, characterised in that said load element comprises an identifying element for its recognition and a validation element for its validation, and said edible-product making machine comprises means for recognising said identifying element and said validation

element of said load element, and means for validation of said validation element of said load element.

The use of an identification element and recognition means, as well as the step of recognising the identification element allows the machine to recognise the load element and, hence, its contents. This in turn enables the machine to automatically select the operating conditions appropriate for that specific load element. This prevents the user from having to verify the contents of the load element, and from having to know and select the operating conditions appropriate therefor. It also helps to prevent the safety hazard associated with the use of inappropriate operating conditions.

The use of a validation element and validation means, as well as the step allowing the machine to take further steps only if it also recognises on the load element the validation element help to prevent the use of an already-used single use load element in the machine, thereby avoiding the production of an edible product of inferior quality and ensuring the proper functioning of the machine. In the case of re-use of a load element originally containing a water soluble aromatic substance, the dynamics of the fluid flow through the machine could be different if there is no substance in the load unit for the water to contact, thereby causing incorrect functioning of the machine and the associated health hazard.

The use of an activation step of automatically activating the cycle of edible-product production only when the same identifying element is recognised in combination with the validated validation element ensures that the operating conditions actually used are the correct conditions as selected by the machine in the first recognition step. This helps to prevent the user from making the mistake of inserting into the machine a different load element to the one that was first recognised, for which the operating conditions are set.

Other characteristics of the present invention are moreover defined in the subsequent claims.

The process of the present invention comprises a first step of the edible-product making machine recognising an identifying element on the load element. This can optionally be through an infra red (IR) wave communication channel, a radio frequency (RF) wave communication channel, or an optical wave communication channel. The user may hold the identifying element on the load element up against recognition means located externally on the edible-product making machine.

The identification element preferably contains information about the contents of the load element. This permits the optional further step of self-programming of the edible-product making machine according to the specific load element recognised such that the appropriate operating conditions are automatically set.

The edible-product making machine is only allowed to take further steps if it in the first step also recognises on the load element a validation element to be validated. In practice, this may take the form of unlocking the machine when both the identification element and the unvalidated validation element are recognised. Thus, the production process cannot be activated unless the first step has been completed. The process could also require that the validation element be of a specific kind or be related to or associated to the identification element in a specific way in order for this first step to be completed. The validation element could be identical to the identification element, but is preferably different thereto, and could either be either of the same or of a different type to the identification element. If the identification element and the validation element are of different types, the recognition means for the two must accordingly also be different.

The process comprises a second step of validation of the validation element. This may be performed by the machine, such as by a tool in or on the machine, or independently from the machine, such as by hand or by the user using a tool not associated with the machine. The validation preferably takes the form of mechanical destruction of the validation element, such as ripping, cutting, scratching or piercing the identification element. Validation ensures that the validation element can no longer be recognised as an

unvalidated validation element. Usually, this is evidenced by the communication channel producing a null-signal. It may also be advantageous if said validation is visible to the user, such that it is clear if a load element has been validated and can therefore not be re-used in the process as it would not pass the first step.

In a third step of the process, the product-making machine automatically activates a cycle of edible-product production. However, this is only after having recognised on the load element the same identifying element as that recognised in the first step, and it must be recognised in combination with the validation element as validated. As with the first and second steps, this step may take place inside or outside the machine. However, for reasons of cost efficiency, it is preferable to use the same recognition means in step three as in step one.

The system of the present invention comprises an edible-product making machine and at least one single use load element having a brewable or water soluble aromatic substance to be fed into the machine for preparation of an edible product. The load element is preferably in the form of a capsule, and is preferably sealed. It may optionally comprise a capsule and a protective packaging thereof. The capsule may have a protective sheet on the outlet base of the capsule, designed to be removed by the user or by the machine prior to activation of the production cycle.

The load element of the system comprises an identifying element for its recognition and a validation element for its validation. These are preferably in the form of barcodes, antennae, or paints having optically measurable properties. The machine comprises means for recognising the load element and the validation element, such as at least one infra red barcode reader, radio frequency wave transmitter and receiver, or optical sensor. These are preferably located externally on a lateral wall of the capsule, externally on the protective packaging of the capsule, or externally on the protective sheet on the outlet base of the capsule.

The machine of the system further comprises means for validating the validation element, this preferably comprising a mechanical destruction tool having a plurality of tips adapted to rip, cut, scratch or pierce said validation element. The machine may perform this validation, or the user may manually engage the validation element with the validation means.

The system further optionally comprises checking means connected to a control unit of the machine. This may be in the form of a computer programme within the control unit. The checking means compares the signal from the recognising means for the identifying element and the validation element with pre-stored data in order to allow the machine to proceed to activation only if it recognises the identifying element and the unvalidated validation element. The checking means may be

connected to unlocking means for unlocking the machine when said recognition takes place.

The system also optionally comprises activation means connected to the recognising means through the control unit. This automatically activates the machine, but only if the identifying element is recognised, and in combination with the validation element as validated. The activation means cannot be triggered unless the checking means have first indicated a positive recognition of the identifying element and the unvalidated validation element.

Further characteristics and advantages of the present invention will become more evident from the description of a preferred, but not exclusive, embodiment of a system of edible-product making machine and a load element according to the finding, illustrated in the attached, non-limiting drawing, wherein:

Figure 1 shows a schematic view of one embodiment of the system of the present invention.

With reference to the above figure, the system comprises an edible-product making machine 1 and a single use load element in the form of a capsule 2. The load element contains a brewable or water soluble aromatic substance 3 for preparation of an edible product. The capsule 2 comprises an identifying element in the form of a barcode 4 and a validation element also in the form of a barcode 5, both located externally on a protective sheet 6 of the outlet base of the capsule.

The machine 1 comprises recognising means in the form of an infrared barcode reader 7. This is connected to checking means 8 stored within a control unit 9 of the machine. The checking means allow the machine activation means 10 to be engaged only if the barcode reader 7 recognises the identification barcode 4 and the validation barcode 5.

The machine 1 further comprises validation means in the form of a mechanical tool 11 having a plurality of tips for destroying the validation barcode 5, for example by ripping, cutting, scratching or piercing, such that the barcode reader 7 cannot recognise it as an unvalidated validation barcode.

If, after the positive signal from the checking means 8 from the first recognition of the identification and validation barcodes 4,5, the barcode reader 7 performs a second recognition of the identification barcode 4 combined with the validated validation barcode 5, the activation means 10, connected to the barcode reader 7 through the control unit 9, automatically activate a cycle of production of the edible product.

CLAIMS

1. Process for controlling the operation of an edible-product making machine of the type being fed with a single use load element having a brewable or water soluble aromatic substance for preparation of said edible product, characterised in that it comprises a first step of recognition wherein said edible-product making machine recognises an identifying element on said load element allowing said edible-product making machine to take further steps only if it also recognises on said load element a validation element to be validated, a second step of validation of said validation element, and a third step of activation wherein said edible-product making machine automatically activates a cycle of production of said edible product only after having recognised on said load element said identifying element in combination with said validation element as validated.

2. Process for controlling the operation of an edible-product making machine as claimed in claim 1, characterised in that said second step is performed by said edible-product making machine.

3. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that said second step is not performed by said edible-product making machine.

4. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that said second step consists of mechanical destruction of said validation element.

5. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that said mechanical destruction comprises ripping, cutting, scratching or piercing of said validation element.

6. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that it comprises a further step of self-programming of said edible-product making machine according to the specific load element recognised in said first step.

7. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that in said first step said recognition occurs through an IR communication channel.

8. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that in said first step said recognition occurs through an RF communication channel.

9. Process for controlling the operation of an edible-product making machine as claimed in any preceding claim, characterised in that in said first step said recognition occurs through an optical communication channel.

10. A system comprising a edible-product making machine and at least one single use load element having a brewable or water soluble aromatic substance to be fed into said edible-product making machine for preparation of said edible product, characterised in that said load element comprises an identifying element for its recognition and a validation element for its validation, and said edible-product making machine comprises means for recognising said identifying element and said validation element of said load element, and means for validation of said validation element of said load element.

11. A system as claimed in claim 10, characterised in that said validation means comprises a mechanical destruction tool having a plurality of tips adapted to rip, cut, scratch or pierce said validation element.

12. A system as claimed in claim 10 or 11, characterised in that it comprises checking means connected to a control unit of said edible-product making machine for allowing said edible-product making machine to proceed to activation only if said recognition means recognises said identifying element and said validation element.

13. A system as claimed in any of claims 10 to 12, characterised in that said checking means comprise a computing programmes stored within said control unit of said apparatus.

14. A system as claimed in any of claims 10 to 13, characterised in that it comprises activation means connected

to said recognising means through said control unit for automatic activation of a cycle of production of said edible product only if said identifying element is recognised in combination with said validation element as validated.

15. A system as claimed in any of claims 10 to 14, characterised in that said validation element and said identification element comprise at least one barcode, and in that said identification means comprise at least one IR barcode reader.

16. A system as claimed in any of claims 10 to 15, characterised in that said validation element and said identification element comprise at least one antenna, and in that said identification means comprise at lease one RF transmitter and receiver.

17. A system as claimed in any of claims 10 to 16, characterised in that said validation element and said identification element comprise at least one paint with measurable optical properties, and in that said identification means comprise at least one optical sensor.

18. A system as claimed in any of claims 10 to 17, characterised in that said load element comprises a capsule.

19. A system as claimed in any of claims 10 to 18, characterised in that said load element comprises a capsule and a protective packaging thereof.

20. A system as claimed in any of claims 10 to 19, characterised in that said identification element and said

validation element are located externally on a lateral wall of said capsule.

21. A system as claimed in any of claims 10 to 20, characterised in that said identification element and said validation element are located externally on said protective packaging of said capsule.

22. A system as claimed in any of claims 10 to 21, characterised in that said identification element and said validation element are located externally on a protective sheet of the outlet base of said capsule.

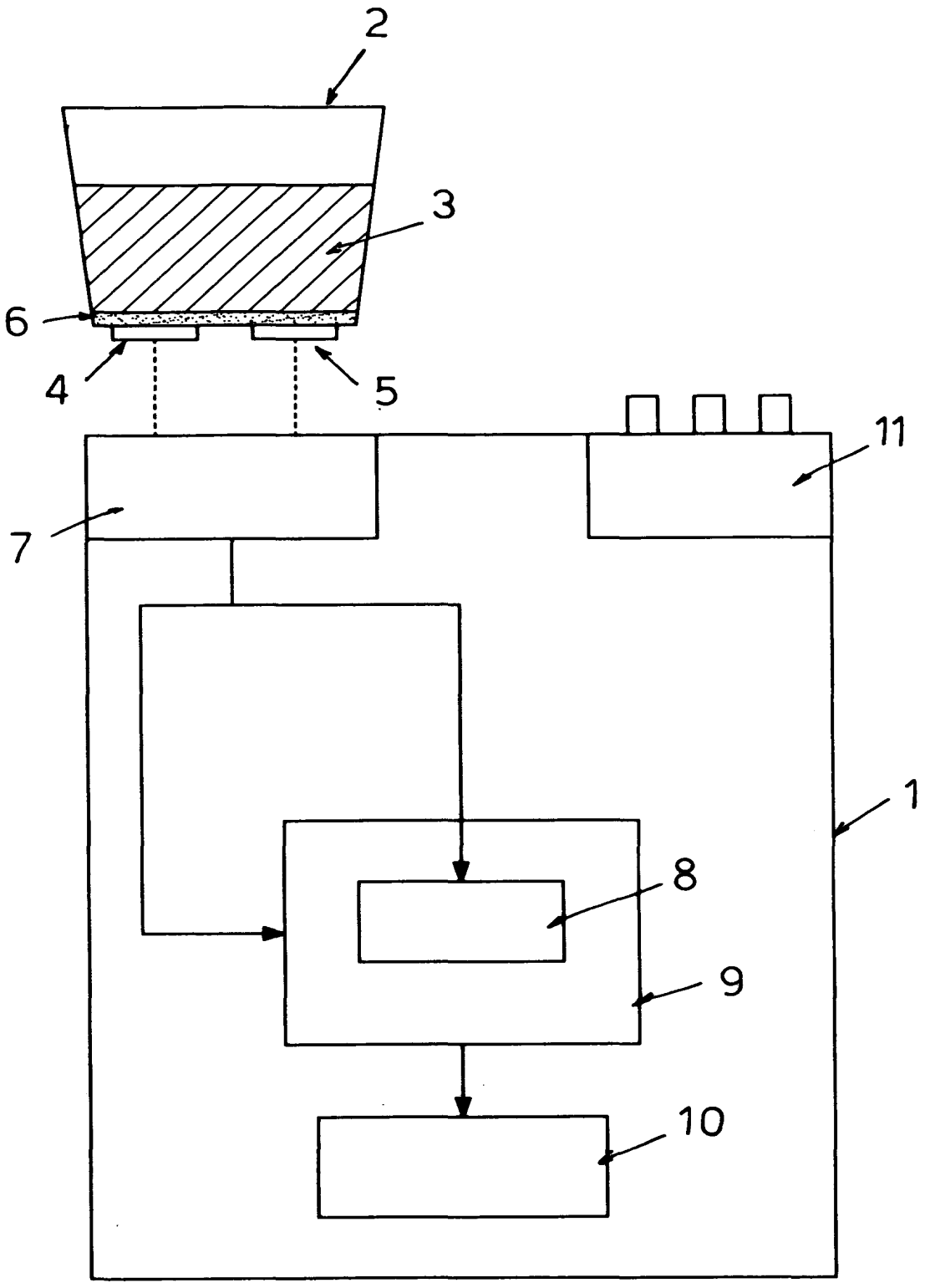


FIG.1

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INV. A47J31/36

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)
A47J

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 890 271 A (GRIMAC S R L [IT]) 20 February 2008 (2008-02-20) paragraph [0009] - paragraph [0023]; figures 1,2	1,2, 6-10, 12-22
Y		4,5,11
A		3
Y	GB 964 657 A (UNIVERSAL MATCH CORP) 22 July 1964 (1964-07-22) page 2, line 87 - page 4, line 38; figures 1-9	4,5,11
X	EP 1 764 015 A (GRIMAC S R L [IT]) 21 March 2007 (2007-03-21) paragraph [0013] - paragraph [0028]; figures 1-6	1,2,6, 10,12-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

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Name and mailing address of the ISA/	Authorized officer
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1890271 A	20-02-2008	NONE	
GB 964657 A	22-07-1964	NONE	
EP 1764015 A	21-03-2007	NONE	

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(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

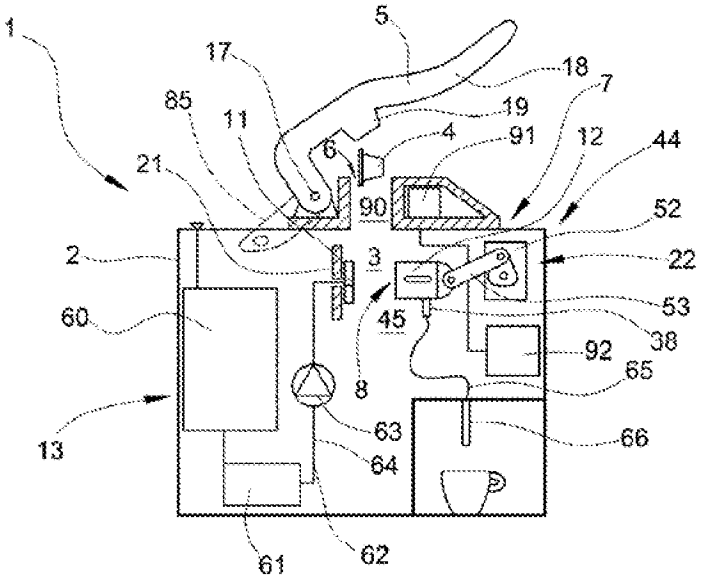
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) Title: MACHINE OPERATING WITH CAPSULES FOR THE PREPARATION OF COFFEE AND OTHER HOT BEVERAGES AND METHOD OF EQUIPPING MACHINES OPERATING WITH CAPSULES

FIG. 1



(57) Abstract: A machine (1) operating with capsules for the preparation of coffee and other hot beverages is designed to be equipped selectively with a first motorized actuator module (44), which comprises a support (43) and a first electro-mechanical locking assembly (22) mounted on the support (43) so as to form a preassembled interchangeable module, and with a second manually operated actuator module (70), which comprises a second mechanical locking assembly (72) able to be releasably connected to a lever (5) which can be operated by a user so as to be manually actuated by means of the lever (5).

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Published:

---- *with international search report (Art. 21(3))*

---- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Machine operating with capsules for the preparation of coffee and other hot beverages and method of equipping machines operating with capsules

The present invention relates to a coffee machine, in particular for domestic use, of the type operating with coffee capsules and suitable also for the preparation of other hot beverages by means of capsules containing suitable ingredients.

The invention also relates to a method of equipping coffee machines operating with coffee capsules, specifically so as to convert a machine operating in manual/mechanical mode into a machine operating in motorized/electrical (automatic) mode and vice versa.

It is known that in general a coffee machine for domestic use operating with coffee capsules comprises a machine body having, formed therein, an internal chamber for housing a capsule during use, a locking assembly acting on the capsule inside the chamber so as to lock the capsule between a thrust member and an abutment member and pierce the capsule, and hot water circulation means for circulating a flow of pressurized hot water through the capsule and obtaining an infusion. Depending on the contents of the capsule, the desired hot beverage (coffee, tea, etc.) is obtained.

The known machines comprise both manually operated machines, i.e. those where the user, for example by means of a lever which also has the function of pushing the capsule into the chamber, manually operates the locking assembly, and automatic machines, where the locking assembly is instead operated by an electro-mechanical or pneumatic actuator which is activated by the user via a switch or automatically when the capsule is inserted into the chamber.

The known machines are not entirely satisfactory, in particular in terms of simplicity of manufacture and maintenance.

In fact, the known machines, of both the abovementioned types (manual and automatic), are normally composed of a large number of components, usually specifically designed and manufactured for the specific use for which they are intended.

In particular, the two types of machine are normally designed and manufactured in a different manner, i.e. each type is specifically manufactured for operation in the initially predefined modes and cannot be modified to operate in another mode.

Moreover, since these machines are frequently returned to the manufacturers for overhaul and/or maintenance, there exists a need not only for rapid overhaul thereof, but also for possible modification of their configuration, depending on the specific requirements in any one moment. For example, there could be a need, in a certain period, to have several manually operated machines and, in another period, to have automatically operated machines.

It is an object of the present invention to provide a coffee machine which is without the abovementioned drawbacks of the prior art; in particular, it is an object of the invention to provide a machine which is relatively simple and inexpensive to produce and assemble and which allows also overhaul and maintenance operations to be performed easily and quickly.

A further object of the invention is to provide a method of equipping coffee machines allowing conversion, in a simple and rapid manner, of a machine which is designed to operate in manual/mechanical mode into a machine operating in motorized/electrical (automatic) mode and vice versa.

The present invention therefore relates to a coffee machine operating with coffee capsules as described with regard to its basic features in the accompanying Claim 1 and its additional features in the dependent claims.

The invention also relates to a method of equipping coffee machines operating with coffee capsules, specifically intended to convert a machine operating in manual/mechanical mode into a machine operating in motorized/electrical (automatic) mode and vice versa, as defined in the accompanying Claim 10.

The machine according to the invention is relatively simple and inexpensive to

manufacture and assemble, comprising a small number of components compared to the known solutions.

Moreover, the machine according to the invention is designed so that overhaul and maintenance operations may be performed easily and quickly. In particular, the machine is configured so that it may be easily converted from a manual operation mode (i.e. purely mechanical mode where the capsule is locked by members operated manually by the user) into an automatic operation mode (where the capsule is instead locked by members operated by a motorized actuator, in particular via a gear motor) and vice versa.

The invention is further described in the following non-limiting examples of embodiment with reference to the accompanying figures in which:

- Figure 1 is a schematic overall view, with parts removed for greater clarity, of a machine operating with capsules according to the invention;
- Figures 2 and 3 show a detail of two alternative embodiments of the machine according to Figure 1;
- Figure 4 is an exploded view of a first preassembled actuator module forming part of the machine according to Figure 1;
- Figures 5 and 6 show a second actuator module interchangeable with the actuator module according to Figure 4, shown in two operating positions.

With reference to Figure 1, a machine 1 operating with capsules for the preparation of coffee and other hot beverages comprises a machine body 2 provided with an inner compartment 3 for housing a capsule 4 during use, a lever 5 for pushing the capsule 4 into the compartment 3 through an inlet opening 6, closing means 7 acting on the capsule 4 so as to enclose the capsule 4 inside an infusion chamber 8 defined by two oppositely arranged co-operating members 11, 12 and pierce the capsule 4 on opposite sides, and circulation means 13 for circulating a flow of pressurized hot water through the capsule 4 inside the infusion chamber 8.

As shown in greater detail in Figure 2, the capsule 4 is, in particular, of the known type having a substantially cup-shaped sealed casing 14 which is closed by a lid 15 provided

with a radially external annular edge 16; the capsule 4 contains coffee or other substances or infusion mixtures.

The lever 5 is hinged with the machine body 2 about a rotational fulcrum 17 and has a gripping portion 18 which can be operated by a user and a projecting portion 19 formed so as to push the capsule 4 inside the compartment 3 through the opening 6.

In the non-limiting example shown, the closing means 7 include a member 11, mounted on a wall 21 of the compartment 3 and a defining an abutment member, a member 12 movable with respect to the member 11 and defining a thrust member, and a locking assembly 22 operating on the member 12 so as to move it in a straight sliding direction S.

The abutment member 11 projects from the wall 21 and is fixed to the wall 21 (as shown for example in the embodiment according to Figure 2) or is connected resiliently to the wall 21 (as shown for example in the embodiment according to Figure 3).

In both cases, the member 11 comprises a plate 23, which is for example substantially circular and optionally provided with a raised, annular, perimetral edge 24, and has an inlet duct 25 and pointed front protrusions 26 associated with respective channels and designed to pierce the capsule 4.

In the embodiment shown in Figure 2, the plate 23 is fixed to the wall 21 and projects from the wall 21; an annular sealing member 28 is arranged around the plate 23 and resilient opposition members 29 (springs) are arranged between the sealing member 28 and a stop formed on the member 11 (or on the wall 21).

In the example instead shown in Figure 3, the member 11 is mounted on the wall 21 by means of resilient members 29 (springs) arranged between the member 11 and the wall 21; the edge 24 is optionally provided with a sealing ring 30.

With reference also to Figure 4, the thrust member 12 is arranged facing the abutment member 11 and is slidable in the sliding direction S so as to be alternately moved towards

the member 11 and away from it, being for example guided by special guides 31 parallel to the sliding direction S and engaged by projections 32 which project laterally from the member 12; in the case in question, the member 12 comprises a substantially cup-shaped hollow body 33 internally provided with a shaped seat 34 for receiving a capsule 4 and defining the infusion chamber 8; an end wall of the hollow body 33 has piercing needles 36 which are situated opposite the protrusions 26 of the member 11 and designed to pierce the capsule 4 and associated with respective channels converging into an outlet duct 38 situated behind the needles 36.

The member 12 also has a front edge 39 optionally provided with a sealing ring 40 (Figure 3) configured so as to come into contact, during use, with the sealing member 28 (Figure 2) or with the edge 24 of the member 11 (Figure 3) so as to grip in a fluid-tight manner the annular edge 16 of the capsule 4 and define the infusion chamber 8 containing the capsule 4. The member 12 also comprises a rear joint 41 connected to the locking assembly 22.

The locking assembly 22 is an electro-mechanical locking assembly mounted on a support 43 so as to form a first actuator module 44 removably housed inside an inner receiving seat 45 of the machine 1 and fixed to the machine 1 by means of releasable fixing members 46 so that it may be removed from the receiving seat 45.

The support 43, for example consisting of a pair of facing plates 47 joined together by transverse spacers 48, is arranged inside the receiving seat 45 and is fixed to the machine 1 by means of the members 46 (for example screws or any other known releasable fixing member). The plates 47 are provided with respective slits which, engaged by the projections 32, form the guides 31.

The locking assembly 22 comprises a gear motor 52 and a connecting-rod/crank mechanism 53 which is operated by the gear motor 52 and connected to the member 12 by means of the joint 41. A crank 54 is connected to a shaft 55 of the gear motor 52 and moves a connecting rod 56 hinged with the joint 41, pushing the member 12 in the sliding direction S. Preferably, the connecting rod 56 is arranged between a pair of cranks 54, one of which is coupled to the gear motor 52 and the other one of which is mounted idle on the

support 43.

The actuator module 44 is therefore an electrically operated, motorized, actuator module in which the locking assembly 22 is operated by means of an electrical control device (known and not shown) and moves the member 12 with an alternating, straight, translatory movement in the sliding direction S.

The circulation means 13 are of the essentially known type and are therefore not described or illustrated in detail for the sake of simplicity; in general terms, said means comprise a water reservoir 60, a boiler 61 and a hydraulic circuit 62 provided with a circulating pump 63; the circuit 62 has a hot water feed line 64, which connects the reservoir 60 to the boiler 61 and the boiler 61 to the inlet duct 25 formed in the member 11, and a beverage supply line 65 which connects the outlet duct 38 of the member 12 to the beverage supply nozzle 66.

The actuator module 44 is removable and able to be replaced with another actuator module, for example a second manually operated actuator module 70, shown in Figures 5 and 6, which in turn comprises a support 43 (not shown in Figure 5, but for example similar to the support 43 described above) and a locking assembly 72 which is instead a mechanical locking assembly which can be releasably connected to the lever 5 so as to be manually operated by means of the lever 5.

In particular, the mechanical locking assembly 72 comprises a toggle mechanism 73 which is configured so as to connect the lever 5 to the member 12 and move the member 12, which is for example constrained to the guides 31 by means of the projections 32 (as described above and not shown in detail in Figures 5 and 6) in the sliding direction S.

For example, the mechanism 73 comprises at least one tie-bar 74, an arm 75 and an operating rod 76. The tie-bar 74 comprises a bar 77 and two opposite longitudinal end portions 78, 79 projecting laterally from the bar 77; the portion 78 is hinged with the joint 41 of the member 12, while the portion 79 is hinged with an articulation 80 which also connects respective ends 81, 82 of the arm 75 and the rod 76; a second end 83 of the arm

75, opposite to the end 81, is hinged with the machine 1 (directly or by means of the support 43) and a second end 84 of the rod 76, opposite to the end 82, is hinged with a rear portion 85 of the lever 5 in an eccentric position relative to the rotational fulcrum 17 of the lever 5.

Preferably, the machine 1 also comprises a pre-chamber 90 (Figures 1 and 3) communicating with the compartment 3 and provided with a capsule recognition device 91 for detecting a code (for example, a bar code, a colour code, or any other kind of identification code of an optical, magnetic or other nature) indicated on the capsule 4; the recognition device 91 is connected to a control unit 92 (known and only schematically shown) which then selects the operating cycle of the machine 1 on the basis of the code detected, for example operating the boiler 61, the pump 63 and/or the locking assemblies 22, 72. For the sake of simplicity the connections between the control unit 92 and the other components of the machine 1 are not shown.

Both the configurations of the machine 1, i.e. the configuration with the motorized actuator module 44 and the configuration with the manually operated actuator module 70, are simple to realize and assemble, being moreover simple and reliable in terms of operation.

Moreover, it is possible to modify the machine 1 so as to pass from one configuration to another one in a simple and quick manner by replacing the motorized actuator module 44 with the manually operated actuator module 70 or vice versa.

The invention therefore also provides a method of equipping machines operating with capsules for the preparation of coffee and other hot beverages, so as to change the operating mode of a machine from manual/mechanical to motorized/electrical and/or vice versa. This method comprises the steps of:

- preparing the machine 1 with the internal compartment 3, the lever 5 and the inner receiving seat 45 configured to receive the actuator module 44 or alternately the actuator module 70, and the circulation means 13;
- preparing the actuator modules 44, 70 operating in different modes;
- selecting an actuator module 44, 70 operating in the required modes and placing the

actuator module 44, 70 selected inside the receiving seat 45;

- fixing the actuator module 44, 70 inside the receiving seat 45 by means of the releasable fixing members 46.

During overhaul or maintenance of the machine 1, withdrawn from the market, it is therefore possible to modify the configuration and consequently the operating modes of the machine 1 by simply replacing an actuator module 44, 70 with another module.

Moreover, it is understood that modifications and variations may be made to that described and illustrated here, without departing from the scope of the invention as defined in the accompanying claims.

CLAIMS

1. Machine (1) operating with capsules for the preparation of coffee and other hot beverages, comprising an inner compartment (3) for housing a capsule (4) during use, a lever (5) for pushing the capsule into the compartment, closing means (7) for enclosing the capsule inside an infusion chamber (8) defined by a pair of oppositely arranged members (11, 12) and piercing the capsule on opposite sides, and circulation means (13) for circulating a flow of hot pressurized water through the capsule inside the infusion chamber; the machine being characterized in that it is designed to be equipped selectively with a first motorized actuator module (44), which comprises a support (43) and a first electro-mechanical locking assembly (22) mounted on the support (43) so as to form a preassembled interchangeable module, and with a second manually operated actuator module (70), which comprises a second mechanical locking assembly (72) able to be releasably connected to a lever (5) which can be operated by a user so as to be manually actuated by means of the lever (5).

2. Machine according to Claim 1, wherein the first actuator module (44) is removably housed inside an inner receiving seat (45) of the machine and is fixed to the machine by means of releasable fixing members (46) so as to be removable from the receiving seat and replaced with a second manually operated actuator module (70).

3. Machine according to Claim 1 or 2, wherein the first electro-mechanical locking assembly (22) is connected to a first one of said members (11, 12) so as to move it towards the other member in an essentially straight sliding direction (S).

4. Machine according to one of the preceding claims, wherein the locking assembly (22) comprises a gear motor (52) and a connecting-rod/crank mechanism (53) driven by the gear motor and connected to a thrust member (12) by means of a joint (41), for displacing the thrust member (12) in the sliding direction (S).

5. Machine according to Claim 4, wherein the locking assembly (22) comprises a crank (54) connected to a shaft (55) of the gear motor (52) and to a connecting-rod (56)

hinged with the joint (41) of the thrust member (12), the latter being mounted slidably in the sliding direction (S) inside a guide (31).

6. Machine according to one of the preceding claims, wherein the second manually operated actuator module (70) comprises a second locking assembly (72) which is a mechanical locking assembly able to be releasably connected to the lever (5) so that it can be manually actuated by means of the lever (5).

7. Machine according to Claim 6, wherein the mechanical locking assembly (72) comprises a toggle mechanism (73) configured to connect the lever (5) to the thrust member (12) and move the thrust member (12) in a substantially straight sliding direction (S).

8. Machine according to Claim 7, wherein the toggle mechanism (73) comprises at least one tie-bar (74), an arm (75) and a rod (76); the tie-bar (74) being hinged with the thrust member (12) and with an articulation (80); the arm (75) being hinged with the articulation (80) and with the machine (1); the rod (76) being hinged with the articulation (80) and with the lever (5).

9. Machine according to one of the preceding claims, comprising further a pre-chamber (90) communicating with the compartment (3) and provided with a capsule recognition device (91) for detecting a code indicated on the capsule (4).

10. Method of equipping machines operating with capsules for the preparation of coffee and other hot beverages, so as to change the operating mode of a machine from manual/mechanical to motorized/electrical and/or vice versa, comprising the steps of:

- preparing a machine (1) having an inner compartment (3) for housing a capsule (4) during use, a lever (5) for pushing the capsule into the compartment, an inner receiving seat (45) configured to receive an actuator module (44, 70), and circulation means (13) for circulating a flow of hot pressurized water through the capsule;
- preparing at least two actuator modules (44, 70) operating in different modes, each actuator module comprising a support (43), a thrust member (12) and a locking assembly

(22, 72) which moves the thrust member (12) and is mounted on the support (43) so as to form a pre-assembled interchangeable module;

- selecting one actuator module (44, 70) operating in the desired modes and placing the selected actuator module inside the receiving seat (45);
- fixing the actuator module (44, 70) inside the receiving seat (45) by means of releasable fixing members (46) such that the actuator module is removable from the receiving seat for replacement by another actuator module.

11. Method according to Claim 10, wherein the machine is provided with an abutment member (11) mounted on a wall (21) of the compartment (3) and co-operating with the thrust member (12) so as to enclose the capsule (4) inside an infusion chamber (8) defined by said members (11, 12); the abutment member (11) remaining mounted in the machine during the replacement of the actuator modules (44, 70).

12. Method according to Claim 10 or 11, wherein a first actuator module (44) is an electrically operated, motorized, actuator module having an electro-mechanical locking assembly (22) and a second actuator module (70) is a manually operated actuator module having a mechanical locking assembly (72) connectable in a releasable manner to the lever (5) so that it can be operated manually by means of the lever.

FIG. 1

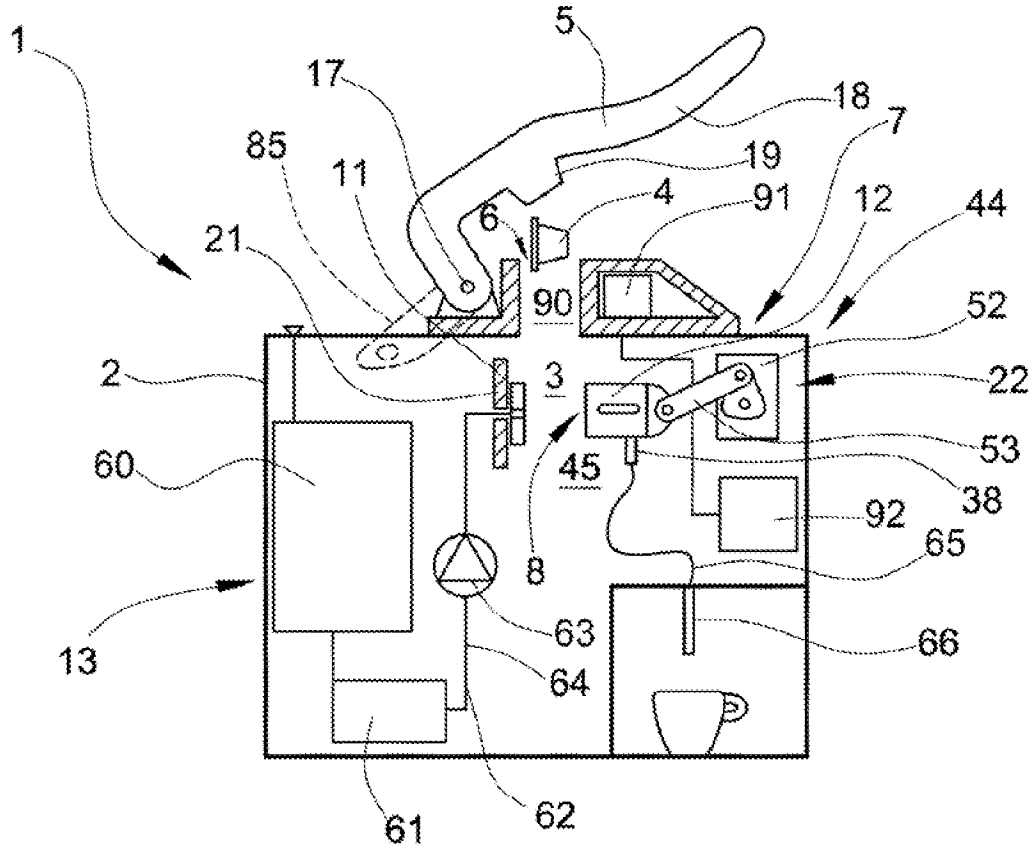

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FIG. 2

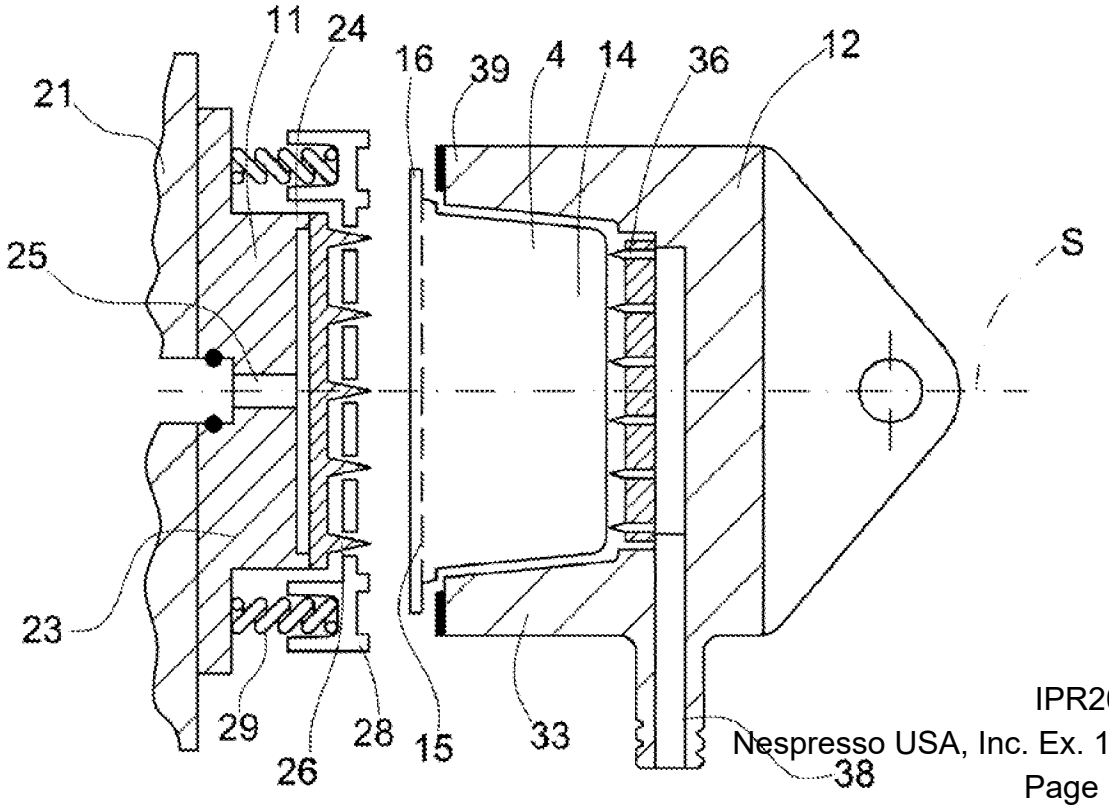

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FIG. 3

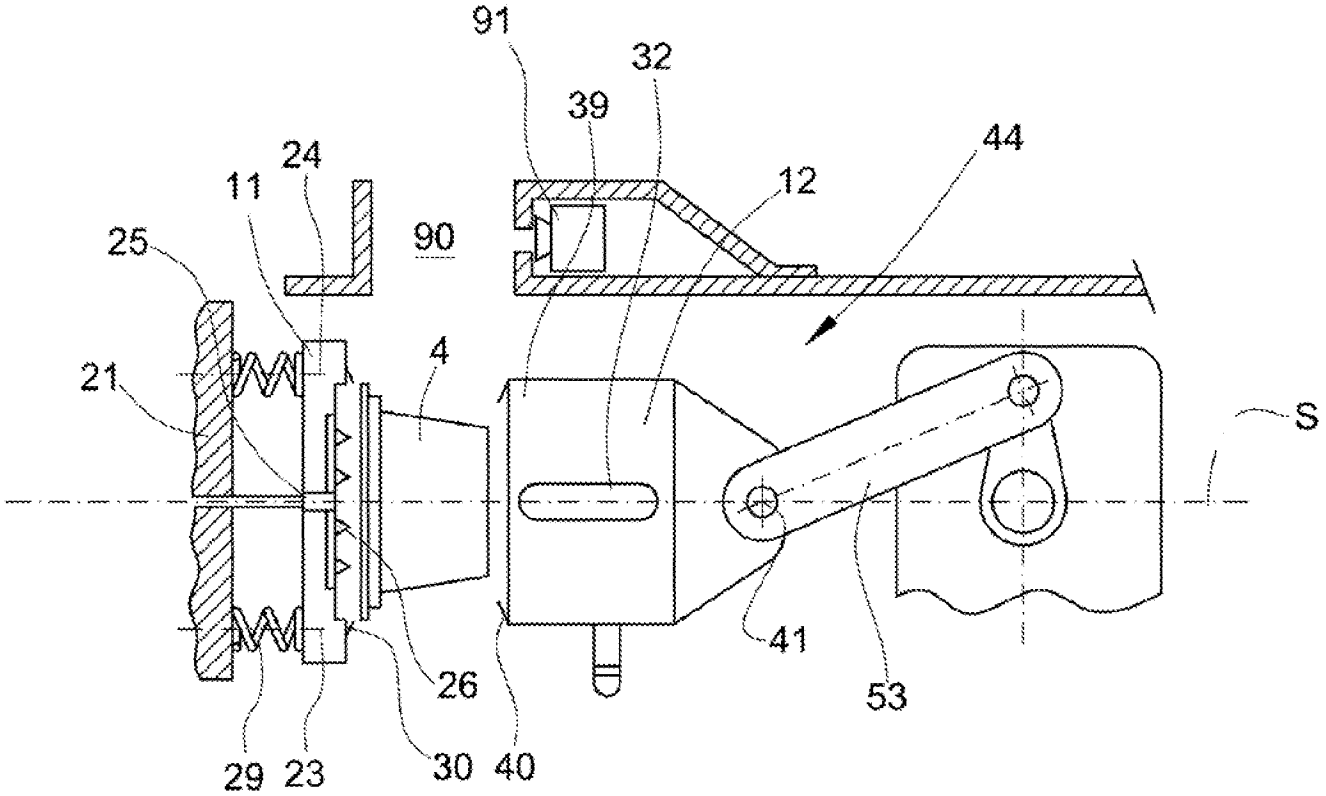

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FIG. 4

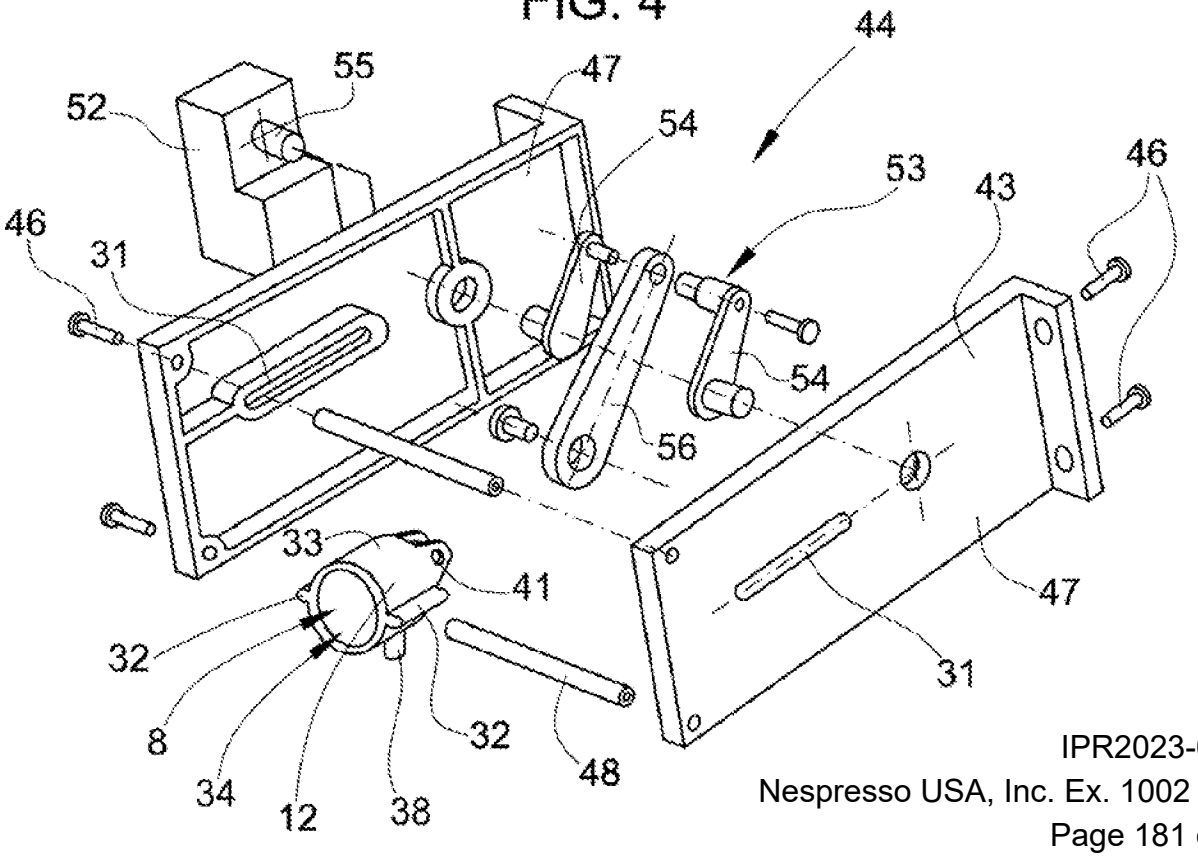

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FIG. 5

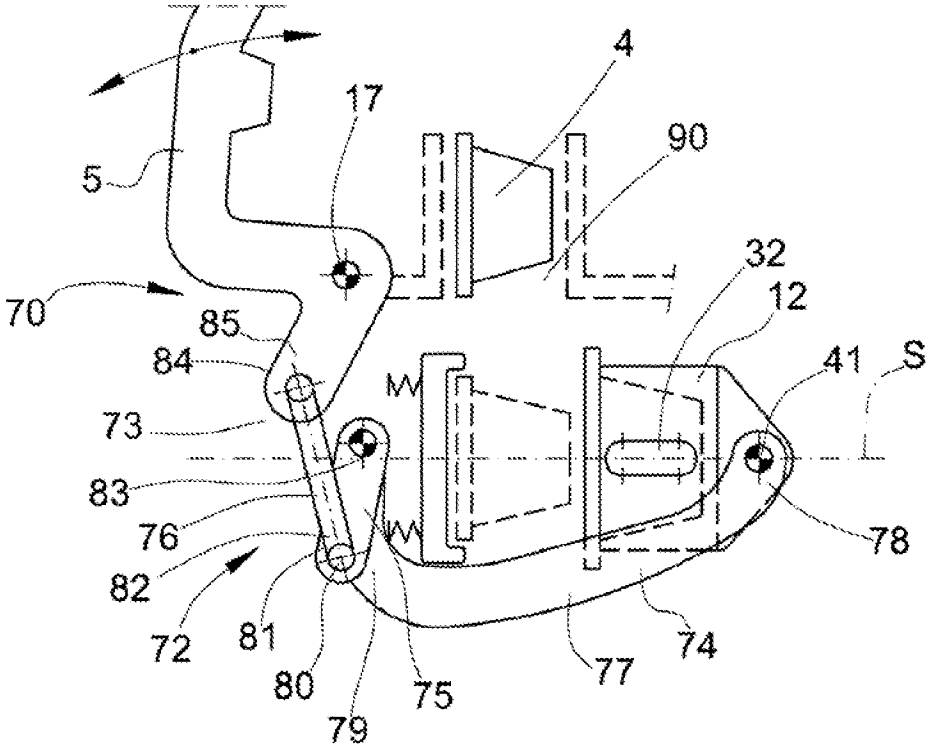
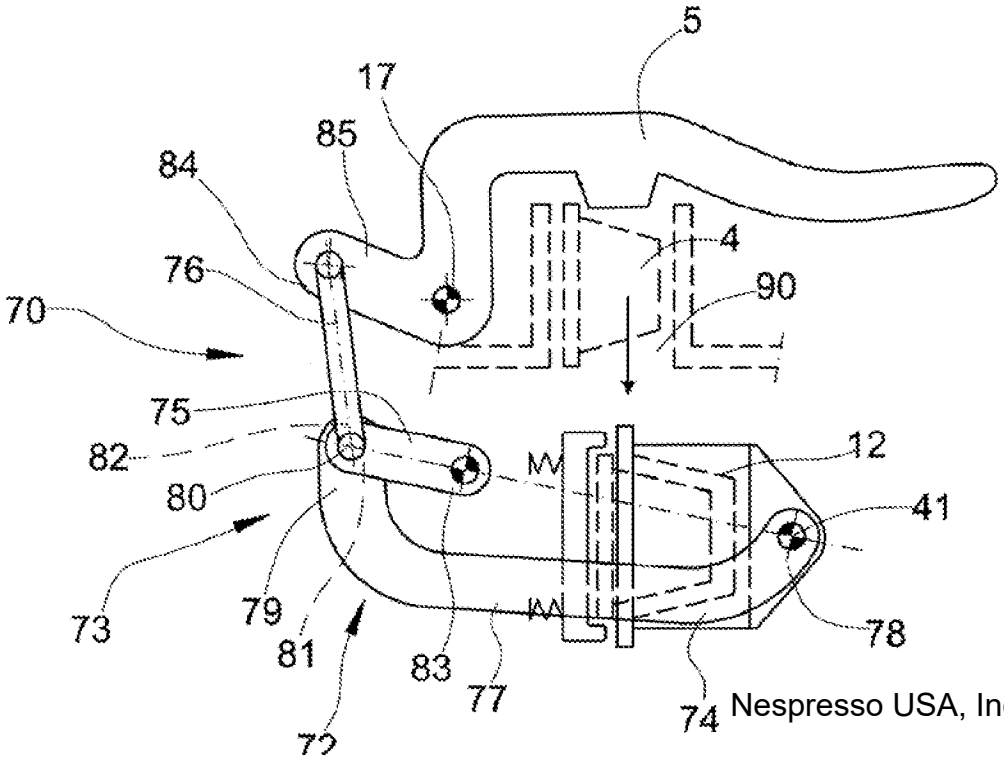

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FIG. 6


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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/055976

A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47J

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 854 384 A (LAVAZZA LUIGI SPA [IT]) 14 November 2007 (2007-11-14)	1-6,9-12
A	paragraph [0006] - paragraph [0040]; figures 1-5	7,8
X	WO 2005/115206 A (SGL ITALIA SRL [IT]; CORTESE VIRGINIO [IT]) 8 December 2005 (2005-12-08) page 4, line 22 - page 6, line 25; figures 6,7	1
X	EP 1 859 713 A (NESTEC SA [CH]) 28 November 2007 (2007-11-28) paragraph [0026] - paragraph [0045]; figures 1-9	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"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
26 April 2010	06/05/2010

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	Lehe, Jörn

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2009/055976

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1854384 A	14-11-2007	AT 451040 T	15-12-2009
WO 2005115206 A	08-12-2005	AR 054969 A1	01-08-2007
		BR PI0510917 A	13-11-2007
		CN 1980588 A	13-06-2007
		EP 1768532 A1	04-04-2007
		HK 1105108 A1	26-03-2010
		US 2008041234 A1	21-02-2008
EP 1859713 A	28-11-2007	AR 061182 A1	13-08-2008
		AT 442798 T	15-10-2009
		AU 2007253304 A1	29-11-2007
		CA 2651900 A1	29-11-2007
		CN 101453929 A	10-06-2009
		EP 2119385 A1	18-11-2009
		WO 2007135136 A1	29-11-2007
		ES 2332378 T3	03-02-2010
		JP 2009537270 T	29-10-2009
		PT 1859713 E	24-09-2009
		US 2009308258 A1	17-12-2009

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(74) Agent: **BORNE, Patrice**; Ave Nestlé 55, CH-1800 Vevey (CH).

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[Continued on next page]

(54) Title: CAPSULE WITH FLOW CONTROL AND FILTERING MEMBER

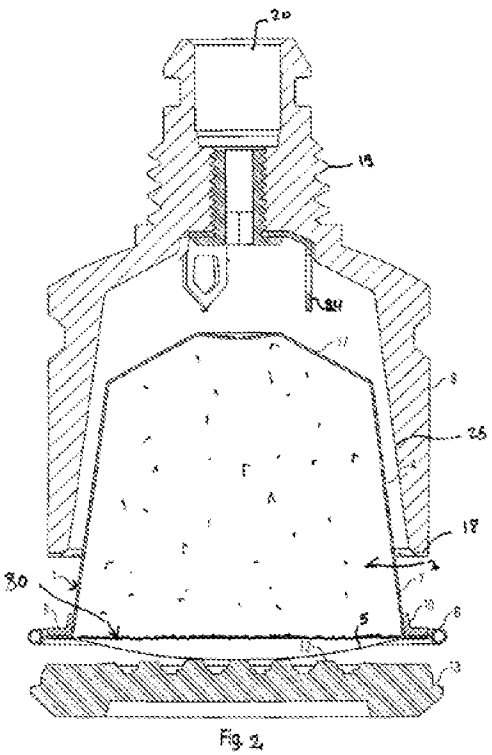


Fig. 2

(57) Abstract: A capsule for use in a beverage production machine comprising: - a first wall member (4), - a second perforable wall member (5) tightly attached to the first wall member (4), - at least one porous layer (80) between the ingredients in the capsule (1) and the second wall member (5); wherein the porous layer forms with the perforable non- porous foil member, a multilayer laminate. The flow control porous member provides a faster and more consistent flow of the liquid extract through the capsule and significantly reduces the resurgence of non- soluble solids.

WO 2010/076048 A1

MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

Capsule with flow control and filtering member

The present invention generally relates to capsules for containing beverage ingredients, to a beverage producing system for use in connection with such capsules as well as to methods for producing beverages on the basis of ingredients contained in such capsules.

The background of the present invention is the field of capsules which contain beverage or other comestible (e.g. soup) ingredients. By means of an interaction of these ingredients with a liquid, a beverage or other comestibles, such as for example soups, can be produced. The interaction can be for example an extraction, brewing, dissolution, etc. process. Such a capsule is particularly adapted to contain ground coffee in order to produce a coffee beverage by having hot water under pressure enter the capsule and draining a coffee beverage from the capsule.

FR 1537031 does not show separated capsules, but a blister pack containing coffee powder. As two foil members are sealed together at the top foil member in an area between two adjacent compartments, these compartments can not be separated from each other without loosing the tight seal between the foil members. A filter is arranged at the bottom of each compartment and thus opposite of the area where the two foil members are sealed. The outlet side of the compartment is opened by actively moving a perforation

member, via a spring force, against the lower face of the compartment. Due to the blister pack technology the top face of the compartments has to be flat.

Also according to CH605293 a filter is, at its rim portion, sandwiched between the foil member and the capsule base body wall. The foil member is additionally provided with a weakened area and is not designed to be perforated by being thrust against a relief plate. The filter is used as a screen to avoid coffee grains from being delivered in the liquid.

EP0507905B1 relates to an apparatus and cartridge for preparing a liquid product. An internal filtering membrane is placed in the bottom of the cartridge for retaining solid particles in the cartridge and prevent clogging of the flow channels provided in the perforating members.

EP-A-512468 relates to a capsule for the preparation of a beverage wherein a filter paper is welded between the peripheral area of the cup and the tearable membrane. The filter paper is used only to ensure no coffee grains can exit the membrane when torn.

EP-A-0602203 relates to a flexible sachet in the form of an individual portion adapted to be extracted under pressure containing a beverage ingredient; the sachet being symmetrical with respect to its plane of sealing, the material used for the flexible sheets being impermeable to oxygen and water vapour for its storage and the sachet being opened only under the effect of the increase in pressure when the extraction fluid is injected.

US2006/0236871A1 relates to a single portion cartridge which is suitable in particular for brewing a portion of a coffee beverage wherein a distributing and/or supporting structure is provided with at least one opening which is covered by a textile fabric forming a screen between the enclosure and the large outlet. The essential object of this invention is to minimize the escape of particles of the beverage substance from the cartridge during the brewing operation because a large opening is made in the bottom of the capsule body and the particles would be washed out in absence of such distributing structure. The textile fabric has a pore size in the range from 10 to 500 microns, preferably from 30 to 150 microns.

Systems and methods for obtaining fluid comestibles from substances containing isolated capsules are for example known from EP-A-512470 (counterpart of US 5,402,707).

The capsule 200 as shown in Fig. 1 has a frustoconically-shaped cup which may be filled e.g. with roasted and ground coffee 300 and which is closed by a foil-like tear face cover 400 welded and/or crimped to a flange-like rim 140 which extends laterally from the side-wall of cup. A capsule holder 130 comprises a flow grid 120 with relief surface element members.

The capsule holder 130 can be accommodated in a larger support 150 which has a lateral wall 240 and a beverage outlet 270 for the passage of extracted coffee beverage.

As can be seen from Fig. 1 the extraction system further comprises a water injector 700 having water inlet channel(s) 201 and an annular element 800 with an internal recess of which the shape substantially corresponds to the outer shape of the capsule. On its outer part, the annular member 800 comprises a spring 220 holding a ring 230 for releasing the capsule on completion of extraction.

In operation, a capsule 200 is placed on the capsule holder 130. The water injector 700 perforates the upper face of the cup. The lower tear face 400 of the capsule rests on the radially arranged members of the capsule holder 130.

The water is injected through the channel 201 of the water injector 700 and impinges on the bed 300 of coffee. The pressure in the capsule increases and the tear face 400 increasingly follows the shape of the radial opening relief members. Such radial opening relief members could be replaced by pyramid-shaped reliefs or other shapes of relief. When the constituent material of the tear face reaches its breaking stress, the tear face tears along the relief members. The extracted coffee flows through the orifices of the flow grid 120 and is recovered in a container (not shown) beneath the beverage outlet 270.

The principles of this extraction process as far as it can be maintained in connection with the present invention can be summarized as follows:

- An initially gastightly sealed capsule is inserted in capsule holder means.

- The capsule holder means is then introduced associated to the water injection means of the machine such that an annular element surrounds the sealed capsule. In a first wall of the capsule at least one opening is generated.
- Water entering the capsule through the opening in the first wall is interacting with the ingredients contained in the capsule while traversing the interior of the ingredient contained in the capsule and is then made to leave the capsule through at least one opening/perforation created in the second wall under the effect of the pressure building up in the capsule.

The perforations in the second face, especially when cooperating with the relief members, filter the beverage leaving the interior of the capsule so that non-soluble coffee particles remain in the capsule. It has been considered in the prior art that such filtering is sufficient (see e.g. column 4 of EP512470B1).

EP 512468B1 teaches to have a capsule with a flat perforable foil member for delivery of the coffee. A filter paper can be sealed between the foil member and the rim of the base body. The capsule, i.e., the membrane opens under the sole effect of the pressure in the capsule.

Also according to CH605293 a filter is, at its rim portion, sandwiched between the foil member and the capsule base body wall. The foil member is additionally provided with a weakened area and is not designed to be perforated by being thrust against a relief plate.

The invention has found that, according to the teaching of the prior art, when a sealed gastight capsule with a simple perforable foil member is placed against a capsule holder with a multitude of small reliefs, and in particular, small squared or rectangular perforation elements, one may have the following problems:

- The extraction process may be slowed down, in particular for capsules containing a larger dose of coffee designed for delivering coffee beverages,
- The extraction process may flow at inconsistent flow times from one capsule to another,
- The extraction is not clean enough and coffee particles can escape the capsule through the small perforations created through the foil member after extraction, when the capsule is removed from the machine in particular, due to the presence of fine grinding outside the typical range designed for the current system (e.g., below an average grind size of 200 microns).

These problems are targeted at by the present invention and is remedied by means of the features of the independent claims. The dependent claims further develop the central idea of the invention.

According to a first aspect, the invention relates to a capsule for use in a beverage production machine comprising:

- means for perforating an inlet side of the body of the capsule opposed to the foil member and the flange-like rim

and injecting a liquid or a liquid/gas mixture into the capsule,
- a relief plate with a multitude of relief elements which relief plate is arranged in the machine such that the injection pressure thrusts the foil member against the relief plate,
the capsule comprising:
- a base body sealed off by a foil member tightly attached to the flange-like rim of the base body,
the foil member being made from a material which is then perforated by the relief plate to form at least one opening, preferably a multitude of openings, when the pressure of the injected liquid or liquid/gas mixture reaches a value of at least 4 bar, wherein the capsule further comprises a flow control porous member arranged between at least a portion of ingredients in the capsule and the foil member.

The capsule is thus provided with a flow control and filtering member called "flow control porous member" in the rest of the description. The flow control porous member is positioned between at least a portion of ingredients and the foil member.

As a result, the flow was significantly faster and more consistent than for the flow of a capsule of the prior art, i.e., comprising no such flow control porous member.

In particular, it was measured that the flow time could be up to 25% shorter of the mean flow time without significantly changing the quality of the coffee liquid extract. A four

times smaller flow time standard deviation was also surprisingly noticed when comparing the mean flow time of a plurality of capsules. Finally, the ground coffee was successfully retained in the capsule with reduced coffee solid resurgences through the perforated membrane.

The flow control porous member may be positioned between the ingredients and the plane defined by the ring-shaped sealing area between the foil member and the rim of the base body.

The base body of the capsule may comprise a rim onto which the foil member is sealed at an annular sealing area. The rim of the base body may further extend outwardly by a curled end.

The base body and/or the foil member can be made from aluminum or aluminum alloy or a laminate of aluminium or aluminium alloy and polymer.

In the context of the invention, the base body and the foil member can also be made of two foils of flexible material which are sealed at their periphery, e.g., by heat sealing as described in EP0602203A1. Therefore, the two foils can form a symmetrical container when sealed at their periphery and the container may also contain two flow control porous members, each one being placed between the flexible foils and the ingredients. In this case, the ingredient can be a compacted coffee cake placed in sandwich between the two flow control porous members.

The flow control porous member may be connected to the capsule in being sandwiched, in the sealed area, between the rim of the base body and the foil member.

The flow control porous member may have a higher rigidity in flexure than the foil member so that the member deforms less under pressure than the foil member against the relief elements. A lower deformation (or a differential of deformation) provides space between the member and the foil member during extraction allowing the beverage, e.g., liquid coffee extract to better flow between the perforated openings and the relief elements. This results in a faster flow of the liquid through the foil member without affecting significantly the strength of the liquid extract (i.e., total solid content, yield). A higher rigidity can be obtained by a porous member being thicker than the foil member and/or being made of more rigid material.

In particular, the flow control porous member thickness may be between 0.1 microns and 1.5 mm. Preferably, the flow control porous member thickness is between 0.4 microns and 1.0 mm.

The foil member of the capsule is configured to be successfully torn against a multitude of relief elements by a relief plate of the beverage production device. The foil member must be designed to tear in a consistent manner, in particular, when a predetermined threshold of pressure in the capsule is reached. Therefore, the design of the foil member and the design of the relief plate of the device are

determined in such a way that the opening/tearing of the foil member is reliably and consistently carried out.

Therefore, preferably, the foil member has a thickness of between 10 and 100 microns, more preferably between 15 and 45 microns. Most preferably, the foil member thickness is of about 30 microns plus or minus the typical manufacturing tolerances (e.g., +/- 5 microns). Furthermore, the foil member is preferably made of aluminium or aluminium alloy.

Preferably, the ratio of flow control porous member thickness to the foil member thickness is comprised between 1.5:1.0 and 50:1, most preferably between 5:1 and 20:1.

The flow control porous member may be positioned in the capsule in a manner separate from the capsule walls, i.e., disconnected from the walls. For instance, the flow control porous member may be loosely inserted between the ingredients and the foil member.

The flow control porous member can cover at least 62% of the total inner surface of the foil member to ensure that it covers most of the openings created through the foil member when torn under pressure and thus prevents a flow bypass effect and so a reduction of the efficiency of the flow control.

In an advantageous mode, the flow control member has a square or rectangular shape. Hence, the cost of production of the flow control member can be significantly reduced with significantly less material scraps during cutting in the

sheet or laminate.

In another mode, the flow control porous member may be connected to the walls of the base body of the capsule and/or to the foil member. The flow control porous member can be connected to the wall by sealing or other connection modes such as mechanical engagement e.g., clipping.

In certain modes, the flow control member is a thin porous membrane of polymeric material.

In other modes, the porous member comprises essentially polymeric fibre-containing material.

The flow control porous member may be made from a non-woven material. The flow control porous member may also be made from a woven material. The porous member can be formed of food-grade meltable polymeric fibres.

In a preferred mode, the porous member comprises microfibres of diameter of less than 20 microns.

In a mode, the porous member comprises a melt blown (MB) microfibres-containing material.

The porous member can be selected within the group consisting of: polypropylene, polyethylene, polybutyleneterephtalate (PBT), polycarbonate, poly(4-methyl pentene-1), polyurethane, polyethyleneterephtalate (PET), polyethersulfone, polyamide, resin bonded- glass fibres and combinations thereof.

The porous member can also comprise fibres of a diameter higher than 20 microns. For example, blends of microfibres and larger diameter fibres can form the porous member. For example, a porous member can be formed of melt blown (MB) and/or spunbond (SB) material.

In possible modes, the flow control porous member may be a solid injected plastic plate with small flow control openings.

Preferably, the flow control porous member has a pore size (i.e. average opening diameter) comprised between 0.4 and 100 microns. Particularly good results on flow time reduction were obtained with a flow control porous member with a pore size of between 0.4 and 25 microns. The pore size may be lower than 10 microns, even lower than 2 microns, i.e., between 0.4 and 2 microns. Flow time reduction was also obtained with ground coffee having a particle size ($D_{4,3}$) comprised between 190 and 400 microns.

A flow time of less than 40 seconds, with a standard deviation of less than 15 seconds, was successfully obtained, from a capsule containing about 5.5 grams of ground coffee, for delivering a coffee liquid extract of 40 g corresponding to an espresso coffee with a total solid content between 2.7 and 3.8% in weight. Similarly, a flow time of less than 30 seconds, with a standard deviation of less than 5 seconds, was successfully obtained, from a capsule containing about 6 grams of ground coffee, for delivering a coffee liquid extract of 110 g corresponding to a lungo coffee with a total solid content between 1.1 and 1.5% in weight.

It was also observed that the flow time was significantly lowered when the ground coffee particle size is increased.

The flow control porous member may be, at its rim, sandwiched between the foil member and the capsule walls.

The flow control porous member may be distanced from the foil member. In a possible mode, the flow control porous member may transversally separate two portions of ingredients, in particular, two portions of ground coffee.

In a possible mode, the two portions of ground coffee have different brewing characteristics. The brewing properties may refer, in relation to each of said portions, to the mass, the volume, the tap density, the average particle size ($D_{4,3}$), the type of blend, the degree of roasting and combinations thereof. In one mode, the upstream portion of ground coffee portion comprises a mass of ground coffee which has a lower average particle size $D_{4,3}$, than the downstream portion of ground coffee. The upstream portion of ground coffee may be of a higher volume or smaller volume than the downstream portion. In another mode, the upstream portion of ground coffee portion comprises a mass of ground coffee which has a higher average particle size $D_{4,3}$, than the downstream portion of ground coffee. Again, the upstream portion of ground coffee may be of a higher volume or smaller volume than the downstream portion. These variations enable to tune the flow characteristics in the capsule and also to tailor different characteristics (TC, yield, crema) of the delivered coffee extract to the various consumer's preference.

The flow control porous member may be placed adjacent to the foil member in the capsule. A small space may be allowed between the porous member and the foil member due to the deformation differential between the two elements. Indeed, due to its lower rigidity the foil member deforms more to a convex shape under the pressure of gas (e.g., carbon dioxide) inside the sealed capsule and a small gap may form between the foil member and the porous member.

The flow control porous member may be attached to the inner side of the foil member. In particular, the flow control porous member may be welded to the inner surface of the foil member. In another mode, in order to reduce the thickness of the flow control, the porous member may be printed directly on the inner surface of the foil member.

The flow control porous member may be thicker than the foil member, preferably at least 1.5 times thicker than the foil member.

In possible modes, the flow control porous member may be flat or corrugated. The flow control porous member may also comprise, for example, channels and/or protruding zones that promote a collection gap for the beverage between the foil member and the flow porous member.

The foil member may be free of weakened areas before being inserted in a beverage production machine.

The foil member may be a continuous sheet of metal or polymer or a laminate of metal and polymer.

The flow control porous member may be positioned and arranged such that it is not sandwiched between the foil member and the rim of the base body. For instance, the flow control porous member may be placed loosely in the capsule or may be attached in a localized area onto the inner surface of the foil member and with the edge of the flow control porous member being at a distance from the sealing area of the foil member and base body.

The outer edge of the flow control porous member may end at a position radially inwards from the sealing area of the foil member and the rim of the base body.

In another embodiment, the flow control porous member and the tearable foil member form a multilayer laminate.

The multilayer laminate preferably comprises:
- a tearable flexible layer of aluminium or of another metal or of polymer or a multilayer of aluminium and polymer or a multilayer of polymers and,
- at least one porous polymeric layer.

The porous polymeric layer forms the flow control porous member of the capsule. The metal layer preferably forms a gas barrier of the laminate. One or more additional non-porous layers can be associated to the metal layer in order to reduce the thickness of the metal layer and/or form a gas barrier. The gas barrier can also be obtained by a polymer

layer of the tearable foil member such as EVOH when it is made of a multilayer of polymers.

Preferably, the flow control porous member resists to the tearing by the relief member when the foil member is torn by the relief member under the pressurized extraction condition.

Therefore, in the laminate, the porous polymeric layer, e.g., the thin membrane, has preferably greater elastic properties than the tearable layer.

Hence, during extraction, the multilayer laminate has the ability to deform against the relief plate causing tearing of the non-porous layer(s) to form a multitude of small openings and stretching or deforming without tearing of the porous layer(s). As a result, the flow control properties of the non-porous layer(s) are maintained when the liquid is allowed to pass through the delivery foil member of the capsule.

The porous polymeric layer is preferably a thin membrane or a non-woven layer. The layer can be made of a material chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone and polyamide.

The porous layer has a pore size between 0.4 and 25 microns, more preferably between 0.4 and 2 microns.

The flexible layer for the laminate can be aluminium or another metal depending on the mechanical properties suitable for opening the capsule, on the gas barrier properties of the material and on the laminating technique.

A multilayer laminate facilitates the handling of the membrane during the production of the capsule. In particular, it reduces the risk for the fragile membrane of the porous member, to be damaged during handling, filling and/or sealing the capsule.

The laminate may be produced by any suitable method such as thermal lamination such as multilayer extrusion (co-extrusion), extrusion lamination, lamination moulding using heat rolls or heat press.

In another aspect, the invention relates to a capsule for use in a beverage production machine comprising:
- a first wall member,
- a second foil member tightly attached to the first wall member,
- at least one porous layer between the ingredients in the second foil member;
wherein the porous layer forms with second foil member a multilayer laminate.

The second wall member is preferably made of gas impervious, perforable material made of aluminium, aluminium alloy or a laminate of aluminium or aluminium alloy and polymer or made of only polymer(s). Most preferably, the second wall member is an aluminium foil of between 15 and 45 microns.

However, in an alternative, the second wall member can be made of liquid permeable material that physically supports the porous filter. In this case, the second wall member has

preferably a higher pore size than the porous member so that the porous member remains the flow control member of the capsule.

The tear strength of the porous layer, under the pressure extraction conditions, is preferably higher than the one of the second wall member. The tear strength of the porous layer is such that it should resist tearing during extraction so as to provide the filtering and flow control effect.

The porous layer may exert a significant pressure drop for the flow of beverage which can be controlled by the pore size and/or porosity.

The material for the porous layer is chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone, and polyamide.

Preferably, the porous layer has a pore size lower than 10 microns, preferably between 0.4 and 2 microns.

Preferably, a second porous layer is placed between the first wall member and the ingredient to form a second multilayer laminate.

Preferably, the tear strength of the second porous layer, under the pressure extraction conditions, is also higher than the one of the first wall member.

Preferably, the second porous layer has also a pore size lower than 10 microns, preferably between 0.4 and 2 microns.

The first and second wall members are preferably made of gas impervious, perforable material.

The first and second wall members are preferably sealed and symmetrical along their periphery rim.

The ingredient is essentially a compacted roast and ground coffee cake.

In a most preferred packaging configuration, the first and second walls are formed of a multi-layer comprising the following layers (from exterior to interior): PET/Colour layer/Adhesive/Aluminium/Adhesive/OPP. The aluminium layer has preferably a thickness between 10 and 80 microns, an OPP (i.e., oriented polypropylene) layer has a thickness of between 5 to 40 microns and PET layer of between 5 and 40 microns.

The multilayer laminate(s) can comprise:
- a layer of aluminium or of another metal or of polymer or a multilayer of aluminium and polymer and,
- at least one porous polymeric layer.

The metal layer preferably forms a gas barrier of the laminate.

One or more additional non-porous layers can be laminated to the metal layer in order to reduce the thickness of the metal layer and/or form a gas barrier. The gas barrier can also be obtained by a polymer layer of the tearable foil member such

as EVOH when it is made of a multilayer of polymers.

Another aspect of the invention relates to a method using a capsule according to any of the aforementioned features.

In particular, the method is for producing a beverage on the basis of an ingredient in a capsule, the method comprising the steps of:
- providing a capsule comprising a preferably frusto-conical base body sealed off by a foil member tightly attached to the flange-like rim of the base body,
- inserting the sealed capsule in a beverage production machine,
- perforating an inlet side of the capsule opposed to the foil member,
- injecting a liquid or a liquid/gas mixture into the capsule causing a pressure to build up in the capsule and the foil member to thrust against a fixed relief member of the beverage production machine,
the foil member being made from a material which is then perforated by a multitude of openings when the pressure of the injected liquid and liquid/gas mixture reaches a value of at least 4 bar,
- draining a beverage from the capsule, wherein the beverage passes between the multitude of openings and the relief member,
comprising the step of:
- filtering the beverage via a flow control porous member arranged between at least a portion of ingredients and the foil member.

In particular, said flow control porous member is effective for reducing the flow time and/or improve the flow time consistency, i.e., by reducing the flow time standard deviation of the mean flow time, when delivering a given volume of coffee extract compared to a capsule without said member. In particular, a standard deviation of less than 10% of the mean flow time can be obtained when delivering a coffee extract of 40 or 110 mL.

In general, the capsule contains a dose of between 5.5 to 6.5 grams of ground coffee. For short coffee, a dose of between 5.5 and 6.0 grams is preferred. For a lungo coffee, a dose of between 6.0 and 8.0 grams of coffee is preferred.

According to the method of the invention, a stronger lungo coffee can be obtained while maintaining an acceptable flow time, i.e., of less than about 40 seconds, more particularly, less than 35 seconds. In particular, a capsule for a stronger lungo contains above 6.0 grams of ground coffee, preferably between 6.2 and 7.0 grams.

Also, the capsule contains ground coffee having a particle size $D_{4,3}$ between 250 and 450 microns. The higher the particle size, the more reduced the flow time can be. Therefore, by tuning the particle size of the ground coffee, it is also possible to reach lower flow time while maintaining substantially the same strength of coffee or, alternatively, to increase the strength of the coffee (e.g., higher TC, Yield) without increasing the flow time.

According to the method of the invention, the flow time for delivering 40 mL of coffee extract is lower than 40 seconds, preferably lower than 30 seconds, most preferably lower than 25 seconds.

According to the method of the invention, the flow time for delivering 110 mL of coffee extract is lower than 40 seconds, more preferably lower than 30 seconds.

Preferably, the flow control porous member has a pore size comprised between 0.4 and 100 microns, preferably between 0.4 and 25 microns, most preferably, between about 0.45 and 2 microns.

Remarkable results have been obtained with a flow control porous member which is a thin porous membrane or a non-woven member. Remarkable results have also been obtained when the tearable foil member has a thickness of 15 and 45 microns, e.g., about 30 microns. The foil member is preferably in aluminium or aluminium alloy.

The fixed relief member of the beverage production device may comprise a tearing structure preferably configured to produce a grid-like perforation of the foil member.

For this, the fixed relief member of the beverage production device may comprise a tearing structure which has exclusively tearing edges forming angles of at least 80 degrees. In other words, the structure is free of sharp shape with angles formed of less than 80 degrees.

Preferably, the tearing structure comprises shapes of truncated pyramids and recesses forming a network of beverage collecting channels; which structure forms, as a result of thrust of the foil member against the fixed relief member, partial rectangular or squared imprints forming small discrete tears in the foil member. It is observed that the foil member tends to intimately deform to tear against the structure whereas the flow control porous member remains less deformed against such a structure and/or has a greater ability to elastically deform without tearing against said structure. The structure is also such (with no sharp edges like needles) that the risk of rupture of the porous member is low and that the porous member can be thin enough while providing its flow control properties.

Another aspect of the invention relates to the combination of a capsule and a beverage production machine according to any of the aforementioned features.

Further features, objects and advantages of the invention will become evident for the skilled person when reading the following detailed explanation of an embodiment of the invention when taken in conjunction with the figures of the enclosed drawings.

Figure 1 shows a known beverage production device encasing a capsule with beverage ingredient,

Figure 2 shows an example of a capsule and a beverage production machine according to the present invention,

Figure 3 shows a capsule according to the present invention with a removed foil member and a removed porous member,

Figure 4 shows a detail of a capsule according to the present invention,

Figure 5 shows a modification of the capsule of claim 4,

Figure 6 illustrates a photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction without flow control porous member,

Figure 7 illustrates a photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction, with flow control porous member (Invention),

Figure 8 illustrates another photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction without flow control porous member,

Figure 9 illustrates another photographic illustration of the effect of the present invention on a perforated capsule after coffee extraction, with flow control porous member (Invention),

Figure 10 shows comparative curves of the cup concentration, in percentage, as a function of the flow time, in seconds, for a cup of espresso-type coffee weighting 40 grams,

Figure 11 shows the evolution of the flow time in seconds as a function of the coffee average particle size ($D_{4,3}$) for a long cup ("lungo") cup of coffee weighting 110 grams with capsules having no flow control porous members,

Figure 12 shows the evolution of the flow time in seconds as a function of the coffee average particle size ($D_{4,3}$) for a long cup ("lungo") cup of coffee weighting 110 grams with capsules having a flow control porous members (Invention),

Figure 13 shows the "crema" value as a function of the flow time for a lungo coffee cup with and without flow control porous member in the capsule and,

Figure 14 and 15 show views of a cut capsule according to variants of the capsule of the present invention,

Figure 16 shows a partial schematic view (Half view along a longitudinal median plane) of a capsule according to another embodiment,

Figure 17 shows a capsule holder of the device according to the system of the invention,

Figure 18 shows a symmetrical capsule of the invention in cross sectional perspective view.

With reference to Fig. 2 now a first detailed embodiment of the capsule of the invention will be explained.

The "total solids" is defined as the weight of extracted solids contained in the extract divided by the total weight of the extract. This value is typically expressed in percentage.

The "extraction yield" refers to the character of the extract and it is defined as the weight of total solids in the liquid extract divided by the total weight of starting coffee ingredients in the cartridge (e.g., roast and ground coffee). This value is typically expressed as a percentage.

The average particle size "$D_{4,3}$" represents the mean volumetric diameter of the coffee grind as obtained by laser diffraction method using a Malvern® optical instrument and butanol as dispersing agent for the particles.

The "crema" is defined as the head of foam created on the coffee extract with a texture of substantially small bubbles. The crema attribute can be measured by an empirical sugar test which consists in arranging a well defined crystal sugar layer (i.e., crystal sugar of $D_{4,3}$ of 660 microns of particle size) on top of a freshly prepared cup of coffee and

measuring the elapsing time between the start of overlaying and the main part of sugar's sinking. The "sugar test value" is thus a number of seconds.

The "pressure of liquid or liquid/gas mixture" is typically a measure of relative pressure above atmospheric pressure taken at the injection site in the capsule.

Typically the pressure of liquid or liquid/gas mixture according to the process of the invention is of at least 4 bar for providing the tearing of the foil member during extraction, preferably of at least 6 bar, most preferably of at least 8 bar.

Note that in the following the invention will be explained referring to a certain design of a capsule, i.e. a design according to which the capsule comprises a cup-like base body and a closing foil member. Generally a capsule according to the present invention comprises at least two opposing wall members which are connected to each other at the edges to form a sealed flange-like rim area, thus enclosing a sealed interior.

Comparable to the prior art also this embodiment shows a capsule holder 13 having relief elements 12 which are designed to tear and perforate a foil member 5 closing off a cup-like base body 4 of the capsule 1. This tearing of the foil member can e.g. occur as soon as the pressure inside the capsule exceeds a threshold value. Note that the relief elements can have any protruding shape able to cause a (partial) tearing of the foil member, preferably of grid-like

design. As an example pyramids, bumps, cylinders, elongated ribs are cited as preferred examples.

Within the capsule 1 ingredients 3 are contained, wherein the ingredients 3 are selected such that a beverage can be produced when having a liquid entering the capsule in the region of the top wall 17 of the capsule 1 and then interact which such ingredients 3. Preferred ingredients are e.g. ground coffee, tea or any other ingredients from which a beverage or other liquid or viscous comestible (e.g. soup) can be produced.

Fig. 2 shows a state in which such a capsule has been placed on a capsule holder 13, the foil member 5 resting on the relief element 12 side of the capsule holder 13 and the cup-like base body 4 of the capsule 1 being already partly surrounded by the circumferential wall 25 of an enclosing member 9 of the beverage production device. The shown enclosing member has the shape of a bell. Other shapes are viable, wherein the design of the interior contours (recess) of the enclosing member is generally adapted to substantially match the contours of the capsule 1.

Note that the foil member 5 as shown may not be exactly flat due to a defined over pressure inside the capsule, which over pressure is generated by introducing e.g. a protective gas when producing the filled capsule and/or by gas being released by the ingredients contained in the capsule. In particular with ground coffee, gas such as carbon dioxide is released after closure of the capsule at the production site

which results in the foil member being deformed to a slightly convex shape.
According to invention, a flow control member 80 is placed between the ingredient 3 and the foil member 5.

The enclosing (bell) member 9 furthermore comprises a pressing surface 18 for applying a closure pressure on the rim area 8 of the capsule, an external thread 19 for mounting the bell member in a beverage production device and a water inlet opening 20 for feeding a liquid such as for example hot water under pressure to a water injector 14 which is releasably mounted (screwed) to the bell member 9.

Note that the thread 19 is just an example for connection means, be it releasable or permanent connection means.

The other components of the beverage production device, such as e.g. the mechanism for displacing the bell member and eventually also the capsule holder are known from the prior art in the field of capsule-based espresso machines.

The water injector comprises perforation element(s) (blade, pin, etc.) 24 designed to produce an opening in the top wall 17 of the capsule 1 when the capsule holder 13 and the bell member 9 are moved close together e.g. by a manually operated or an automatic mechanism. A channel (not shown in the drawings) traverses the perforation element 14 such that water can be fed to the interior of the capsule 1 once the perforation element 14 protrudes into the interior of the capsule 1.

The capsule 1 comprises said top wall 17, a sidewall 7 and a flange-like rim 6, wherein the foil member 5 is sealed to said flange-like rim 6 to close-off hermetically the cup-like base body 4 of the capsule 1. Again, other designs for the capsule are possible as long as the capsule can be sealed and contain the mentioned ingredients.

Fig. 3 shows a capsule 1 where the aluminum or aluminium alloy foil member 5 before it is sealed onto the base body 4, and the flow control porous member 80 inserted between the bed 3 of ingredient and the foil 5.

Also the flange-like rim 6 of the base body of the capsule 1 is visible.

Further on, a flow control porous member 80 is shown. The flow control porous member 80 is an example of a filtering web made out of a non-woven material. It is preferably made of polymer such as polypropylene, polyethylene, polybutyleneterephtalate (PBT), polycarbonate, poly(4-methyl pentene-1), polyurethane, polyetheyleneterepthalate (PET), polyethersulfone, polyamide or any other meltable fibrous polymers. Its pore size may range of from 0.4 to 100 microns, more precisely of from 0.4 to 30 microns, more precisely of from 0.4 to 20 microns, even more precisely between 0.4 and 10 microns, even more precisely between 0.4 and 2 microns. The filter disk can be reinforced, e.g. by a non-woven or woven material such as polyester.

Fig. 4 shows a flow control porous member 81 which has been cut into the proper dimensions and which can then be sealed,

together with the aluminum foil member, e.g. via ultrasonic welding, to the flange-like rim 6 of the capsule 1. Since the porous member is made of meltable polymer(s), its welding to the capsule is so made possible. Preferably the flow control porous member dimensions are such that the edge of the flow control porous member overlap the flange-like rim 6 of base body 4 of the capsule 1.

Fig. 5 shows the example of a flow control porous member 82 which has been cut into the proper dimensions, preferably slightly smaller diameter "D0" than the inner diameter "D" of the base body of the capsule. Therefore the edges of the flow control porous member do not reach to the walls of the capsule and the flow control porous member is then simply placed on the ingredients already filled in the capsule beforehand. Finally the foil member 5 is attached, for example heat or ultrasonically sealed, to the flange-like rim 6 of the capsule 1.

The flow control porous member and the tearable member can also form a multilayer laminate to facilitate handling during production of the capsule. In this case, the flow control member is necessarily provided as the innermost layer or multilayer in the capsule relative to the tearable foil member. The flow control member can be formed of a porous mono- or multilayer membrane laminated to a mono- or multilayer non-porous tearable foil. The non-porous tearable foil member is hence chosen in a material which provides controllable and reproducible tearing conditions. A preferred material is aluminium. The thickness of the aluminium layer is preferably of from 20 to 50 microns. The aluminium may

further be laminated with one or more layers of non porous polymer layer such as a thermofusible lacquer. The additional layer may be of lower thickness (e.g., less than 5 microns) and be suitable for sealing to the capsule's body and porous layer.

The flow control member is preferably chosen in a material having a higher tear strength than the one of the tearable foil member when the foil member is opened, i.e., torn by the relief member 12 under the effect of the internal pressure, the porous member stretches sufficiently to resist to tearing under the pressurized extraction conditions. In particular, the flow control member is resilient enough to deform without breaking or forming enlarged passages for the flow of liquid. The liquid is so forced under pressure to pass through the many pores of the flow control member then to the perforations provided through the foil member as this one tears against the relief member.

As aforementioned, the porous member is preferably a mono-layer or a multilayer chosen among: polypropylene, polyethylene, PBT, polycarbonate, poly(4-methyl pentene-1), polyurethane, PET, polyethersulfone, polyamide, resin bonded-glass fibres and combinations thereof.

Fig. 6 and 7 illustrate the filtering effect of the present invention. As can be seen, the invention is particularly adapted to a grid-shaped perforation 205 of the foil member 5 of the capsule, wherein the grid is comprised by small essentially rectangular or squared imprints defining a plurality of perforations of the foil member obtained as a

result of the brewing process. The perforation is provided by the relief elements 12 (Figures 2 or 17) onto which the foil member extends and tears under the effect of the internal pressure during extraction. The tearing structure is formed of surfaces which are free of sharp angles or edges, i.e., angles of less than about 80 degrees.

Figure 6 shows that there is resurgence of coffee particles through the perforation 205 in absence of the flow control member. Figure 7 shows a significant improvement with no resurgence at all of solids with capsules of the invention.

Surprisingly, figures 8 and 9 show also a neater perforation 205 for the capsule of the invention. In other words, the perforations seem to be more consistent and of a more well defined profile. On figure 8, one can notice perforations of different size and depth.

It has been found out that the internal flow control porous member means according to the invention are particularly effective and suited in combination with an aluminium or aluminium alloy foil member 5 to be perforated in such a grid-like structure and with small openings 205.

In particular, the pressure drop during extraction under pressure of the coffee in the capsule is caused in the piping of the coffee machine, in the coffee bed, but primarily across the interface of the foil member and the puncture plate, i.e., the tearing structure.

The resulting time required to extract a certain amount of liquid depends therefore on the phenomena happening between the foil member and the puncture plate (i.e., "pyramid plate"). Without being bound by theory, the inventors think that the pressure drop occurring at the membrane-pyramid plate interface is mainly determined by the width of the gap between the membrane and "pyramid plate". The width of this gap is established at the beginning of extraction, particularly during the phase when the membrane ruptures. Very dynamic and to some extent chaotic phenomena can happen at this moment. Membrane physical strength (e.g. tensile strength, puncture resistance, elongation before rupture), rupture pressure and hydrodynamic behaviour of the water influence on how intense the membrane will be pressed against the pyramid plate and thus the gap width. Without the flow control porous member, these phenomena observed are more chaotic, thus leading to a fairly high variation of pressure drop and consequently to a high standard deviation of flow time. Additionally, very fine particles may be transported to this very narrow gap and obtrude the outlet, thus creating an increase in pressure drop.

The addition of a flow control porous member between the coffee bed and the foil member is supposed to act on the following 3 main phenomena determining the pressure drop:

a) Fine particles (i.e., particles of less than about 90 microns), which can be washed out from the coffee bed and transported to the outlet of the capsule are withhold by the flow control porous member. Therefore, they do not accumulate at the very narrow gap between the foil member and the

puncturing plate. An increase due to obstruction by fine particles is therefore avoided.

b) The flow control porous member reduces the dynamic water pressure acting on the foil member at the moment of rupture at the beginning of extraction. The foil member is pressed against the puncture plate less intensely. Therefore, the gap between membrane and pyramid plate will be wider than without flow control porous member.

c) As the coffee bed creates a pressure drop during extraction, the resulting force is transmitted to the foil member and puncture plate. This force will further reduce the gap width between the foil member and the puncture plate. Through the rigidity of the flow control porous member however, the force will be distributed differently on to the foil member and puncture plate. The force will be higher on the plateau of the puncturing elements of the plate and lower in the grooves or channels of the plate. As the gap width relevant for pressure drop is mainly around the outlet holes located in the grooves, the reduction of the force transmitted by the coffee on the grooves will further reduce the pressure drop

In a mode, the flow control porous member is not sandwiched between the foil member 5 and the rim 6 of the base body 4. The outer edge of the flow control porous member may end at a position radially inwards from the sealing area 209 of the foil member 5 and the rim of the base body.

Fig. 14 and 15 show that the internal flow control porous member means 206 can be distanced from the foil member 5. The

flow control porous member 206 are respectively sealed to the walls 7 of the base body of the capsule. The flow control porous member can thus separate transversally with respect of the brewing direction two portions of ingredients, e.g., two ground coffee portions. The flow control porous member can thus regulate the flow of liquid between the two portions. Also, the portions of ingredient may have different characteristics such as a different granulometry or be different coffee blends.

In the embodiment of Figs. 14 and 15, there are ingredients both above and below the flow control porous member 206.

The reference sign 207 designates the curled outer rim of the capsule. The foil member 5 and the rim flange of the base body can be sealed together in a ring-shaped area 209 inside and adjacent to the curled outer rim 207.

Figure 16 illustrates another possible mode for a capsule of the system of the invention. In this mode, the capsule comprises a cup-like base body 4, a closing foil 5 and a flange-like rim 6 of the body onto which is sealed an annular part of the closing foil. A flow control porous member 301 is placed in the capsule and is spaced from the inner surface of the foil member by a spacing element 302. The spacing element can be a grid with large holes or rigid member with channels and through holes providing significantly no pressure drop.

In view of figure 17, the relief elements of the capsule holder 13 are designed such that no angles of the relief element is below 80 degrees that could form sharp edges.

Turning to figure 17, an example of a suitable capsule holder 13 is represented. The capsule holder 13 comprises a tearing structure 92 comprising a series of truncated pyramids 920 having substantially squared sections. The upper surface of the pyramids is basically a square surface 921 of smaller section than the base section 922 of the pyramids. The square surfaces 921 form the "plateau" of the tearing structure. The pyramid can comprise a lower base 923 of larger section than the base section 922. The number of pyramids can range of from about 25 to 50. The height of the pyramids can be of from about 0.5 to 3 mm. The tearing edges of the structure are mainly situated at the edge 924 of the upper surface 921 and at the edges 925 of the side walls of the pyramid. All the surfaces of the pyramids connect at the tearing edges by forming angles of more than 80 degrees. More preferably the upper tearing edges 924 are delimited by surfaces forming an angle of more than 90 degrees.

In view of figure 18, the capsule 400 of the invention can be symmetrical as well with a first wall member 401 and a second wall member 402 forming the outer walls of the capsule. The first and second walls are connected at their peripheral rim 403, 404 to delimit a closed chamber 405 containing a dose of beverage ingredient, preferably, a roast and ground coffee cake. The cake 406 can be in compacted or loose form. Preferably, the cake is compact for providing a size reduction of the capsule. First and second flow control porous members 407, 408 are further provided in the capsule between the ingredient, i.e., coffee cake, and the first and second walls 401, 402. The flow control porous members may have the same characteristics as already described in the

previous embodiments. In particular, the porous layer is chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone, and polyamide. Preferably, the porous layer has a pore size lower than 10 microns, preferably between 0.4 and 2 microns.

An additional advantage of such a capsule 400 is that it can be placed in the brewing unit of the beverage preparation device in which any of the first or second walls can form the inlet side or the delivery side. The first and second walls are hence formed of perforable material and preferably gastight. In a preferred packaging configuration, each wall is formed of a multi-layer comprising the following layers (from exterior to interior): PET/Colour layer/Adhesive/Aluminium/Adhesive/OPP. The aluminium layer has preferably a thickness between 10 and 80 microns, an OPP (i.e., oriented polypropylene) layer has a thickness of between 5 to 40 microns and PET layer of between 5 and 40 microns.

EXAMPLES:

Example 1 - Flow time for short coffee (40 grams):

Figure 10 shows comparative curves of the coffee cup concentration as a function of the flow time (in seconds) for delivery of 40 mL of coffee extract, for respectively capsules without flow control porous member and capsules according to the invention with a flow control porous member. The curves show the results on the standard deviation of flow times for different granulometries, respectively, 195, 267,

279 and 399 microns (Coffee ground in a Probat grinder). The capsule contained 5.5 grams of ground coffee and a porous member made of a microfibre-containing web, "Innovatec SAP489" (Specific weight of 50g/m2), made of polyurethane. The porous member of a diameter of about 33 mm was placed adjacent the foil member. The foil member of the capsule had a thickness of 30 microns. The capsules were extracted in a "Nespresso Concept®" machine.

The results show a relatively lower flow time and less standard deviation for the capsule of the invention compared to capsule having no such flow control and filtering member. Surprisingly, it is also possible to create a wider range in coffee concentration in the cup depending on the granulometry, for example, in this specific example, a concentration ranging from about 2.8 to 3.6% in weight.
The numerical results are also provided in the following table.

Flow times to obtain 40ml of coffee extract

		Without flow control porous member			With flow control porous member		
Capsule load (g)	Average particle size (microns)	Average flowtime (s)	Standard deviation (s)	Standard deviation (%)	Average flowtime (s)	Standard deviation (s)	Standard deviation (%)
5.5	195	74	24	32%	34	8	23%
5.5	267	60	18	29%	23	4	18%
5.5	279	43	15	35%	16	1	8%
5.5	399	40	16	40%	12	1	7%

Example 2 - Flow time for long coffee (110 grams):

Figures 11 and 12 show a comparative evolution of the flow time as a function of the particle size $D_{4,3}$ for delivering a

lungo coffee extract of 110 grams from capsules containing about 6 grams of coffee and having a foil member of about 30 microns. The porous member of a diameter of about 33 mm was placed adjacent the foil member. It is surprisingly noticed that the flow time is significantly reduced below 30 seconds for particle size in the range of from 289 to 403 microns (More particularly, for respectively 289, 318, 347, 375 and 403 microns). It is also remarkable to note that the flow time standard deviation is significantly decreased to less than 5 seconds for all particles sizes. The capsules were extracted in a "Nespresso Concept®" machine.

The following table 1 provides results of the tests on capsules with or without flow control porous member (called "filter") corresponding to figures 11 and 12.

Coffee: VIVALTO - 6 g R&G per capsule **Capsule:** NC Al membrane 30 ml
Filter: diameter 33 mm **Extraction machine:** Pelican ref.
Cup: size110 g - 24 extractions (

Filter type	R&G D(4,3) [µm]	Flow type	Flow time [sec]	Flow rate [g/min]	TC extract %	Extraction yield %
no filter	289	slow	50	133	1.4	26.2
		fast	36	185	1.4	25.9
	318	slow	53	124	1.4	25.2
		fast	30	217	1.3	24.4
	347	slow	43	153	1.3	24.2
		fast	26	258	1.2	23.4
	375	slow	61	108	1.3	24.2
		fast	27	243	1.2	22.6
	403	slow	51	131	1.3	22.8
		fast	26	258	1.2	22.3
with filter	289	slow	30	220	1.4	26.1
		fast	28	236	1.4	26.1
	318	slow	28	236	1.3	24.4
		fast	26	252	1.3	24.7
	347	slow	26	259	1.2	23.5
		fast	25	267	1.2	23.4
	375	slow	25	262	1.2	22.7
		fast	25	268	1.2	22.6
	403	slow	25	263	1.2	22.5
		fast	25	269	1.2	22.0

table 1.

Example 3 – Crema results:

Figure 13 shows the results on the results on crema formation using capsules of the invention and comparatively capsules with no flow control porous member. The curves are comparative curves of the "crema" (time in seconds for "sugar test") as a function of the flow time for delivering 110

grams of coffee extract in seconds. The capsule contained 6 grams of ground coffee and a porous member made of microfibrous "Innovatec SAP489" web in polyurethane. The foil member had a thickness of 30 microns. The results clearly show that the flow control porous member does not affect the crema formation whereas the flow time is significantly reduced.

For the example of figure 13, crema is measured according to an empirical test called "sugar test". The procedure for this test is explained below.

Example 4 - Flow time for long coffee (110 grams) and higher mass of ground coffee (6.2 grams):

A comparative test was run for capsules with or without flow control member made of membrane of nylon 6,6, "Ultipor N6,6 Posydine" from PALL Company of 0.65 microns and 33 mm of diameter. The capsules contained 6.2 grams of ground coffee having particle size $D_{4,3}$ of 320 microns. The porous member of a diameter of about 33 mm was placed adjacent the foil member. For capsules with the Nylon membrane, the flow time was comprised between 33 and 37 seconds with an average flow time of 34 seconds. The coffee yield was measured between about 22 and 23%. Comparatively, capsules of the same characteristics but without flow control porous member exhibited a flow time between 24 and 72 seconds with an average flow time of 49 seconds. These results also show that for a higher mass of 6.2 grams, the flow time is reduced in average and the flow consistency is very much improved with capsules of the invention.

Example 5 - Flow time for different flow control porous members:

The following table provides results on flow time for different other porous member tested from PALL Company. The reference was a capsule with no porous member inside. This result shows that the flow time is improved for porous members of between 0.45 to 100 microns. The coffee yield was comprised between about 22 and 23%.

Porous member	Type	Pore size µm]	flow-time in sec/110 ml
HDC II	Polypropylene	0.60	26
HDC II	Polypropylene	20.00	20
Preflow UB	Resin-bonded glass fiber	0.45	28
Ultipor GF Plus	Resin-bonded glass fiber	1.00	29
Ultipor N6,6	Nylon 6,6	0.65	32
Ultipor N6,6 Posidyne	Nylon 6,6	0.65	27
Reference			42

Coffee Blend , D4,3 of 400 microns

Example 6: Sugar test for crema determination:

The mechanised sugar test device is composed of a small sugar-containing silo. The prismatic V-shape of this silo comprising a defined slit (2mm x 40mm) at the bottom edge can create a uniform sugar curtain as long as the slit is free and a minimum of sugar remains in the silo. This silo can be moved horizontally, with controlled speed (~40 mm/s) from one point "A" to a point "B" (distance between A and B is 20 cm). In the end position at both points a baffle prevents the sugar from flowing out if the device is in stand-by mode. When the silo is moved, the sugar curtain is produced all the way between the two points "A" and "B". The crema in a cup that is placed at 60 mm below this path within the two points will be topped with a uniform layer of sugar when the silo passes over it. The chronograph is started when the sugar layer is positioned on the foam's layer. The amount of sugar (a thickness of the layer to obtain a precise weight of 5 g of sugar) deposed in the cup is adjustable by varying the speed of the silo or the dimensions of the slit. The sugar is crystal sugar of $D_{4,3}$ equal to 660 microns. A precise waiting period (20 sec. for small cups) must be observed between the end of extraction and the start of the sugar test. The sugar layer remains some time on top of the crema. Later, when the main part of the sugar sinks suddenly the observing operator must stop the chronograph.

The "sugar test value" is the number of seconds shown by the chronograph. Additional information as to this test can be found in EP1842468B1.

Claims:

1. A capsule for use in a beverage production machine comprising:
- means for perforating an inlet side of the body of the capsule (1) opposed to the foil member (5) and the flange-like rim and injecting a liquid or a liquid/gas mix into the capsule (1),
- a relief plate with a multitude of relief elements which relief plate is arranged in the machine such that the injection pressure thrusts the foil member (5) against the relief plate,
the capsule (1) comprising:
- a base body (4) sealed off by a foil member (5) tightly attached to the flange-like rim (6) of the base body (4),
the foil member (5) being made from a material which is then perforated by the relief plate to form at least one, preferably a multitude of openings, when the pressure of the injected liquid or liquid/gas mixture reaches a value of at least 4 bar,
wherein the capsule further comprises at least one flow control porous member (201, 203, 204, 206, 208) arranged between at least a portion of ingredients in the capsule (1) and the foil member (5).

2. Capsule according to claim 1,
wherein the flow control porous member of the capsule has a pore size comprised between 0.4 and 25 microns.

3. Capsule according to claim 2, wherein the flow control porous member has a pore size lower than 10 microns.

4. Capsule according to claim 3, wherein the porous member (201, 203, 204, 206, 208) is made of at least one thin polymeric membrane.

5. Capsule according to claim 3, wherein the porous member (201, 203, 204, 206, 208) comprises essentially polymeric fibre-containing material(s) and made from a woven and/or non-woven material.

6. Capsule according to claim any of claims 1 to 5, wherein the material for the porous member is chosen among the list of: polypropylene, polyethylene, PBT, Nylon, polycarbonate, poly(4-methyl pentene-1), polyurethane, PET, polyethersulfone, polyamide, resin bonded- glass fibres and combinations thereof.

7. Capsule according to any of the preceding claims, wherein the capsule contains ground coffee having a particle size ($D_{4,3}$) comprised between 190 and 400 microns.

8. Capsule according to any of the preceding claims, wherein the foil member (5) has a thickness of between 15 and 45 microns.

9. Capsule according to any of the preceding claims, wherein the flow control porous member (201, 203, 204, 206, 208) has higher rigidity in flexure than the foil member.

10. Capsule according to any of the preceding claims, wherein the flow control porous member (201, 203, 204, 206, 208) is adjacent to the foil member (5).

11. Capsule according to claim 10, wherein the foil member (5) and the flow control porous member form a multilayer laminate.

12. Capsule according to any of the preceding claims, wherein the flow control porous member comprises microfibres of diameter less than 20 microns.

13. Capsule according to any of the preceding claims, wherein the base body (4) is made from aluminum, aluminium alloy or a laminate of aluminium or aluminium alloy and polymer.

14. Capsule according to any of the preceding claims, wherein the foil member is made from aluminum, aluminium alloy or a laminate of aluminium or aluminium alloy and polymer.

15. Capsule according to any of the preceding claims, wherein the base body and foil member are formed of first and second foils of flexible material which are sealed at their peripheral rim.

16. Capsule according to claim 15, wherein the foils are substantially of same shape and size to form a substantially symmetrical capsule along the rim's plane, are relatively impervious to oxygen.

17. Capsule according to claim 16, wherein a first flow control porous member is placed between the first foil and the ingredient and a second porous member is placed between the second foil and the ingredient.

18. Capsule according to claims 16 and 17, wherein the ingredient is essentially a compacted roast and ground cake.

19. A capsule for use in a beverage production machine comprising:
- a first wall member (4),
- a second perforable wall member (5) tightly attached to the first wall member (4),
- at least one porous layer between the ingredients in the capsule (1) and the second wall member (5);
wherein the porous layer forms with the perforable non-porous foil member, a multilayer laminate.

20. Capsule according to claim 19, wherein the tear strength of the porous layer, under the pressure extraction conditions, is higher than the one of the second wall member.

21. Capsule according to claim 19 or 20, wherein the material for the porous layer is chosen among the list of: polypropylene, polyethylene, PBT, PET, polyethersulfone, and polyamide.

22. Capsule according to claims 20 or 21, wherein the porous layer has a pore size lower than 10 microns, preferably between 0.4 and 2 microns.

23. Capsule according to any of claims 19 to 22, wherein a second porous layer is placed between the first wall member (4) and the ingredient to form a second multilayer laminate.

24. Capsule according to claim 23, wherein the tear strength of the second porous layer, under the pressure extraction conditions, is higher than the one of the first wall member.

25. Capsule according to claims 23 or 24, wherein the second porous layer has a pore size 10 microns, preferably between 0.4 and 2 microns.

26. Capsule according to claims 24 or 25, wherein the first and second wall members are made of gas impervious, perforable material.

27. Capsule according to any of claims 23 to 26, wherein the first and second wall members are sealed and symmetrical along their periphery rim.

28. Capsule according to any of claims 21 to 27, wherein the ingredient is essentially a compacted roast and ground coffee cake.

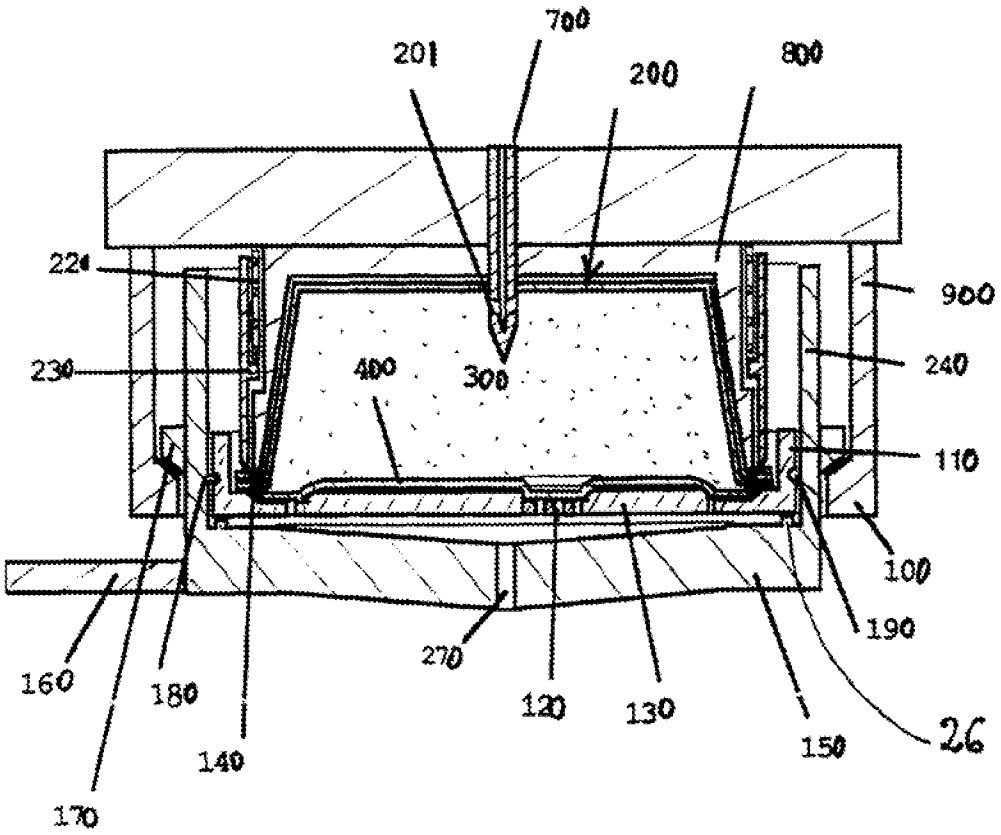

700
201
200
800
224
900
230
400
300
240
110
100
190
270
160
180
120
130
150
26
140
170

FIGURE 1

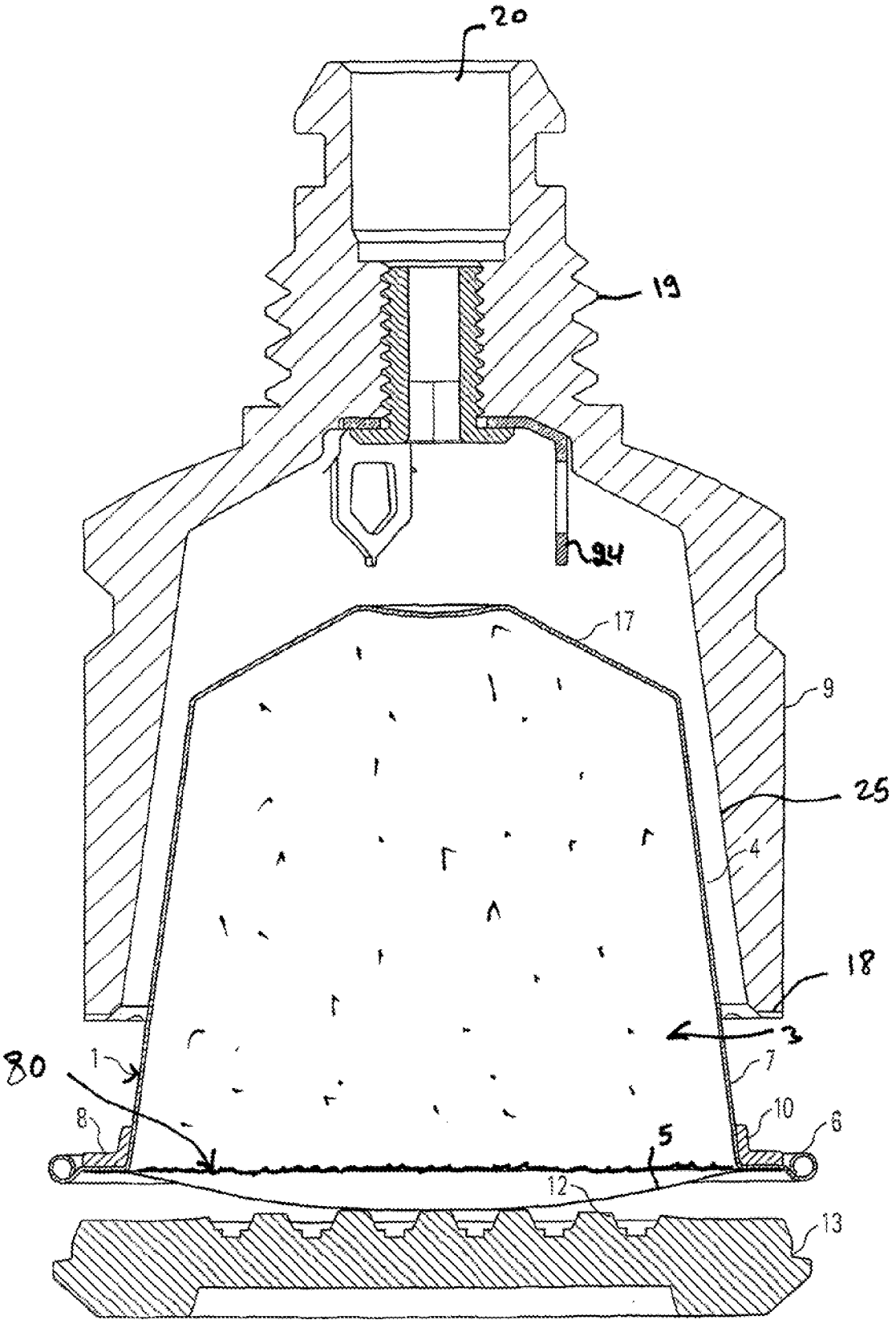


Fig. 2

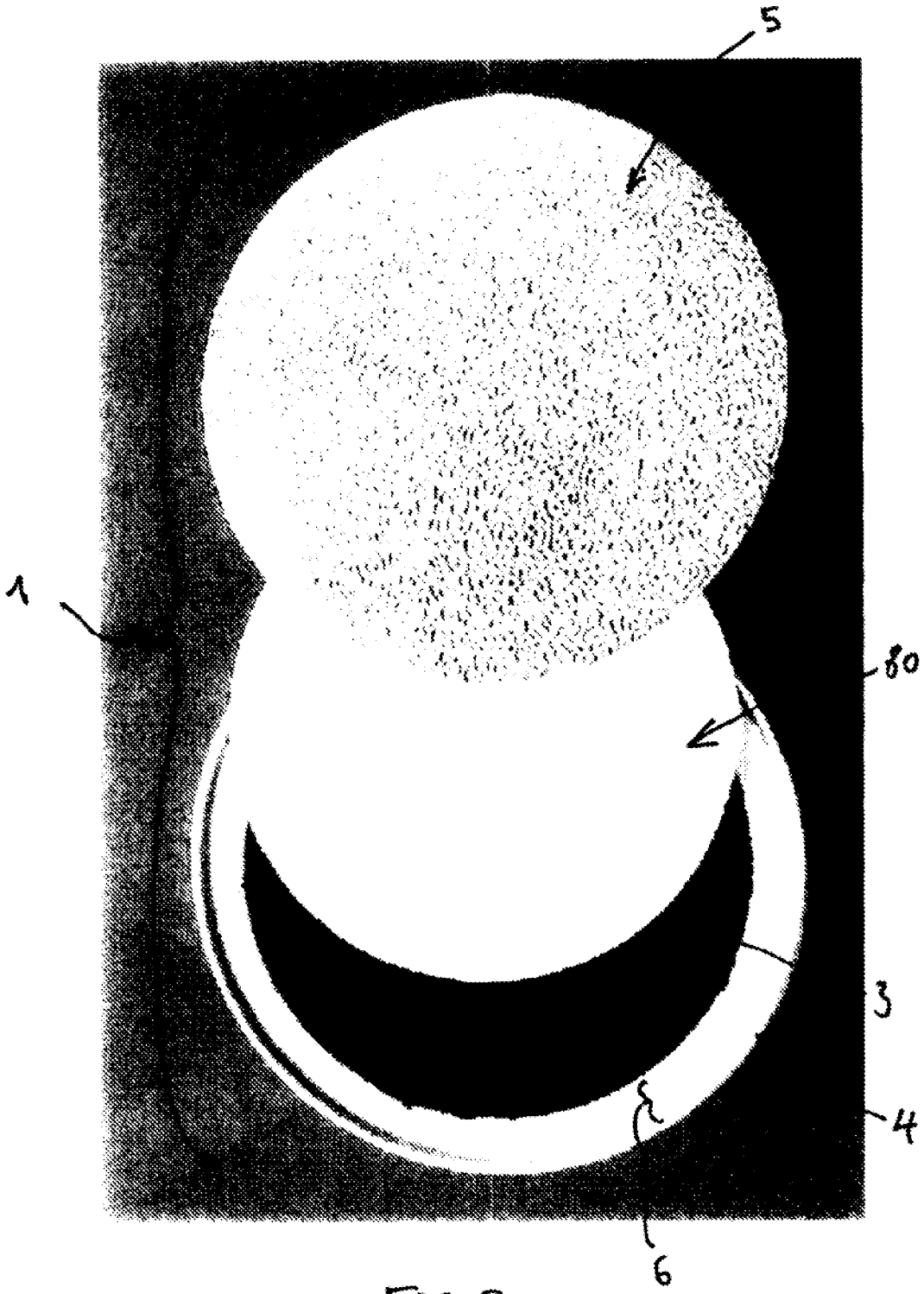


FIG. 3

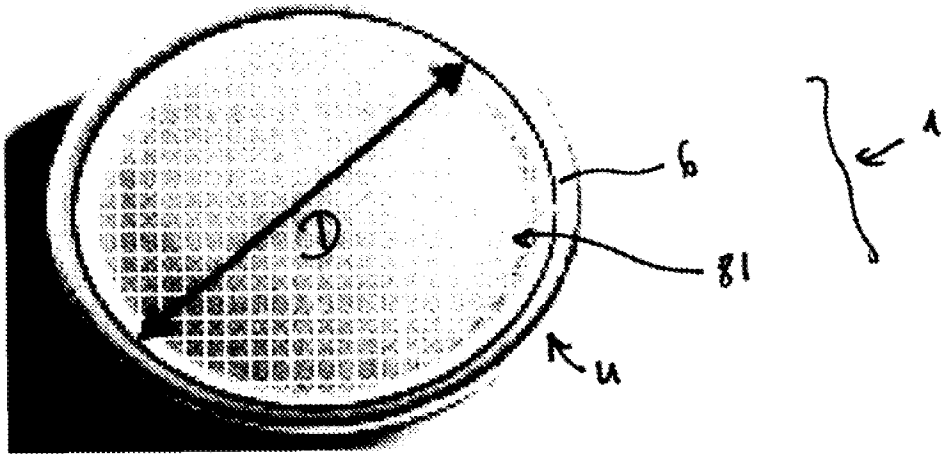


FIG. 4

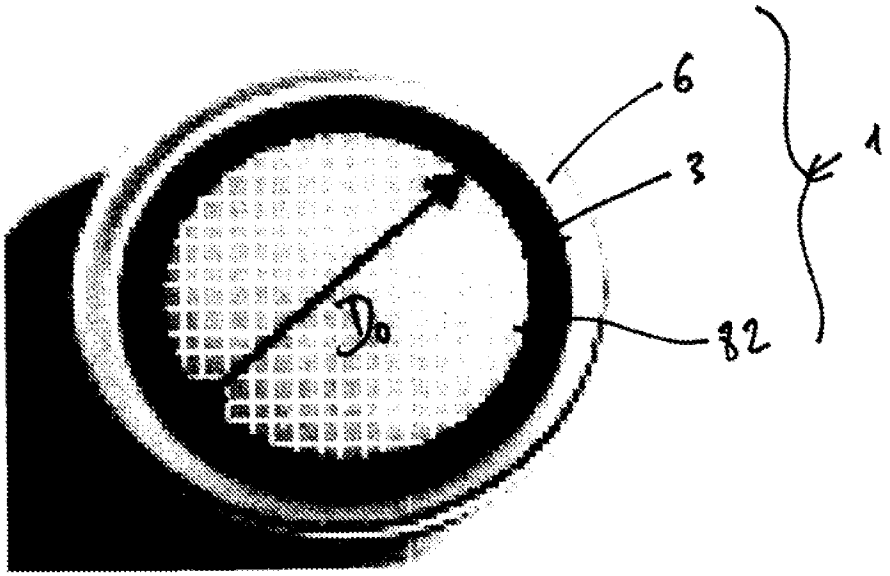


FIG. 5

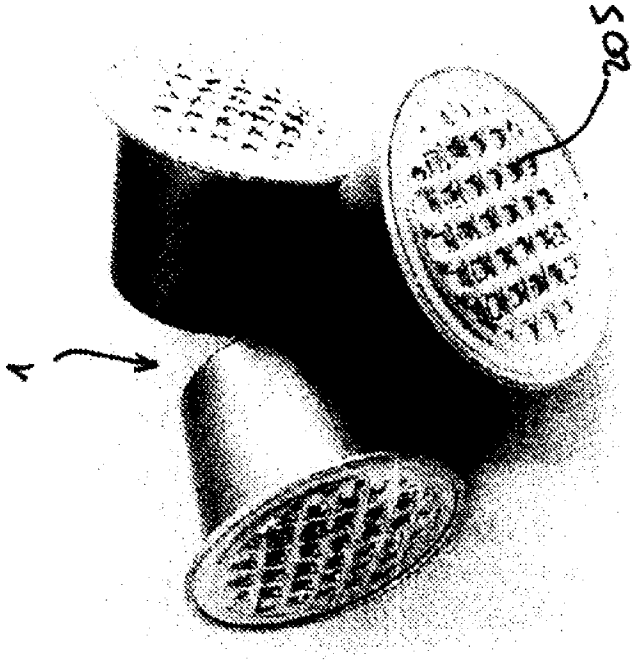


Fig. 7

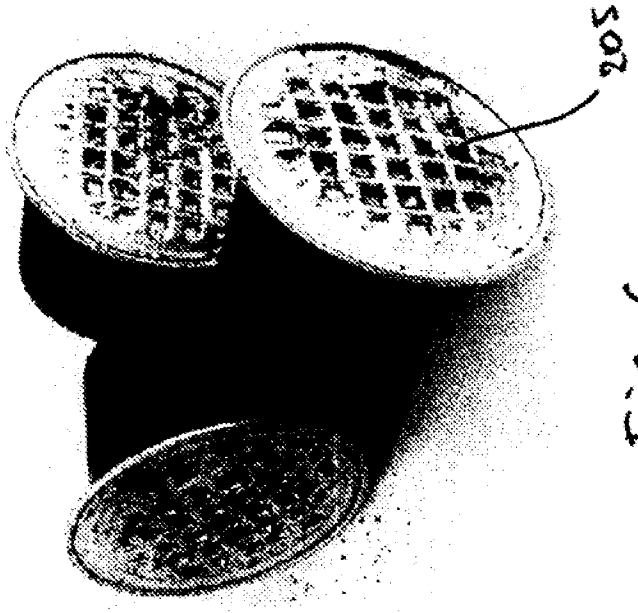


Fig. 6

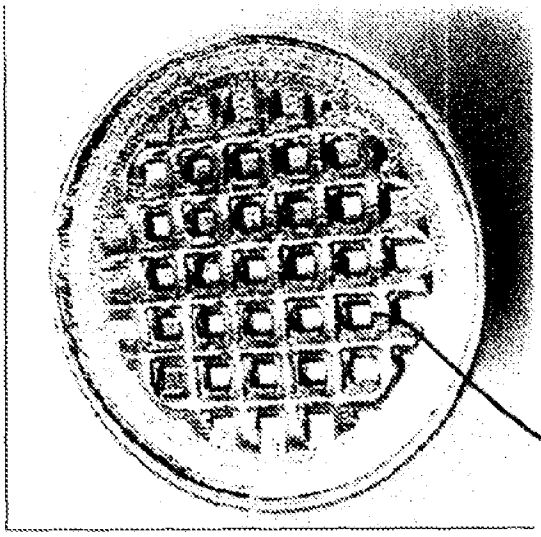


Fig. 9

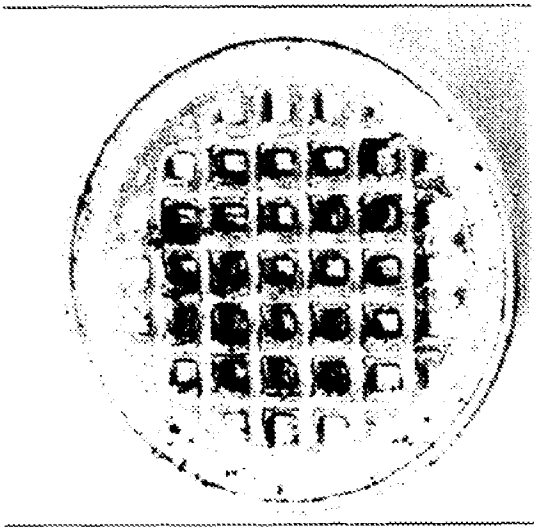


Fig. 8

Fig. 10

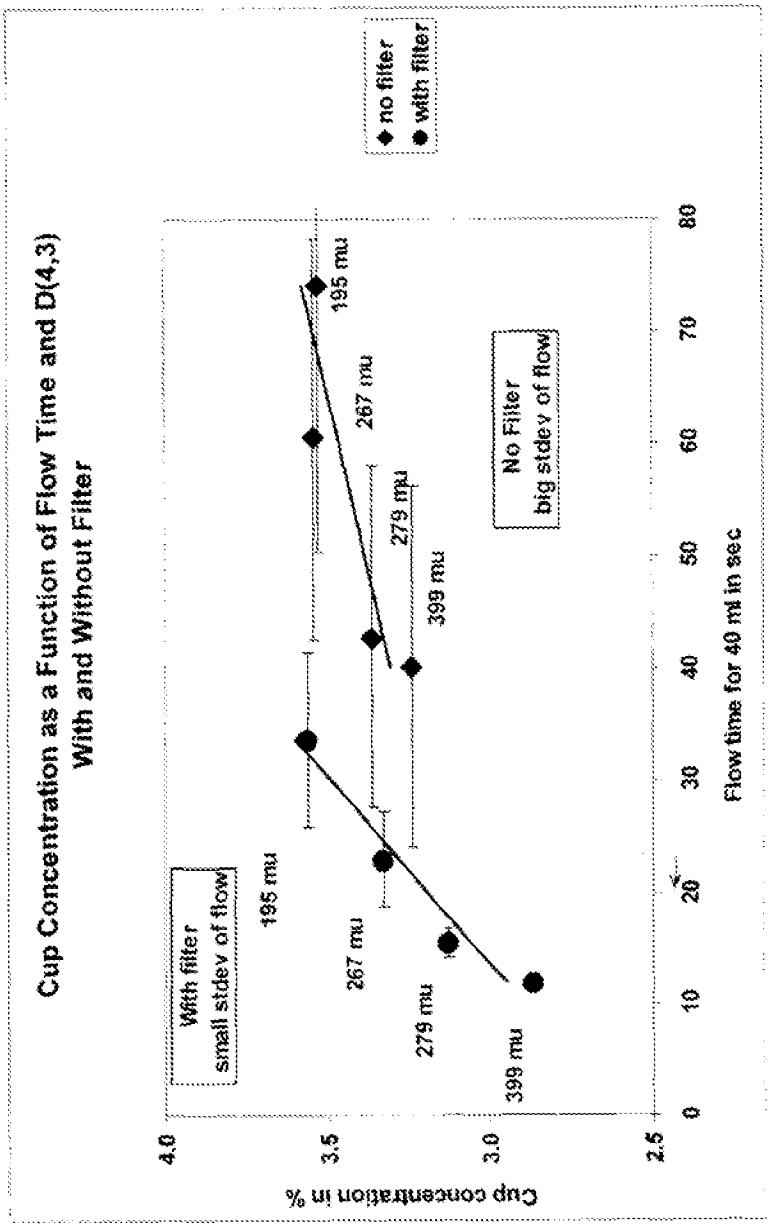

Cup Concentration as a Function of Flow Time and D(4,3)
With and Without Filter
no filter
with filter
With filter
small stdev of flow
No Filter
big stdev of flow
195 mu
267 mu
279 mu
399 mu
Cup concentration in %
Flow time for 40 ml in sec
4.0
3.5
3.0
2.5
0
10
20
30
40
50
60
70
80

FIG. 11

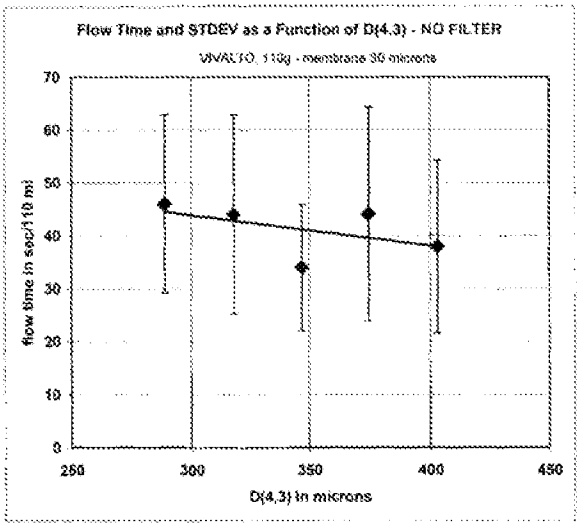

Flow Time and STDEV as a Function of D(4,3) - NO FILTER
VIVALTO, 110g - membrane 30 microns
flow time in sec/110 ml
0
10
20
30
40
50
60
70
250
300
350
400
450
D(4,3) in microns

FIG. 12

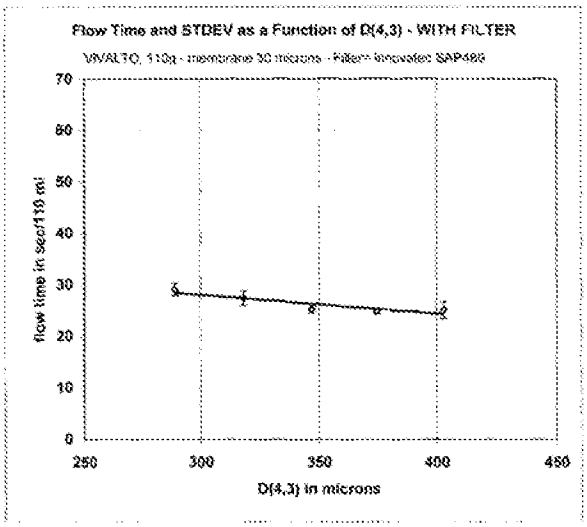
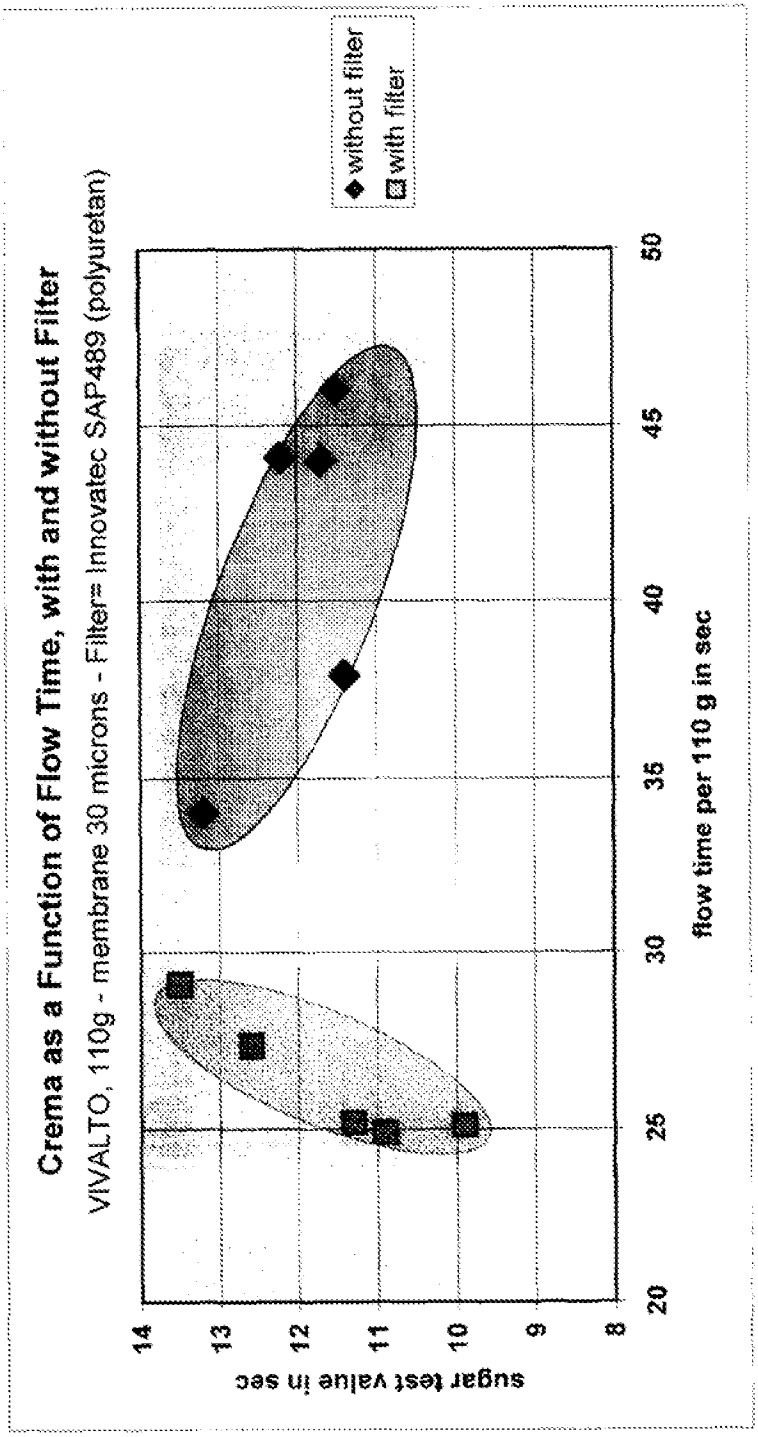

Flow Time and STDEV as a Function of D(4,3) - WITH FILTER
flow time in sec/110 ml
0
10
20
30
40
50
60
70
250
300
350
400
450
D(4,3) in microns

Fig. 13


Crema as a Function of Flow Time, with and without Filter
VIVALTO, 110g - membrane 30 microns - Filter= Innovatec SAP489 (polyuretan)
without filter
with filter
sugar test value in sec
14
13
12
11
10
9
8
flow time per 110 g in sec
20
25
30
35
40
45
50

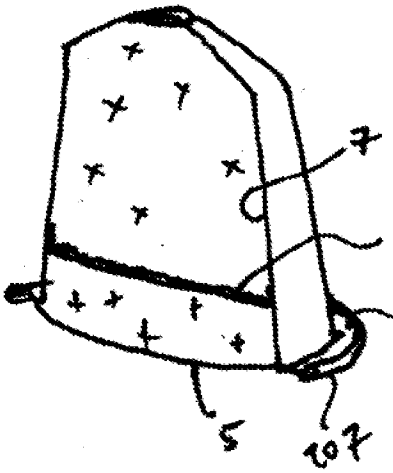


FIG. 14

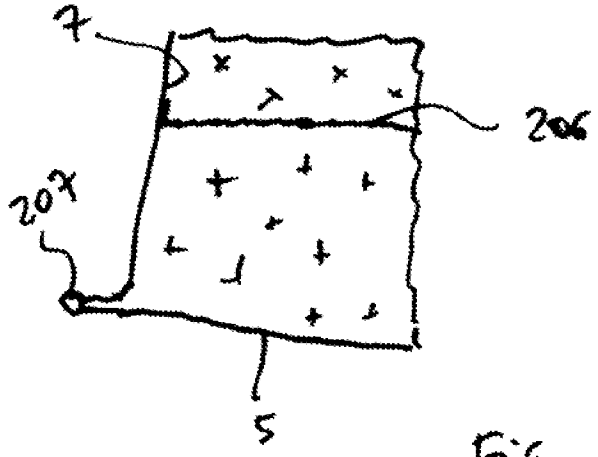


FIG. 15

FIG. 16

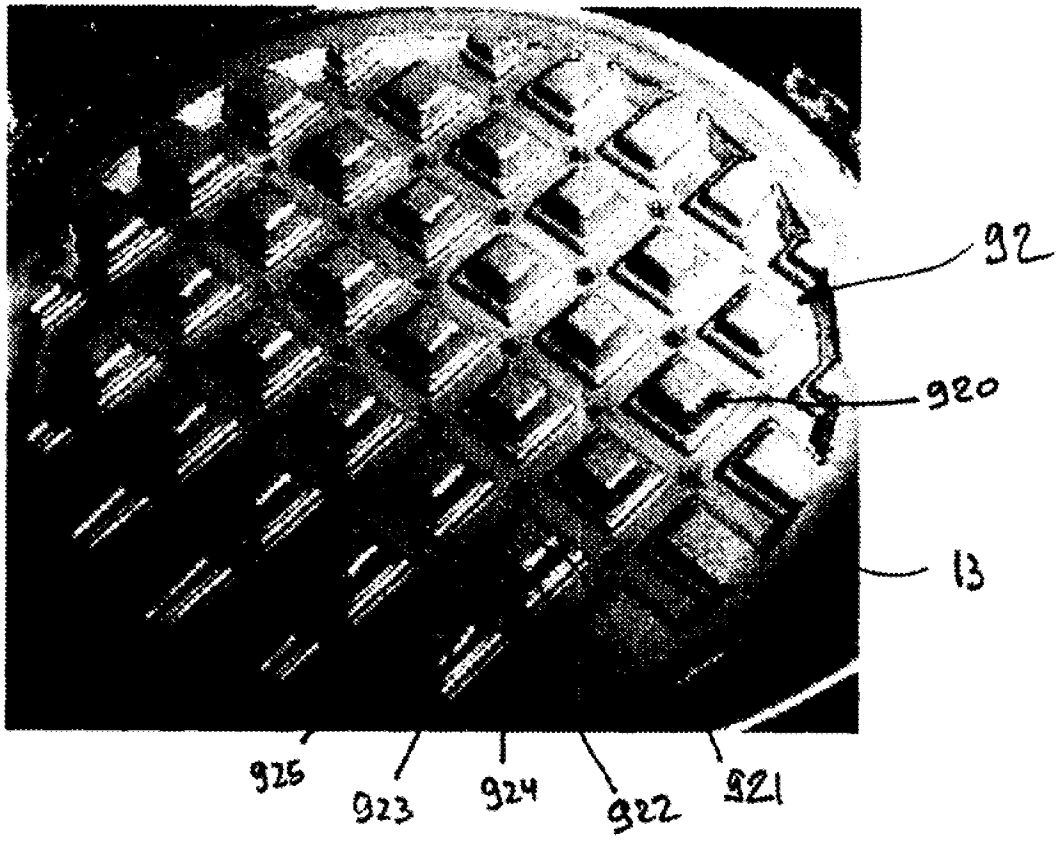


FIG. 17

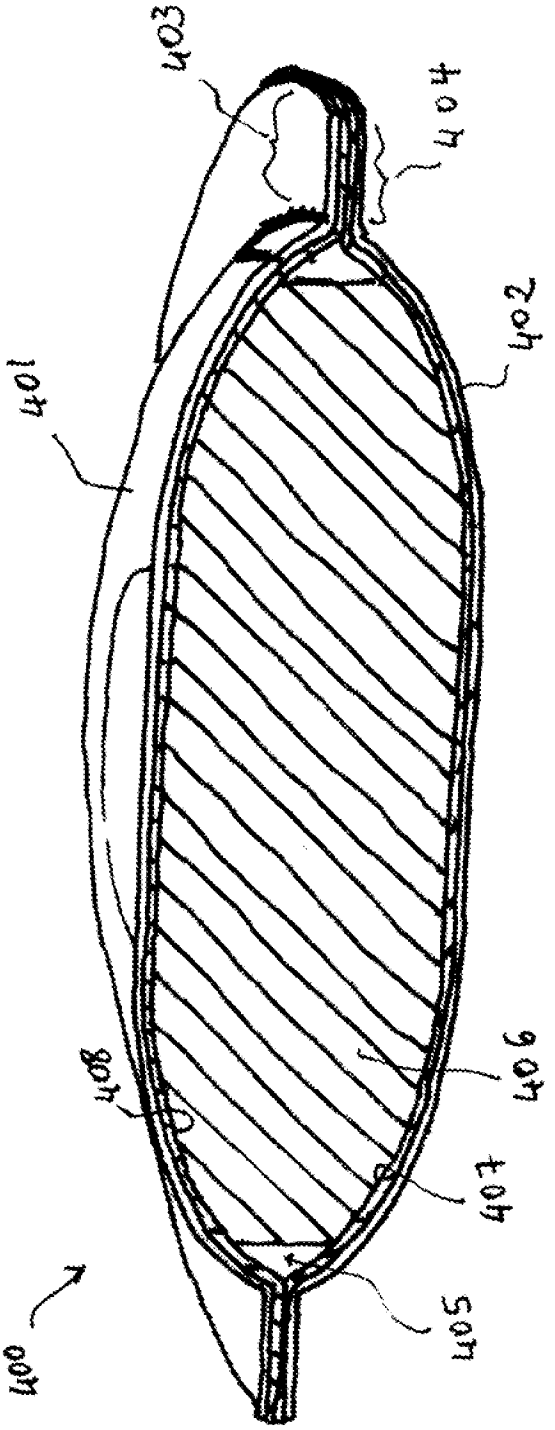


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/061844

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804

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 A47J

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 5 242 702 A (FOND OLIVIER [CH]) 7 September 1993 (1993-09-07) column 1 - column 6; figure 5	1,9,10, 13,14 2,6-8, 11,12
X	EP 1 826 148 A (NESTEC SA [CH]) 29 August 2007 (2007-08-29) paragraph [0001] paragraph [0022] - paragraph [0024] paragraph [0041] paragraph [0047] - paragraph [0065] paragraph [0073] - paragraph [0079]; figures 1,3b	1,10, 13-18

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

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"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
17 December 2009	29/12/2009

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	Mans-Kamerbeek, M

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Page 250 of 429

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 917 723 A (CIE MEDITERRANEENNE DES CAFES [FR]) 26 December 2008 (2008-12-26) page 1, line 1 - page 3, line 14 page 6, line 13 - page 7, line 10; figures 1,3-5	1,15-20, 23,24, 26-28
X Y	EP 0 512 468 A (NESTLE SA [CH]) 11 November 1992 (1992-11-11) column 1, line 46 - column 3, line 25; figure 3	19-21 11
Y A	EP 1 710 173 A (TCHIBO GMBH [DE]) 11 October 2006 (2006-10-11) column 1, paragraph 1 - column 3, paragraph 14 column 4, paragraph 18 - paragraph 19 column 6, paragraph 31; figures 4-6	2,6-8,12 3-5,22, 25
A	US 2003/077359 A1 (FOND OLIVIER [CH] ET AL) 24 April 2003 (2003-04-24) paragraph [0002] paragraph [0008] - paragraph [0010] paragraph [0014] paragraph [0025]; figures 1,2	15,16,18
A	EP 1 654 966 A (NESTEC SA [CH]) 10 May 2006 (2006-05-10) the whole document	
A	CH 605 293 A5 (NESTLE SA) 29 September 1978 (1978-09-29) cited in the application the whole document	
A	EP 0 554 469 A (NESTLE SA [CH]) 11 August 1993 (1993-08-11) the whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/061844

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5242702 A	07-09-1993	AT	93373 T	15-09-1993
		AU	645327 B2	13-01-1994
		BR	9102996 A	18-02-1992
		CA	2046557 A1	28-01-1992
		DE	69002945 D1	30-09-1993
		DE	69002945 T2	20-01-1994
		DK	0468078 T3	03-01-1994
		EP	0468078 A1	29-01-1992
		ES	2043196 T3	16-12-1993
		FI	913267 A	28-01-1992
		JP	2010682 C	02-02-1996
		JP	4236921 A	25-08-1992
		JP	7036801 B	26-04-1995
		MX	174039 B	15-04-1994
		NO	912906 A	28-01-1992
		NZ	238938 A	27-06-1994
		PT	98456 A	31-08-1993
		ZA	9105419 A	29-04-1992
EP 1826148 A	29-08-2007	AR	059634 A1	16-04-2008
		AU	2007217727 A1	30-08-2007
		CA	2644292 A1	30-08-2007
		CN	101389551 A	18-03-2009
		EP	1991477 A2	19-11-2008
		WO	2007096196 A2	30-08-2007
		HR	20080316 A2	31-12-2008
		JP	2009528078 T	06-08-2009
		KR	20090003192 A	09-01-2009
		US	2009047389 A1	19-02-2009
FR 2917723 A	26-12-2008	WO	2008155229 A1	24-12-2008
EP 0512468 A	11-11-1992	AT	148419 T	15-02-1997
		AU	1505192 A	12-11-1992
		CA	2067515 A1	11-11-1992
		DE	69217113 D1	13-03-1997
		DE	69217113 T2	15-05-1997
		DK	0512468 T3	07-07-1997
		ES	2097831 T3	16-04-1997
		FI	922065 A	11-11-1992
		GR	3022936 T3	30-06-1997
		JP	2763987 B2	11-06-1998
		JP	5132056 A	28-05-1993
		MX	9202144 A1	01-11-1992
		NO	921812 A	11-11-1992
		NZ	242567 A	22-12-1994
EP 1710173 A	11-10-2006	DE	102005016297 A1	12-10-2006
		US	2006236871 A1	26-10-2006
US 2003077359 A1	24-04-2003	NONE		
EP 1654966 A	10-05-2006	AR	055279 A1	15-08-2007
		AT	347837 T	15-01-2007
		AT	419769 T	15-01-2009
		AT	399495 T	15-07-2008
		AT	369062 T	15-08-2007
		AU	2005298933 A1	04-05-2006

IPR2023-00502
Nespresso USA, Inc. Ex. 1002 Part 3

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1654966 A		AU 2005298954 A1	04-05-2006
		BR PI0517030 A	30-09-2008
		BR PI0517296 A	07-10-2008
		CA 2581293 A1	04-05-2006
		CA 2584884 A1	04-05-2006
		CN 101043835 A	26-09-2007
		CN 101048094 A	03-10-2007
		DE 602004003713 T2	18-10-2007
		DE 602004008113 T2	15-05-2008
		DE 602004010435 T2	16-10-2008
		DK 1654966 T3	19-02-2007
		DK 1816935 T3	11-05-2009
		DK 1816936 T3	08-09-2008
		DK 1700548 T3	17-09-2007
		DK 1702543 T3	07-01-2008
		EC SP077350 A	26-04-2007
		EP 1816935 A2	15-08-2007
		EP 1816936 A1	15-08-2007
		EP 1700548 A1	13-09-2006
		EP 1702543 A2	20-09-2006
		EP 2098144 A1	09-09-2009
		WO 2006045515 A2	04-05-2006
		WO 2006045536 A1	04-05-2006
		ES 2277184 T3	01-07-2007
		ES 2317314 T3	16-04-2009
		ES 2309804 T3	16-12-2008
		ES 2292154 T3	01-03-2008
		ES 2297791 T3	01-05-2008
		HK 1091703 A1	30-05-2008
		HK 1112166 A1	20-02-2009
		HK 1112569 A1	27-11-2009
		JP 2008517639 T	29-05-2008
		JP 2008517838 T	29-05-2008
		KR 20070085287 A	27-08-2007
		PT 1654966 E	28-02-2007
		PT 1816936 E	04-08-2008
		PT 1700548 E	01-10-2007
		PT 1702543 E	14-12-2007
		RU 2350243 C1	27-03-2009
		SG 156663 A1	26-11-2009
		SI 1654966 T1	30-04-2007
		SI 1700548 T1	31-12-2007
		SI 1816936 T1	31-10-2008
CH 605293 A5	29-09-1978	AR 218048 A1	15-05-1980
		AT 359423 B	10-11-1980
		AU 515875 B2	07-05-1981
		AU 3141877 A	14-06-1979
		BE 861543 A1	06-06-1978
		BR 7708403 A	08-08-1978
		CA 1089801 A1	18-11-1980
		DE 2752733 A1	22-06-1978
		DE 7736129 U1	24-02-1983
		DK 561177 A	18-06-1978
		ES 232747 Y	16-06-1978
		FI 773625 A	18-06-1978
		FR 2373999 A1	13-07-1978

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/061844

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		GB 1561188 A	13-02-1980
CH 605293 A5		IT 1133901 B	24-07-1986
		JP 1382008 C	09-06-1987
		JP 60045325 A	11-03-1985
		JP 61051882 B	11-11-1986
		JP 1338647 C	29-09-1986
		JP 53076171 A	06-07-1978
		JP 61002372 B	24-01-1986
		LU 78694 A1	17-04-1978
		NL 7713597 A	20-06-1978
		NO 774331 A	20-06-1978
		NZ 185867 A	27-05-1980
		PT 67339 A	01-12-1977
		SE 428917 B	01-08-1983
		SE 7714275 A	18-06-1978
		US 4136202 A	23-01-1979
		ZA 7707279 A	27-09-1978
EP 0554469 A 11-08-1993		AT 112227 T	15-10-1994
		DE 69200472 D1	03-11-1994
		DE 69200472 T2	02-02-1995
		DK 0554469 T3	28-11-1994
		ES 2061284 T3	01-12-1994
		JP 5253071 A	05-10-1993

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(74) Agent: **TORTI, Carlo**; Grünecker, Kinkeldey, Stockmair & Schwanhäusser, Leopoldstrasse 4, 80802 München (DE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

---- *with international search report (Art. 21(3))*

(54) Title: FILTERING AND PERMEABLE CONTAINER FOR SUBSTANCES SUITABLE FOR THE PREPARATION OF BEVERAGES

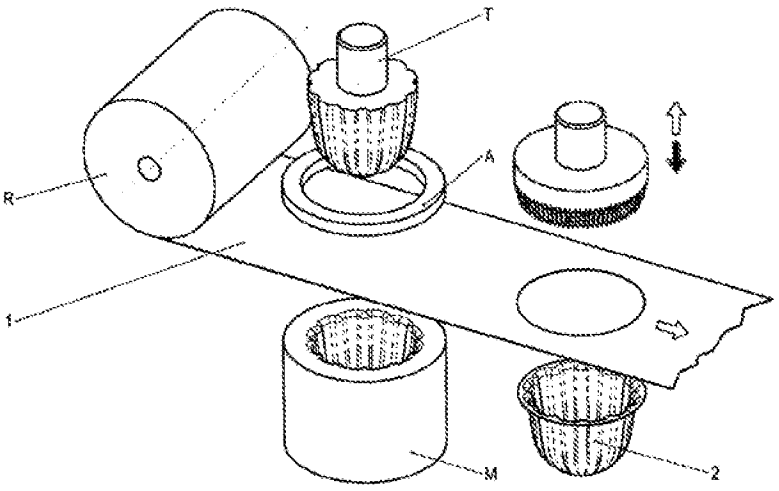


FIG. 5

(57) Abstract: Filtering and permeable container for substances (6) suitable for the preparation of beverages, the container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material, wherein the body (2) of the container comprises longitudinal stiffening ribs (4) wherein the length of the ribs (4) is variable along the surface of the body (2). The container can be adapted to contain water-soluble products or coffee, tea, herbal tea, or similar products adapted to obtain hot or cold beverages.

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FILTERING AND PERMEABLE CONTAINER FOR SUBSTANCES SUITABLE FOR THE PREPARATION OF BEVERAGES

FIELD OF THE INVENTION

The present invention relates to the field of containers for substances suitable for the preparation of beverages. In particular, the present invention relates to the field of filtering and permeable containers for substances such as water-soluble substances, coffee, tea, herbal tea or the like.

STATE OF THE ART

Several kinds of bags or flexible pads are known in the art for obtaining beverages such as tea, herbal teas, coffee or similar beverages such as water-soluble substances based beverages.

These kinds of bags or pads are easily deformed so that the handling of same is complicated and particularly critical, especially in the case of filling and/or packaging machines working at high production rates.

In order to try to overcome these problems, capsule packages have been provided such as those described for example in EP 0 521 186 A1 and in US 2005/0051478 A1.

EP 0 521 186 A1 describes a capsule package containing roast and ground coffee for the preparation of a coffee beverage. The capsule package described in EP 0 521 186 A1 has body and membrane components. The body has a frusto conical shape with base portion capable of allowing flow of a coffee beverage therethrough, an annular sidewall portion which extends transversely from the base about a package body interior space and defines an opening which opposes the base portion, and a rim portion which extends about the opening and transversely from the sidewall portion in a direction away from the opening. The body and the membrane are made of a permeable flexible plastic material. The stability of the system described in EP 0 521 186 A1 is not optimized. In particular, the capsule packages according to EP 0 521 186 A1 are still easily deformed, especially when they are handled by filling and/or packaging machines working at very high production rates.

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US 2005/0051478 A1 describes a beverage filter cartridge having an impermeable cup-shaped out container internally subdivided by a generally cup-shaped filter element into a first chamber inside the filter and a second chamber located between the filter bottom and the container bottom. The upper rim of the filter is joined at a peripheral juncture to the container side wall, and the filter side wall has exterior channels that face the container side wall and lead downwardly from the peripheral juncture to the second chamber. In particular, the channels are provided by forming the filter side wall with a fluted configuration or by pleats in the filter side wall so that the channels increase in width from a minimum at the upper rim of the filter to a maximum at the filter bottom. The channels formed in the filter sidewall according to US 2005/0051478 A1 are not provided for improving the stability of the structure of the system especially for its handling in filling and/or packaging machines working at very high production rates. Accordingly, the structure of these channels is not optimized for the purpose of improving the stability of the structure but rather for encouraging through flow in upper regions of the filter wall. The cartridges described in US 2005/0051478 A1 still exhibit therefore a low stability and render the handling procedures in packaging and/or filling machines extremely industrious, time consuming and costly.

The present invention allows overcoming the problems and drawbacks of the systems known in the prior art. In particular, the present invention guarantees stability of the structure of filtering and permeable containers so that they can easily be handled in packaging and/or filling machines even when these machines operate at very high rates. Moreover, the present invention provides containers which are easily employed in automatic machines both for domestic and industrial use.

SUMMARY

The present invention relates to filtering and permeable containers for substances suitable for the preparation of beverages, such as water-soluble substances or coffee, tea, herbal tea or the like.

The present invention is based on the idea of providing the body of the container with longitudinal stiffening ribs wherein the length of the ribs is variable along the surface of the body. The presence of ribs having different lengths on the body of the container allows the optimization of the stability of the container. The modulation of the length of the ribs along the surface of the container allows improving the stability and rigidity of the system.

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According to an embodiment of the present invention, a filtering and permeable container for substances suitable for the preparation of beverages is provided, the container being made by means of thermoforming starting from a flat strip of permeable, filtering and thermoformable material, wherein the body of the container comprises longitudinal stiffening ribs, wherein the length of the ribs is variable along the surface of the body.

According to a further embodiment of the present invention, a container is provided, wherein long and short ribs are alternated along the surface of the body. The stability of the container is accordingly optimized by providing for example long ribs extending at least partially in the bottom region of the container alternated to short ribs extending only along the side region of the container.

According to a further embodiment of the present invention, a container is provided, wherein the depth of one or more of the ribs decreases toward the bottom of the container. In particular, since one or more of the ribs have a depth which is decreasing toward the bottom of the container, the stability and handling of the container are optimized.

According to a further embodiment of the present invention, a container is provided, wherein at least along a portion of one or more of the ribs, the width of the ribs decreases toward the bottom of the container, so that said one or more of the ribs have a pointed shape. In this way the stability of the container is further optimized. In particular, the side portion of the body is stiffened by the presence of the stiffening ribs and the bottom portion is minimally altered by the presence of those ribs having a pointed shape pointing toward the bottom of the container.

According to a further embodiment of the present invention, a container is provided, wherein the stiffening ribs increase the filtering surface of the body.

According to a further embodiment of the present invention, a container is provided, further comprising an upper annular rim adapted to stiffen the structure of the body.

According to a further embodiment of the present invention, a container is provided, wherein the rim is substantially flat and has a thickness substantially corresponding to the thickness of the flat strip.

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According to a further embodiment of the present invention, a container is provided, wherein the container is sealed by means of a filtering film after having been filled with a substance suitable for the preparation of beverages.

According to a further embodiment of the present invention, a container is provided, wherein the container is hermetically contained into a hermetic and impermeable capsule so as to guarantee the preservation of the organoleptic properties of the substances contained in the container.

According to a further embodiment of the present invention, a container is provided, wherein the container is adapted to be employed in automatic espresso machines. In particular, the container can be adapted to be employed for example for automatic domestic espresso machines or for industrial espresso machines.

According to a further embodiment of the present invention, a container is provided, wherein the container is adapted to be employed in moka pots. For example, the total height of the container can be adapted to insert the container in the basket of existing moka pots.

According to a further embodiment of the present invention, a container is provided, wherein the container further comprises a suspension wire comprising a label so that the container can be introduced into a pot containing boiling water, such as a tea pot or the like.

According to a further embodiment of the present invention, a container is provided, wherein the container further comprises a suspension tab, the suspension tab being adapted to support writings, signs or the like.

According to a further embodiment of the present invention, a method for the production of a filtering and permeable container for substances suitable for the preparation of beverages is provided, the container being made by means of thermoforming starting from a flat strip of permeable, filtering and thermoformable material, the method comprising the step of the formation of longitudinal stiffening ribs on the body of the container, wherein the length of the ribs is variable along the surface of the body.

According to a further embodiment of the present invention, a method for the production of a filtering and permeable container for substances suitable for the preparation of beverages is provided, wherein the formation of the body of the container is performed

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by means of a thermoforming punch and a matrix, the thermoforming punch comprising longitudinal ribs on its outer surface adapted to shape the longitudinal stiffening ribs of the body of the container, the matrix being adapted to house the thermoforming punch so as to form simultaneously the body and the stiffening ribs starting from the flat strip.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described with reference to the enclosed drawings wherein the same reference numbers refer to the same and/or similar parts of the system. In the drawings:

Figure 1 schematically displays the starting phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 2 schematically displays an operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 3 schematically displays a further operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 4 schematically displays a further operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 5 schematically displays a further operative phase of the process for the formation of a container according to an embodiment of the present invention wherein the formed container is cut from the strip of permeable, filtering and thermoformable material;

Figure 6 schematically displays a 3D view of the inner region of the container according to an embodiment of the present invention;

Figure 6bis schematically displays a 3D view of the outer region of the container shown in figure 6;

Figure 7 schematically displays a 3D view of the container according to an embodiment of the present invention filled with a substance suitable for the preparation of beverages;

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Figure 8 schematically displays a 3D view of the container shown in figure 7 sealed by means of a filtering film;

Figure 9 schematically displays a 3D view of the upper region of a container according to an embodiment of the present invention adapted to be employed in a moka pot and sealed by means of a filtering film;

Figure 10 schematically displays a 3D view of the bottom region of the container shown in figure 9;

Figure 11 schematically displays a 3D cut of the bottom region of the container shown in figures 9 and 10;

Figure 12 schematically displays a 3D exploded view of a moka pot employing a container according to an embodiment of the present invention;

Figure 13 schematically displays a vertical cross section of a moka pot employing a container according to an embodiment of the present invention;

Figure 14 schematically displays a 3D view of a hermetic and impermeable capsule containing the container according to an embodiment of the present invention;

Figure 15 schematically displays a 3D view of a cut of the hermetic and impermeable capsule shown in figure 14;

Figure 16 schematically displays a container comprising a suspension wire according to an embodiment of the present invention;

Figure 17 schematically displays a container comprising a suspension tab according to an embodiment of the present invention.

DETAILED DESCRIPTION

In the following, the present invention is described with reference to particular embodiments as shown in the enclosed drawings. Nevertheless, the present invention is not limited to the particular embodiments described in the following detailed description and shown in the figures, but, instead, the embodiments described simply exemplify several aspects of the present invention, the scope of which is defined by the appended claims.

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Further modifications and variations of the present invention will be clear for the person skilled in the art. Therefore, the present description has to be considered as including all the modifications and/or variations of the present invention, the scope of which is defined by the appended claims.

Figure 1 schematically displays the starting phase of the thermoforming process for the formation of a container according to an embodiment of the present invention. The figure displays a reel R of permeable, filtering and thermoformable material. A flat strip 1 of this material is unwound from the roll R. The system for forming the container comprises a thermoforming punch T, a stabilizing ring A and a matrix M.

The outer surface of the apex portion of the punch T comprises ribs adapted to form ribs in the body of the container as described in detail below. The matrix M is adapted to house the punch T. In particular, as can be seen in figure 1, the matrix M comprises an inner cavity with a lateral surface provided with grooves adapted to engage the ribs of the apex portion of the punch T.

As can be seen in figure 2, the stabilizing ring A is employed to press the strip 1 against the upper portion of the matrix M. Accordingly, by means of the stabilizing ring A, the strip 1 is safely kept in place for the formation of the container.

In figure 3, the punch T is lowered through the ring A into the matrix M so as to insert a portion of the strip 1 into the matrix M. The action of the thermoforming punch T in cooperation with the matrix M allows the formation of the body 2 of the container. In other words, both the bottom and the side portion of the container are simultaneously formed in this step. Moreover, since the punch T is provided with ribs and the matrix M is provided with corresponding grooves adapted to engage the ribs of the punch T, the body 2 is formed with stiffening ribs 4 with the optimized stiffening structure as described below. In particular, the body 2 and the stiffening ribs 4 are formed simultaneously.

Figure 4 displays the situation of the system when the punch T and the ring A are lifted. As can be seen, the body 2 of the container is formed with stiffening ribs 4 due to the combined action of the matrix M and of the punch T. Moreover, the region of the strip 1 located below the stabilizing ring A is not deformed. In particular, the portion of the strip 1 located below the stabilizing ring A is substantially flat and has substantially the same thickness as the strip 1.

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Figure 5 schematically displays a further operative phase of the process for the formation of the container wherein the formed body 2 is cut from the strip 1 of permeable, filtering and thermoformable material. In particular, a cutting tool is employed to detach the formed body 2 from the strip 1. By means of the cutting tool, in particular by properly choosing the diameter of the cutting tool or by selecting an appropriate line of cutting, the container is provided with an upper annular rim 3. Since the upper annular rim 3 corresponds to the region of the strip below the stabilizing ring A, the annular rim 3 is substantially flat and has a thickness substantially corresponding to the thickness of the strip 1.

Figures 6 and 6bis schematically display 3D views of the container according to an embodiment of the present invention. The container is provided with longitudinal stiffening ribs 4, and the length L of the stiffening ribs 4 is variable along the surface of the body 2 of the container. In particular, long and short ribs are alternated along the surface of the body 2. The long ribs extends toward the bottom region 5 of the container. In particular, the long ribs occupy a portion of the bottom region 5 of the container. The container has a cup-shaped bottom region 5. The long stiffening ribs occupy, therefore, a portion of the cup-shaped bottom region 5. Each short rib is placed between two long ribs and extends along the lateral region of the container. Accordingly, the stabilization of the structure is optimized and, at the same time, the filtering surface of the container is increased.

Further, as can be seen in figures 6 and 6bis, both the long and short stiffening ribs 4 have a depth which decreases toward the bottom of the container. In particular, the ribs 4 have maximum depth in correspondence to the upper annular rim 3 and minimum depth at their opposed end, i.e. toward the bottom region 5 of the container. This allows improving the stability of the container and, at the same time, increasing the filtering surface of the system. The varying depth of the ribs 4 allows to integrate them in the structure of the container so as to penetrate even in the bottom region of the container. In particular, since toward the bottom of the container the depth of the ribs 4 is minimal, the bottom region can be easily provided with the ribs 4.

Moreover, as can be seen in figures 6 and 6bis, the width of the ribs decreases toward the bottom 5 of the container so that the ribs 4 have a pointed shape. In particular, the pointed end of the ribs 4 points toward the bottom region 5 of the container. This allows inserting a large number of stiffening ribs 4 even if the container is cup-shaped as

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shown in figures 6 and 6bis. In particular, even the narrow bottom region 5 of the cup shaped container can be provided with ribs 4 because the width of the ribs 4 is reduced in this region with respect to the width of the ribs 4 in their upper portion.

As can be further seen in figures 6 and 6bis, the container is provided with an upper annular rim 3 adapted to further stiffen the structure of the body of the container. The annular rim 3 is substantially flat and has substantially the same thickness as the flat strip 1 of permeable, filtering and thermoformable material.

The annular rim 3 and the stiffening ribs 4 guarantee the rigidity of the body 2 of the container so that it can be easily and quickly handled even at very high automated filling and/or production speeds.

Figure 7 schematically displays a 3D view of the container according to an embodiment of the present invention filled with a substance suitable for the preparation of beverages. The substance can be suitable for the preparation of hot or cold beverages. Examples of such substances are water-soluble substances such as milk powder or tea powder for ice tea. Further examples of such substances are infusion substances such as tea or herbal tea. Further examples of such substances are granular substances such as ground coffee or the like.

Figure 8 schematically displays a 3D view of the container shown in figure 7 sealed by means of a filtering film 1'. The filtering film 1' is permeable. Moreover, the filtering film 1' is sealed to the upper annular rim 3 of the container.

Figure 9 schematically displays a 3D view of the upper region of a container 2A according to an embodiment of the present invention adapted to be employed in a moka pot and sealed by means of a filtering film. Figure 10 schematically displays a 3D view of the bottom region of the container 2A shown in figure 9. Figure 11 schematically displays a 3D cut of the bottom region of the container shown in figure 9.

The height of the container shown in figures 9, 10 and 11 is lower than the height of the container shown in figures 6 and 6bis. In particular, the height of the container shown in figures 9, 10 and 11 is adapted to employ the container in the basket of existing moka pots.

As can be seen in figure 10, the alternate length of the stiffening ribs 4 is particularly advantageous in the present case. In particular, in the present case, the container 2A

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has substantially a cylindrical shape with a substantially flat bottom. The short ribs run only along the side wall of the container 2A. In particular, the short ribs run along the entire height of the side wall of the container 2A. The long ribs extend beyond the side wall of the container 2A in the bottom portion of same so as to meet substantially at the centre of the bottom portion of the container 2A. In particular, the pointed endings of the long ribs point toward the centre of the bottom portion of the container 2A. Moreover, the depth of the long ribs decreases toward the centre of the bottom 5 of the container 2A so as to maintain the stability of the central portion. The short ribs have substantially constant depth along their entire length. Moreover, the short ribs have substantially constant width along their entire length and do not exhibit pointed endings.

Figure 12 schematically displays a 3D exploded view of a moka pot employing a container 2A according to an embodiment of the present invention, and figure 13 schematically displays a vertical cross section of the system. As can be seen in the figures, the container 2A is fitted into the basket of the moka pot. Moreover, the moka pot is a traditional existing moka pot, and no modifications are necessary for employing the container 2A according to an embodiment of the present invention.

Figure 14 schematically displays a 3D view of a hermetic and impermeable capsule 10 containing the container according to an embodiment of the present invention. Figure 15 schematically displays a 3D view of a cut of the system shown in figure 14. The container is hermetically contained into the hermetic and impermeable capsule 10 so as to guarantee the preservation of the organoleptic properties of the substances 6 contained in the container.

Figure 16 schematically displays a container 2 comprising a suspension wire 7 according to an embodiment of the present invention. The suspension wire 7 is provided with a label 8. Accordingly, the container according to this embodiment of the present invention can be employed in a similar way to common tea bags. In particular, the container 2 can be easily inserted into pots containing boiling water, such as tea pots or the like. According to the present invention, also the container 2A having reduced height and substantially cylindrical shape can be provided with a suspension wire.

Figure 17 schematically displays a container 2 comprising a suspension tab 9 according to an embodiment of the present invention. The suspension tab 9 is adapted to support

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writings, signs or the like. The suspension tab 9 is formed as an extension of the filtering film 1' sealing the container 2. According to the present invention, also the container 2A having reduced height and substantially cylindrical shape can be provided with a suspension tab.

While the invention has been described with respect to the preferred physical embodiments constructed in accordance therewith, it will be apparent to those skilled in the art that various modifications, variations and improvements of the present invention may be made in the light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

For instance, several kinds of materials can be employed for realizing the containers according to the present invention. Moreover, the containers according to the present invention can have several dimensions. For example, the containers can be adapted to be employed for domestic machines such as moka pots or automatic espresso machines. Alternatively, the containers can be adapted to be employed for industrial machines.

In addition, those areas in which it is believed that those of ordinary skill in the art are familiar have not been described herein in order not to unnecessarily obscure the invention described. Accordingly, it has to be understood that the invention is not to be limited by the specific illustrative embodiments, but only by the scope of the appended claims.

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CLAIMS

1. Filtering and permeable container for substances (6) suitable for the preparation of beverages, said container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material,

characterized in that:

the body (2) of said container comprises longitudinal stiffening ribs (4), wherein the length of said ribs (4) is variable along the surface of said body (2).

2. Container according to claim 1, wherein long and short ribs (4) are alternated along the surface of said body (2).

3. Container according to one of claims 1 or 2, wherein the depth of one or more of said ribs (4) decreases toward the bottom (5) of said container.

4. Container according to one of claims 1 to 3, wherein at least along a portion of one or more of said ribs (4), the width of said ribs (4) decreases toward the bottom (5) of said container, so that said one or more of said ribs (4) have a pointed shape.

5. Container according to one of claims 1 to 4, wherein said stiffening ribs (4) increase the filtering surface of said body (2).

6. Container according to one of claims 1 to 5, further comprising an upper annular rim (3) adapted to stiffen the structure of said body (2).

7. Container according to claim 6, wherein said rim (3) is substantially flat and has a thickness substantially corresponding to the thickness of said flat strip (1).

8. Container according to one of claims 1 to 7, wherein said container is sealed by means of a filtering film (1') after having been filled with a substance (6) suitable for the preparation of beverages.

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9. Container according to one of claims 1 to 8, wherein said container is hermetically contained into a hermetic and impermeable capsule (10) so as to guarantee the preservation of the organoleptic properties of the substances (6) contained in said container.

10. Container according to one of claims 1 to 9, wherein said container is adapted to be employed in automatic espresso machines.

11. Container according to one of claims 1 to 10, wherein said container is adapted to be employed in moka pots.

12. Container according to one of claims 1 to 11, wherein said container further comprises a suspension wire (7) comprising a label (8) so that said container can be introduced into a pot containing boiling water, such as a tea pot or the like.

13. Container according to one of claims 1 to 11, wherein said container further comprises a suspension tab (9), said suspension tab (9) being adapted to support writings, signs or the like.

14. Method for the production of a filtering and permeable container for substances (6) suitable for the preparation of beverages, said container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material, said method comprising the following steps:

formation of longitudinal stiffening ribs (4) on the body (2) of said container, wherein the length of said ribs (4) is variable along the surface of said body (2).

15. Method according to claim 14, wherein the formation of the body (2) of said container is performed by means of a thermoforming punch (T) and a matrix (M), said thermoforming punch (T) comprising longitudinal ribs on its outer surface adapted to shape said longitudinal stiffening ribs (4), said matrix (M) being adapted to house said thermoforming punch (T) so as to form simultaneously said body (2) and said stiffening ribs (4) starting from said flat strip (1).

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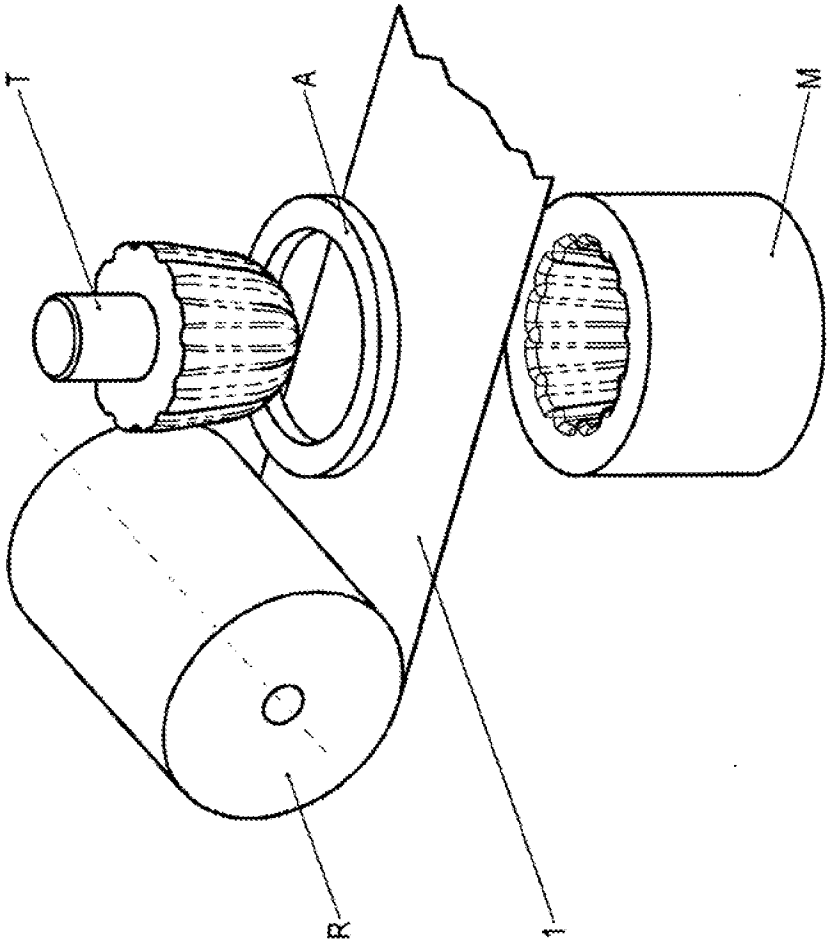


FIG. 1

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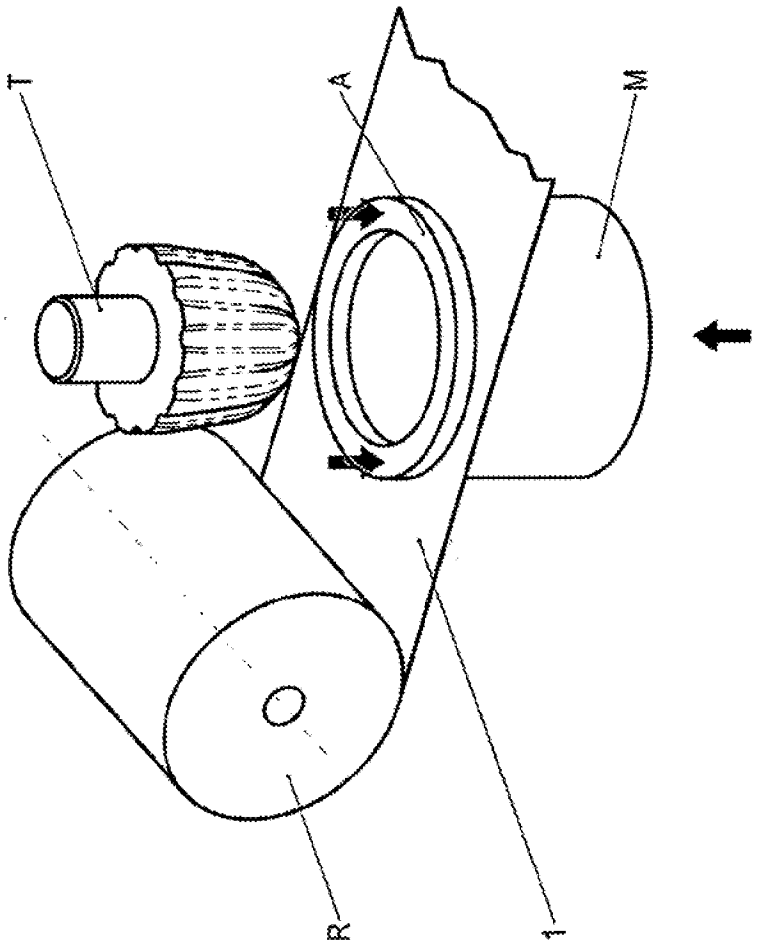


FIG. 2

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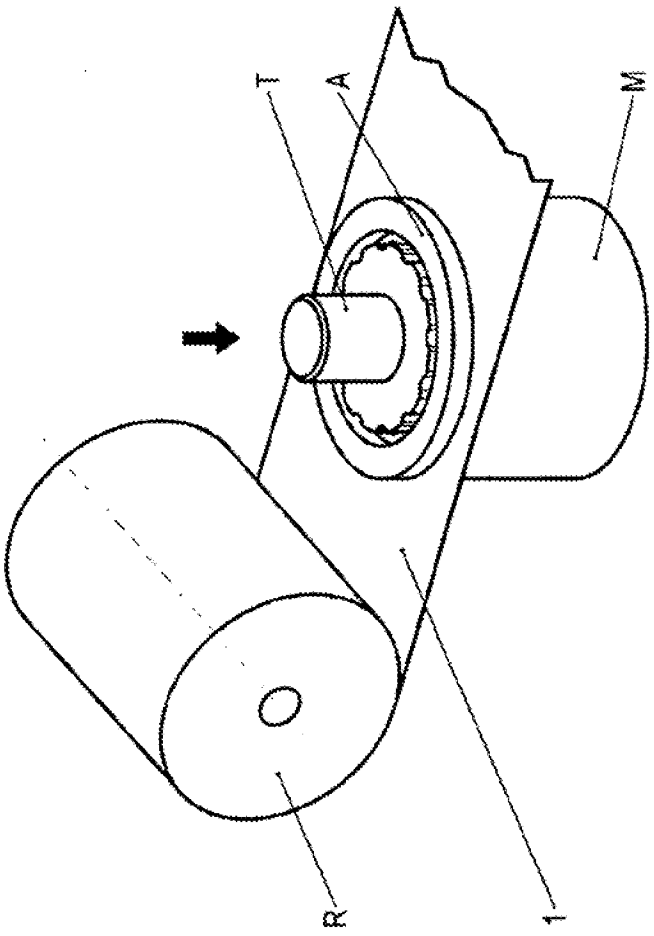


FIG. 3

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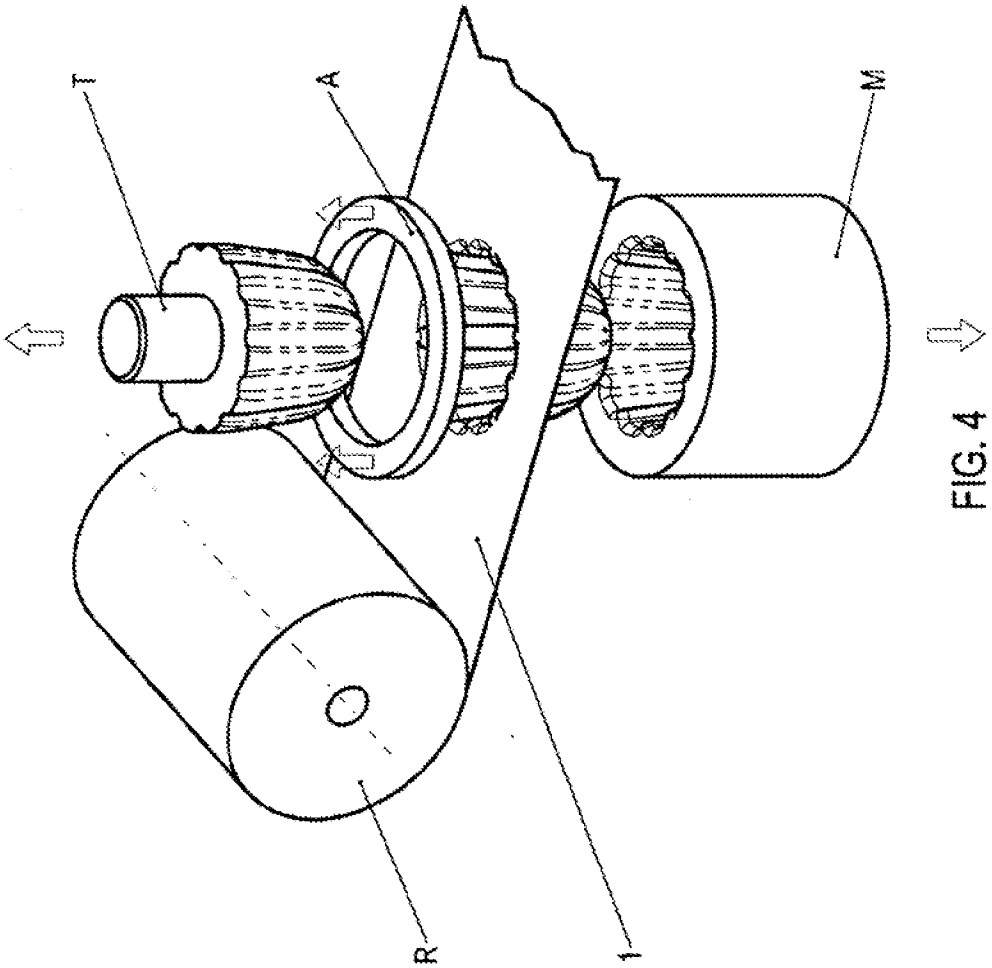


FIG. 4

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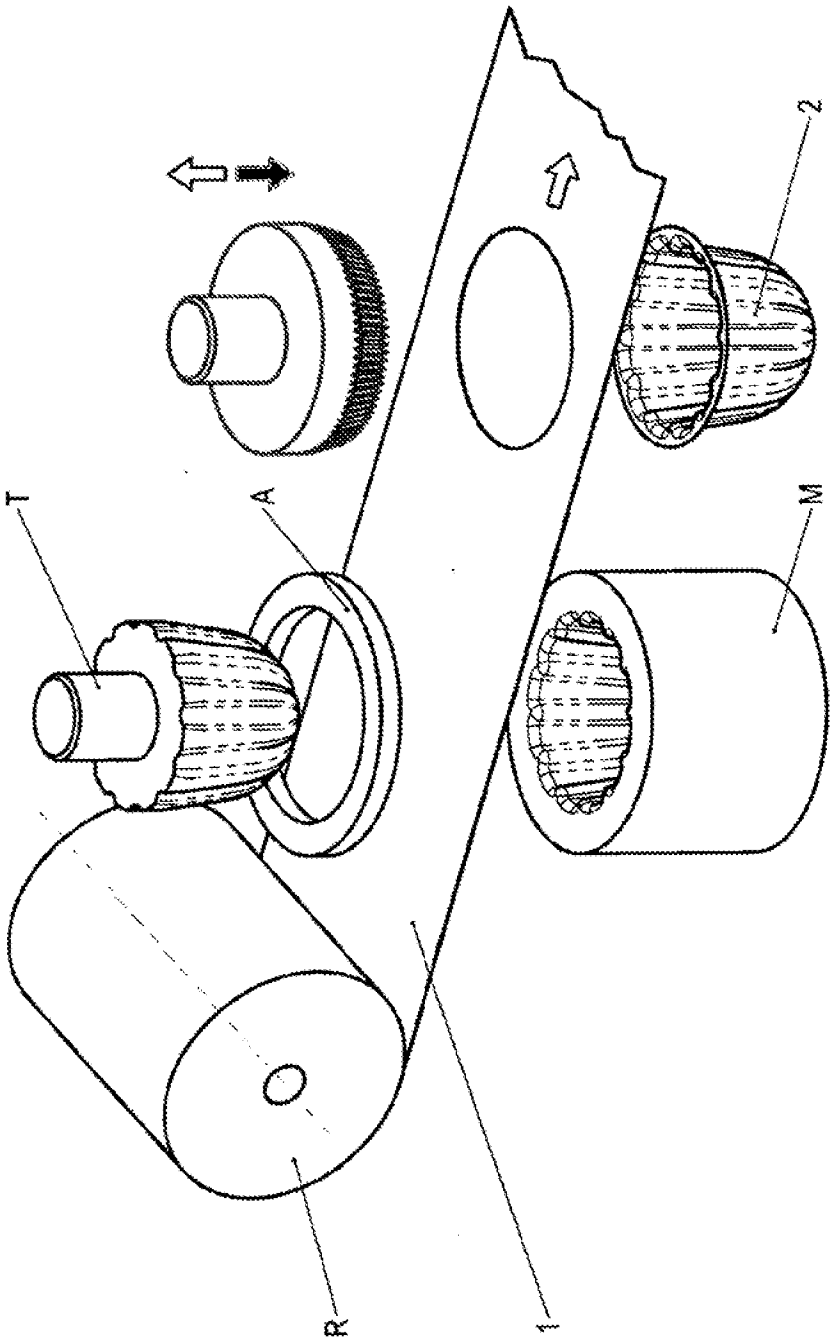


FIG. 5

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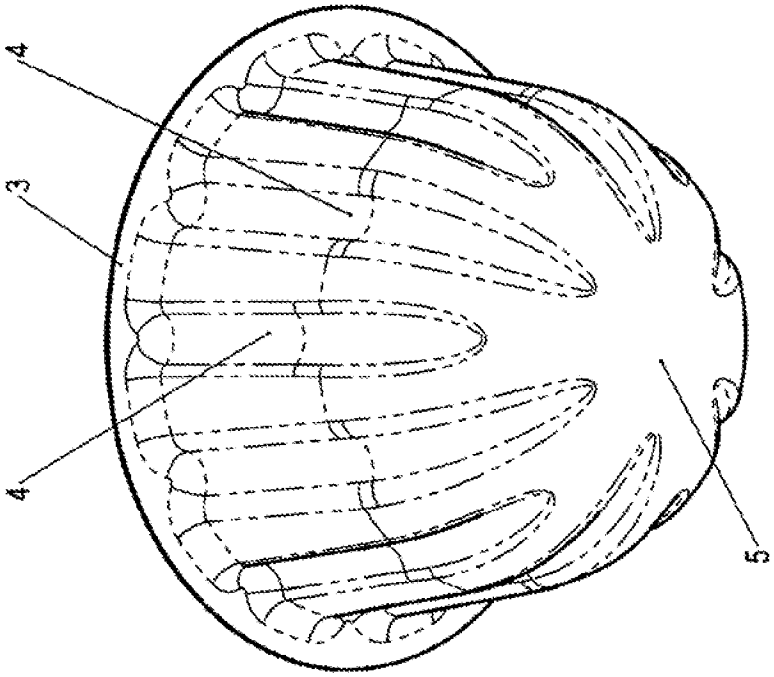


FIG. 6 bis

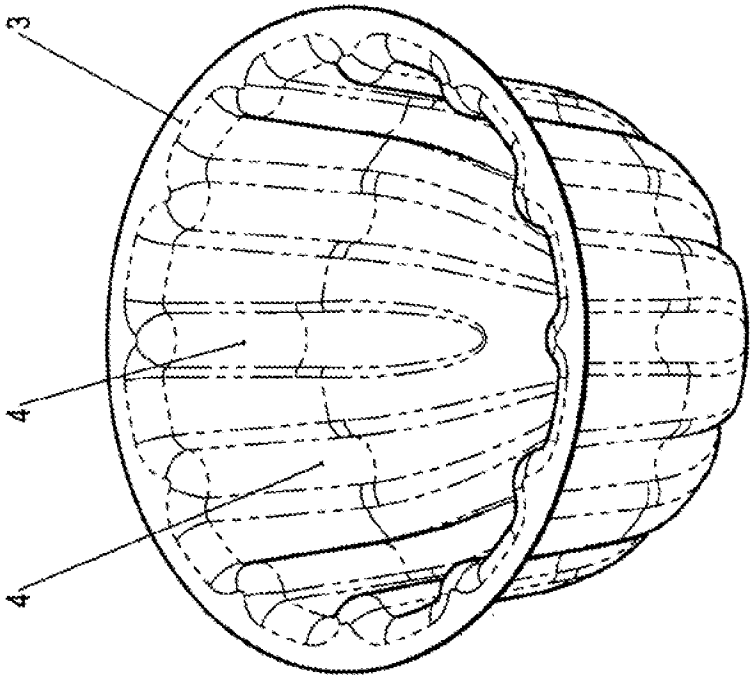


FIG. 6

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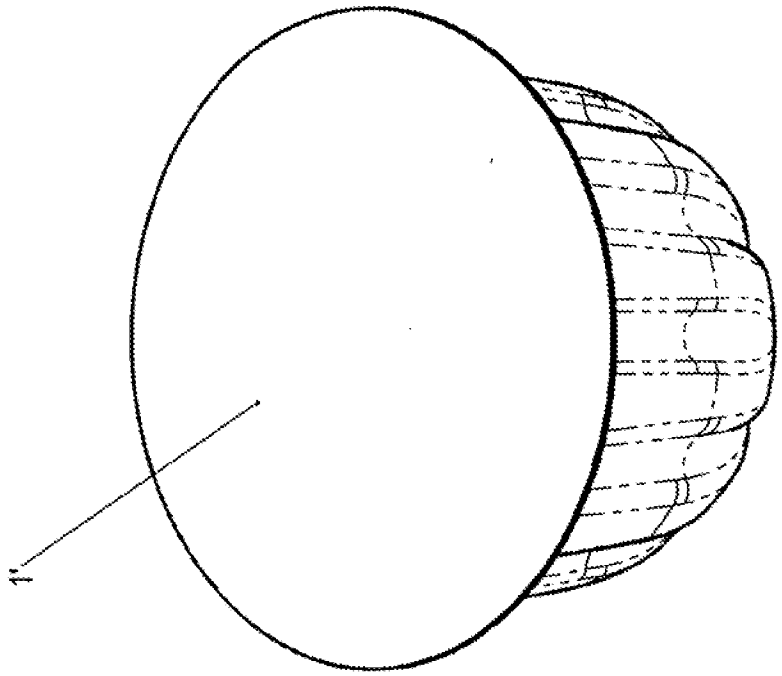


FIG. 8

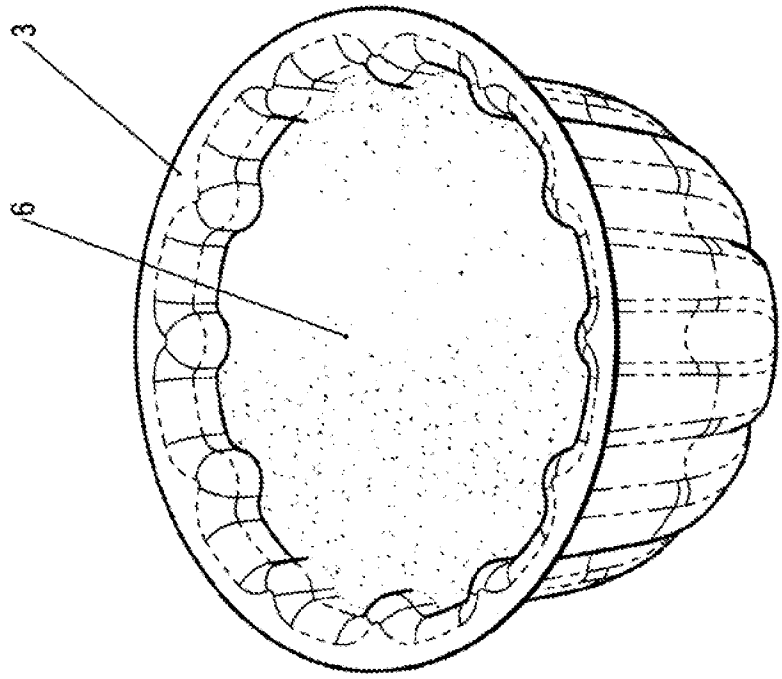


FIG. 7

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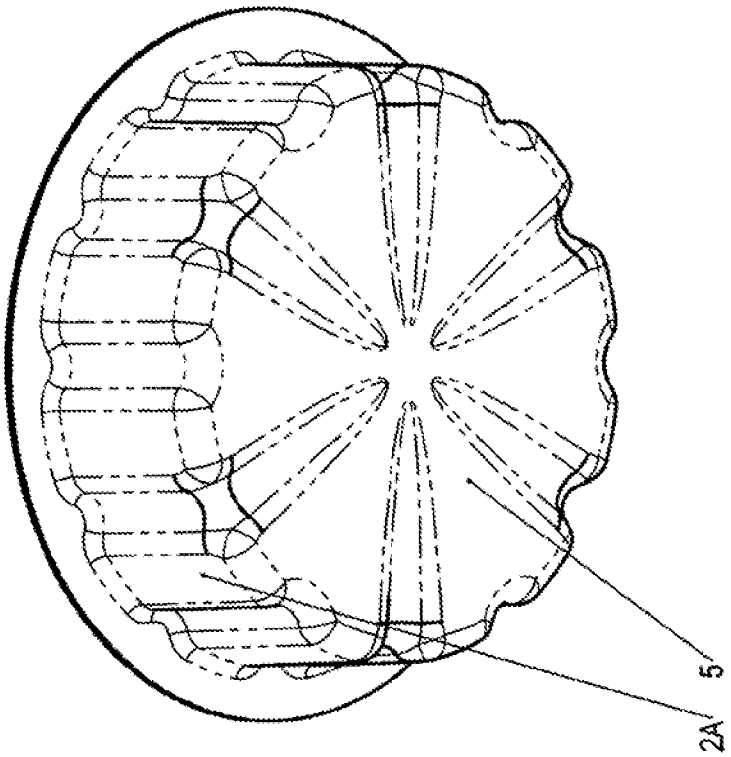


FIG. 10

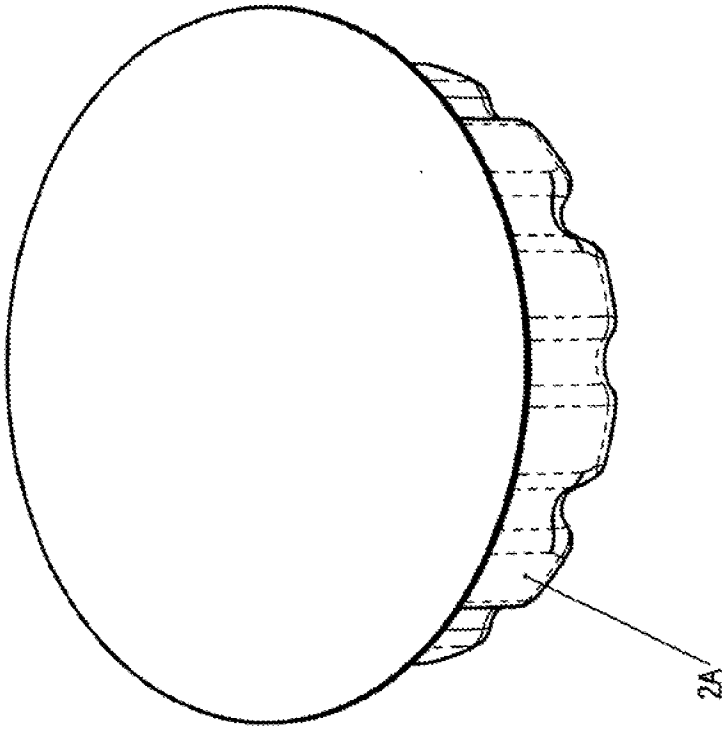


FIG. 9

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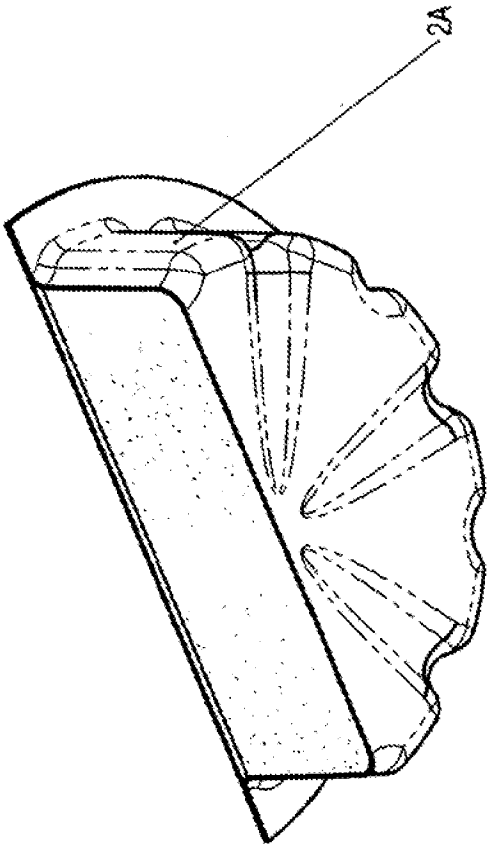
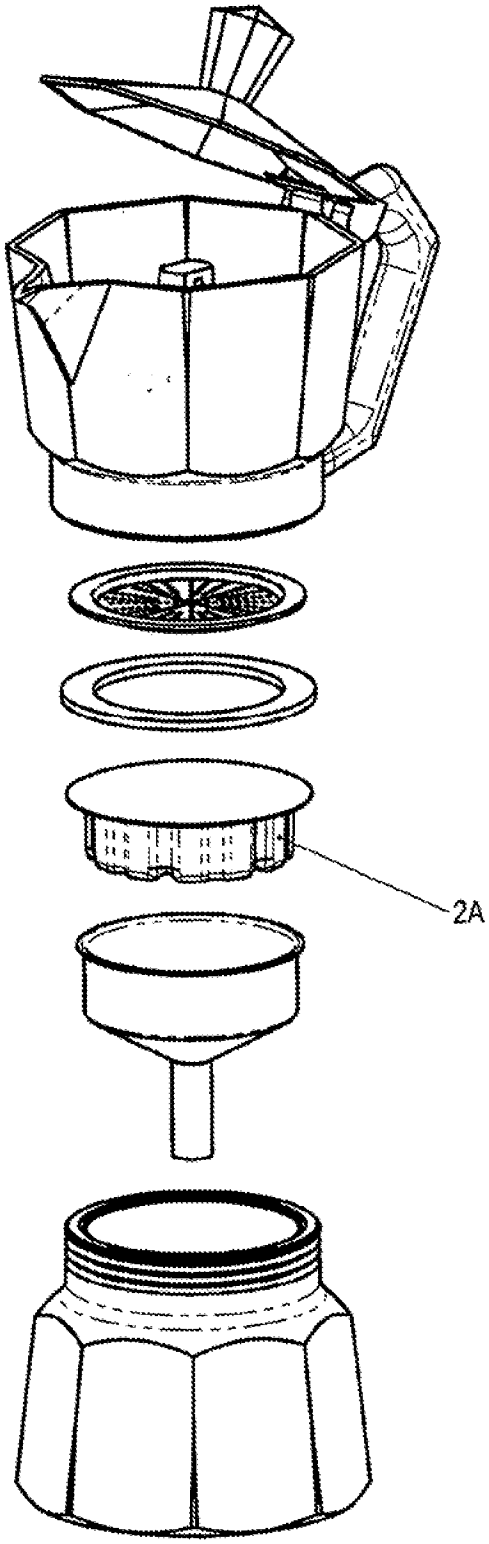


FIG. 11

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FIG. 12



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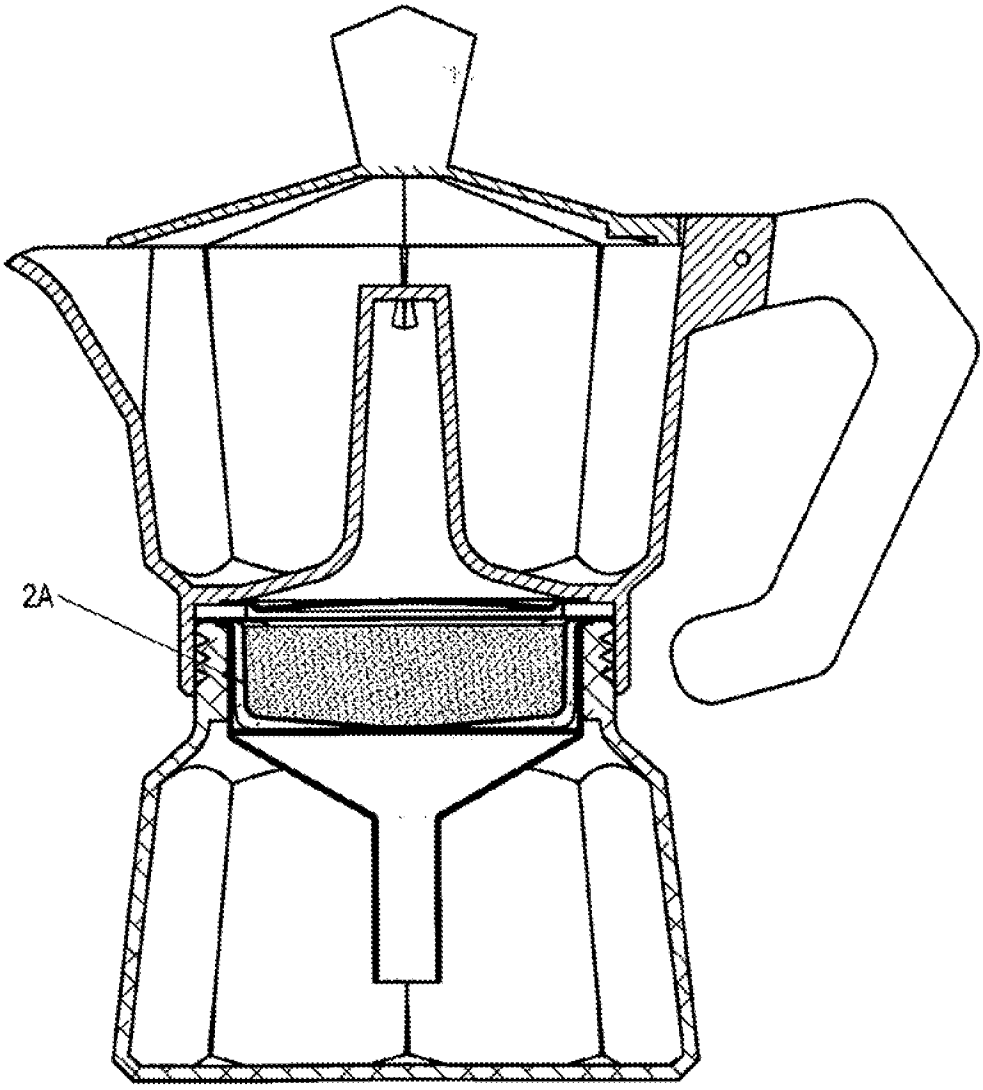


FIG. 13

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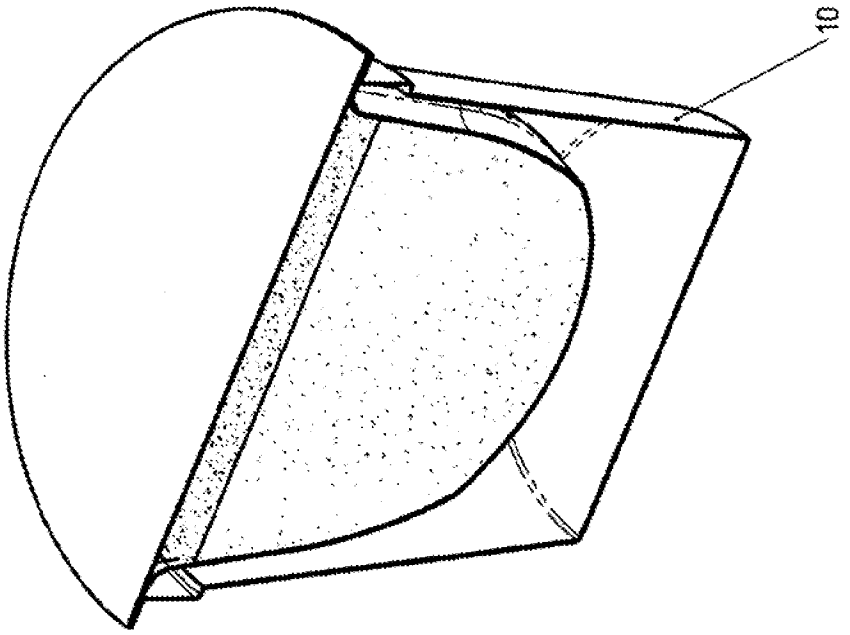


FIG. 15

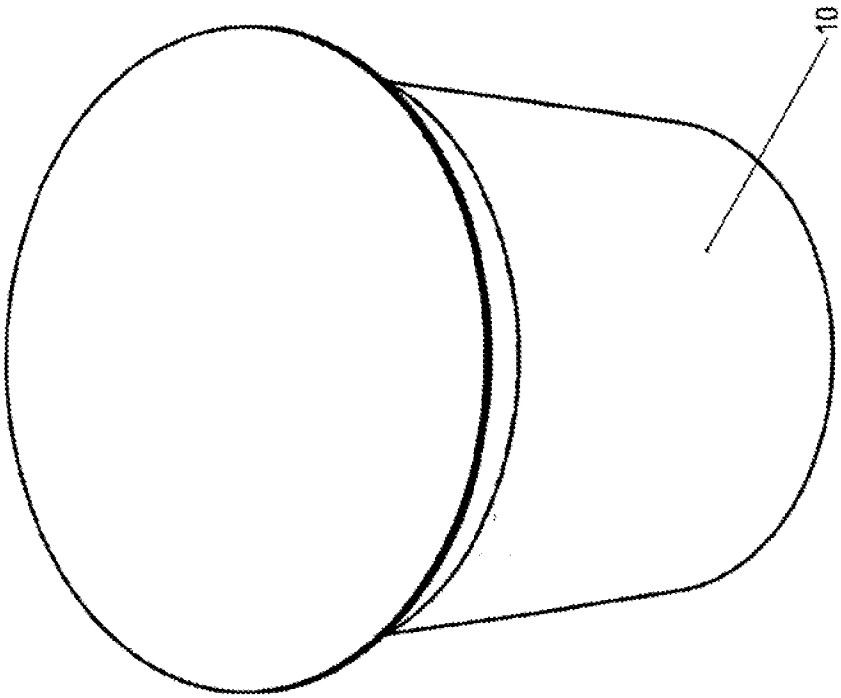


FIG. 14

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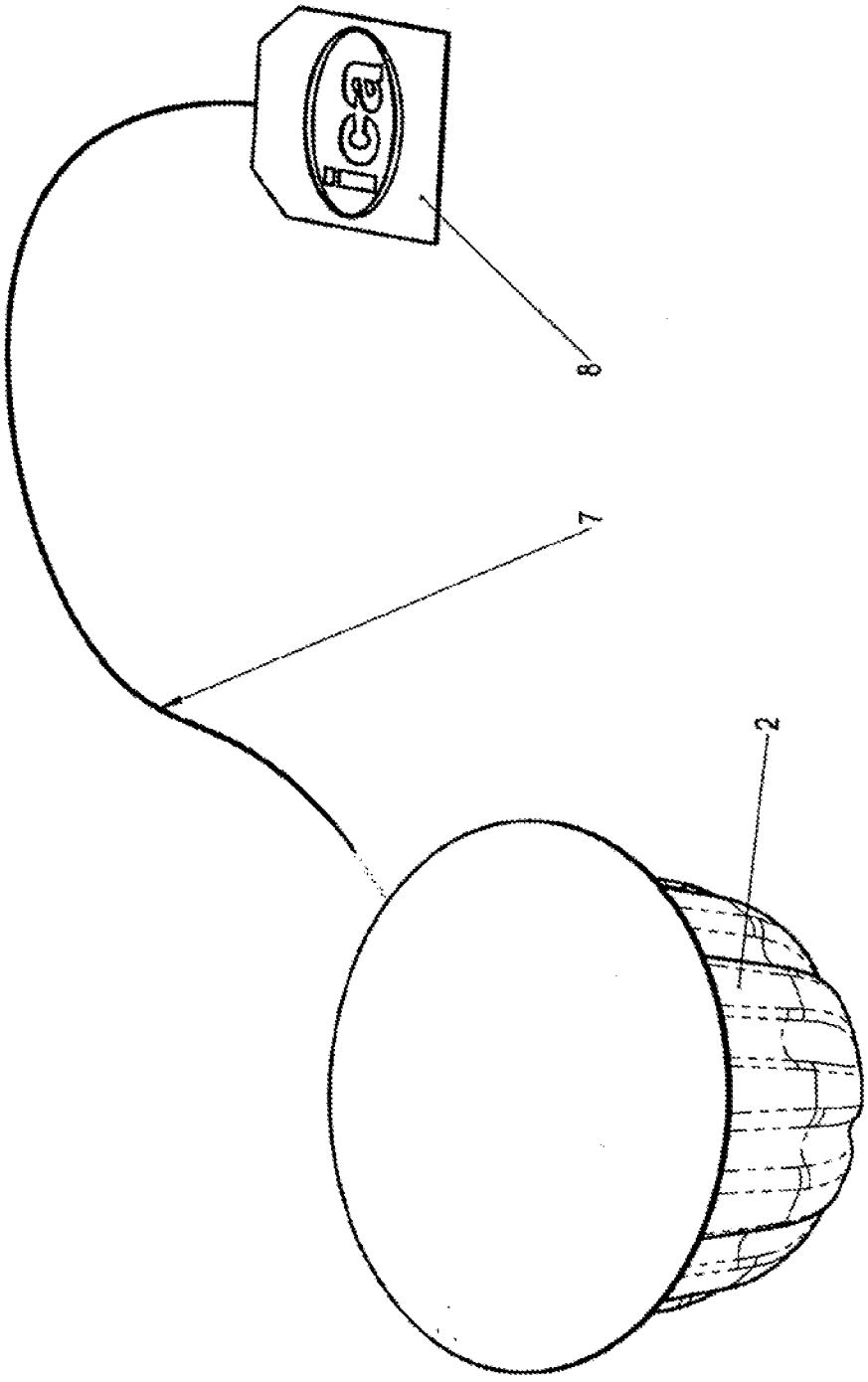


FIG. 16

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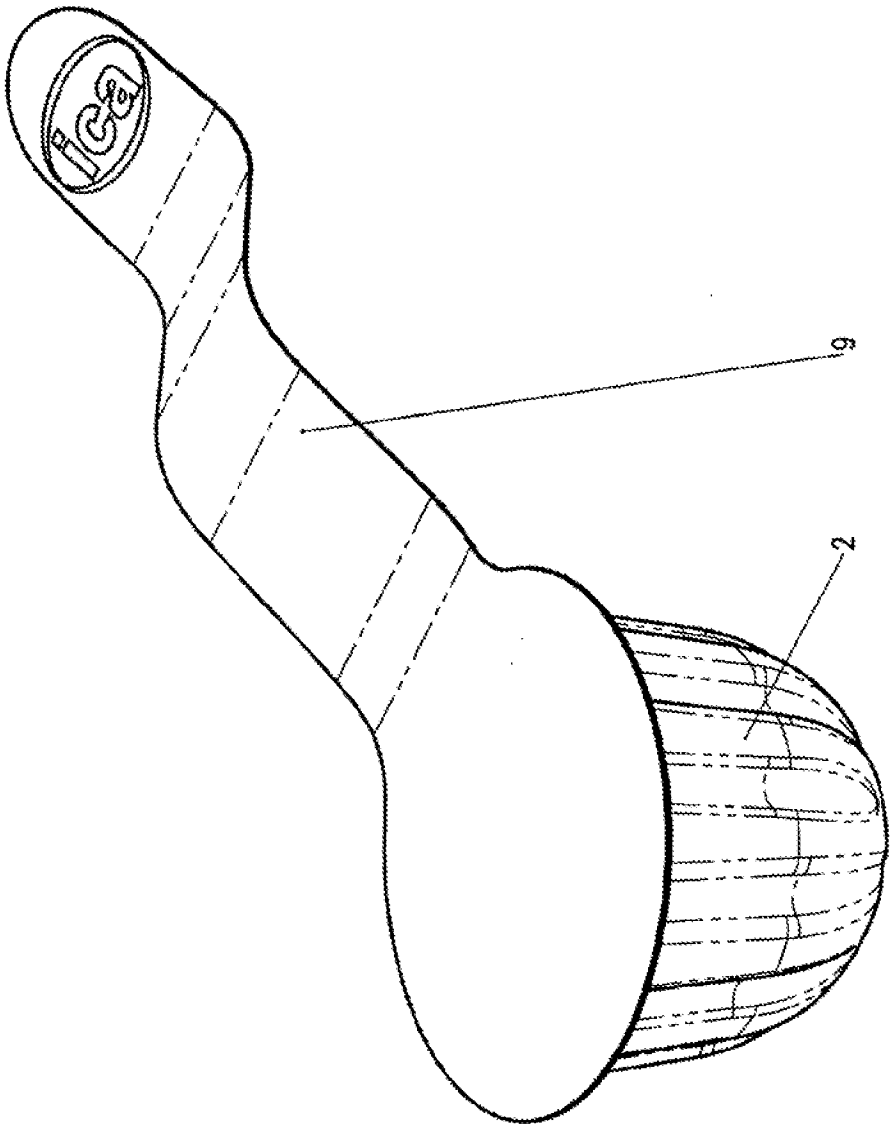


FIG. 17

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/006389

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804 B65D85/808 B65D85/812
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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 521 186 A1 (NESTLE SA [CH]) 7 January 1993 (1993-01-07) column 2, line 20 - line 31 column 3, line 7 - column 4, line 51 column 5, line 11 - line 18; claim 1; figures	1,8,10, 11,14,15
A	EP 0 631 948 A1 (JACOBS SUCHARD AG [CH]) 4 January 1995 (1995-01-04) column 5, line 16 - column 7, line 31; figures	15
A	US 2005/051478 A1 (KARANIKOS BASIL [US] ET AL) 10 March 2005 (2005-03-10) page 1, paragraph 17 - page 2, paragraph 22; figures 1-4	1,3-5, 10,14

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 December 2010	28/12/2010

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	Newell, Philip

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 253 246 A2 (WOLTERMANN ERICH H) 20 January 1988 (1988-01-20) column 3, line 46 - column 4, line 8; figures	1,6,7,9, 10
A	GB 881 784 A (JOHN HENRIK GUY WELIN BERGER) 8 November 1961 (1961-11-08) page 1, line 67 - page 2, line 15; figures	12
A	EP 0 158 511 A2 (GEN FOODS LTD [GB]) 16 October 1985 (1985-10-16) page 2, line 13 - line 25 claims 1,3-9,16; figures	13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/006389

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0521186 A1	07-01-1993	AT 114576 T	15-12-1994
		AU 658192 B2	06-04-1995
		BR 9202611 A	16-03-1993
		CA 2072317 A1	06-01-1993
		DE 69105494 D1	12-01-1995
		DK 0521186 T3	18-04-1995
		ES 2065583 T3	16-02-1995
		FI 922893 A	06-01-1993
		GR 3015003 T3	31-05-1995
		JP 3244777 B2	07-01-2002
		JP 5261023 A	12-10-1993
		NO 922613 A	06-01-1993
		NZ 243240 A	27-06-1994
		PH 31487 A	03-11-1998
		US 5637335 A	10-06-1997
		ZA 9204488 A	31-03-1993
EP 0631948 A1	04-01-1995	CA 2124600 A1	31-12-1994
US 2005051478 A1	10-03-2005	AU 2004272517 A1	24-03-2005
		CA 2538256 A1	24-03-2005
		CN 1849249 A	18-10-2006
		EP 1663813 A1	07-06-2006
		JP 2007504889 T	08-03-2007
		KR 20060121863 A	29-11-2006
		NZ 545752 A	31-01-2009
		WO 2005026018 A1	24-03-2005
EP 0253246 A2	20-01-1988	AU 7568887 A	21-01-1988
		DE 3623952 A1	28-01-1988
		US 4859337 A	22-08-1989
GB 881784 A	08-11-1961	NONE	
EP 0158511 A2	16-10-1985	GB 2156664 A	16-10-1985
		JP 5049552 B	26-07-1993
		JP 60251054 A	11-12-1985

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Nespresso USA, Inc. Ex. 1002 Part 3
Page 285 of 429

Electronic Patent Application Fee Transmittal

Application Number:	16438818
Filing Date:	12-Jun-2019
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc Krüger
Filer:	Paul J. Palinski/BECKY BALLARD
Attorney Docket Number:	1859.029USC4

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	40121004
Application Number:	16438818
International Application Number:	
Confirmation Number:	8813
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc Krüger
Customer Number:	25215
Filer:	Paul J. Palinski/BECKY BALLARD
Filer Authorized By:	Paul J. Palinski
Attorney Docket Number:	1859.029USC4
Receipt Date:	28-JUL-2020
Filing Date:	12-JUN-2019
Time Stamp:	13:32:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	E20207RD33315163
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_1859_029USC4_KRU0022_WO_US_T4.pdf	371913 bd366afbcd41c2fd556f0f03e4402d9204af1854	yes	15

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Specification	2	2
Claims	3	7
Drawings-only black and white line drawings	8	8
Applicant Arguments/Remarks Made in an Amendment	9	15

Warnings:

Information:

2	Drawings-only black and white line drawings	ReplacementDrawings_1859_029USC4_KRU0022_WO_US_T4.pdf	1471350 faaf6d0b838f86c4ab1d0ea1e6bace8efb5b7aad	no	12

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3	Specification	SubstituteSpecification_CleanCopy_1859_029USC4_KRU0022_WO_US_T4.pdf	221385 0b3cac73cedd44556db3438afd68cfd1d31f2e04	no	27

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4	Specification	SubstituteSpecification_MarkedUp_1859_029USC4_KRU0022_WO_US_T4.pdf	5222590 87212d7bb356a68e94feb9cf3acad91eaa9cd9d6	no	27

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5	Information Disclosure Statement (IDS) Form (SB08)	SupplementalIDS_1859_029USC4_KRU0022_WO_US_T4.pdf	1038057 4374bb833f42c761b32b21ef80049e0a4ee3b763	no	5
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6	Foreign Reference	DE3432339A1.pdf	4981859 36bcaab03f9e3655df26d4746165a59dec7a6a36	no	20
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7	Foreign Reference	KR100481892.pdf	2437888 df7a1844b7f8c227e2ef74ab7b7443826282f127	no	8
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11	Foreign Reference	WO2010076048A1.pdf	9349980 41ac637595edbd352053c3a6daf305f7741afeda	no	70
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13	Non Patent Literature	1_NoticeOfOpposition_191652239_20200224.pdf	12347220 b8f452a80f72842b6c6e9b4d8d1584b06be27b63	no	138
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14	Non Patent Literature	2_NoticeOfOpposition_191652239_20200219.pdf	4342471 64d3217513e6c95b8ed7681925bdee374158fb0d	no	74
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15	Non Patent Literature	3_OppositionAgainstEuropeanApplication_191652239.pdf	186086 1bdf9a10f47f13c49684ddc258c550ea1edd2ac3	no	7
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16	Non Patent Literature	4_CommunicationOfNoticeOfOpposition20200127.pdf	10510601 97d58f0e178e1c7f59f8652babb5cb763f4becaa	no	120
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17	Non Patent Literature	5_EnglishTranslationOf_JP2003235733A.pdf	4000809 e95d6b8acea5b819b1999fe2e912ddd40552fba4	no	7
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18	Non Patent Literature	6_WikipediaArticleDeepDrawing.pdf	1270223 60cae9131774813c91859af6d359dc15a5df475a	no	5
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19	Non Patent Literature	7_WikipediaArticleTiefziehen.pdf	1325418 b1c36ccbbe0a75fd247e5375257cb96a2c56e62d	no	4
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Information:					
22	Non Patent Literature	10_RegulationEC_1935_2004.pdf	1947701 c74f6537aee3094024d41404648b16db20b423ee	no	14
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23	Non Patent Literature	11_BriefCommunication_15197336_9.pdf	15511579 85851bc6eddd3793af56895a37da6e8154313eb7	no	259
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24	Non Patent Literature	12_Oral_LetterDated20200316.pdf	1450304 fdd228338efb7c3bfab38f9fafd9606b62a9e6b6	no	31
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25	Non Patent Literature	13_OppositionOralLetterDated20200316.pdf	2630210 87d0c5925941f0df5cfd8c7191f52ac11dcd8abb	no	43
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Information:					

26	Non Patent Literature	14_AnnexToTheCommunication_151973369.pdf	216849 19b181e9c833451a276cf1d2cbfef1a7ded45340	no	6
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27	Non Patent Literature	15_BriefCommunicationOppositionProceedings_20200108.pdf	1210885 0844fc93ef042911d6682294e8d94430533398f2	no	24
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28	Non Patent Literature	16_LetterRegardingOppositionProcedure_20191223.pdf	1186344 8df1185b20bc200818dd7705c8f22c9b4cc29a4c	no	23
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Information:					
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Warnings:					
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31	Non Patent Literature	19_Letter_EP3023362_20191010.pdf	30842 840a69b4d78f66cc02ae56fd5a7015897a8f5e73	no	2
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32	Non Patent Literature	20_BriefCommunication_151973369_20190723.pdf	776359 e356fc64a93d95feab032e1c231194f39ec79ffc	no	17
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Information:					

33	Non Patent Literature	21_Letter_EP3023362_20190717.pdf	24417 a0a7a55228c77481299723fdfea8a813247bebcc	no	1
Warnings:					
Information:					
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Information:					
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Information:					
36	Non Patent Literature	24_MiscellaneousRequest_20190612.pdf	39918 3eb40f19cdfb43b332545e9e7cc8f0c14ba65d9c	no	2
Warnings:					
Information:					
37	Non Patent Literature	25_LetterRegardingOpposition_20190320.pdf	7666390 5be2760113b0c28a50684069c39270731da32c04	no	27
Warnings:					
Information:					
38	Non Patent Literature	26_RalfJesse_Barcode_20190519.pdf	1883298 0695f03c3c681041a9b4c3cee6420d4ca43b7e59	no	9
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Information:					
39	Non Patent Literature	27_InformationTechnology_20190520.pdf	1731169 5033f476eeaf8faff67df7bc93a4abe0f187690d	no	38
Warnings:					
Information:					

40	Non Patent Literature	28_InformationTechnology_1998.pdf	575555 b0e63a679360a2df18c18167f118119684fe045a	no	20
Warnings:					
Information:					
41	Non Patent Literature	29_DeclarationUnder27_20160815.pdf	211679 dbee5a39e3f0511d6722010716388d8fca66fcfc	no	3
Warnings:					
Information:					
42	Non Patent Literature	30_Wikipedia_Binnarcode.pdf	430311 7c1b641a35adb24e19627da8a8c848cf319bc3d5	no	5
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Information:					
43	Non Patent Literature	31_RosenbaumJessie_Bar_Code.pdf	2863066 ada103aa6d54f250c0eb00a6bba5bf11641a6b66	no	12
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Information:					
45	Non Patent Literature	33_OliverRosenbaum_Das_Barcode_Lexicon.pdf	1590239 104cbc397a3c0928a254ab271feb6c84e9502c11	no	5
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Information:					
46	Non Patent Literature	34_FairleyMichael_CodesAndCoding.pdf	1319852 ae68c788f611abd5412e65c137169b29fd00c7b9	no	7
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48	Non Patent Literature	36_Claims_20190520.pdf	267293 d92001211fb0a626b8168e142c8fa8074d0c43a6	no	5
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51	Non Patent Literature	39_DefinitionOfBarcode_ByMerriam.pdf	177472 8e5da593f1a2599335b427894aaecd53eaf129ea	no	1
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52	Non Patent Literature	40_BarcodeWikitionary.pdf	235962 141d2f3e0b06f23dd21a9d4b73ca059f91cdb81a	no	2
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Information:					
53	Non Patent Literature	41_Strichcode.pdf	2856397 6229c9d3f857b4c9b4e896ce7a3e1ebd6c13aa74	no	12
Warnings:					
Information:					

54	Non Patent Literature	42_ReplyOfThePatent1519733669.pdf	286522 8ff3fee7c5e7c63bd888d579c7d8ba0e44f14be6	no	7
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Information:					
55	Non Patent Literature	43_NoticeOfOpposition_20180730.pdf	1298371 16d995ceaed9927f58b2a05f3c10e2cdb6607040	no	20
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56	Fee Worksheet (SB06)	fee-info.pdf	30536 c016c5b2411be4e642e4cda42ed80bb0f589269f	no	2
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New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/438,818	Filing Date 06/12/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/28/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/TERESA J JACKSON WOODRUFF/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	40123123
Application Number:	16438818
International Application Number:	
Confirmation Number:	8813
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc Krüger
Customer Number:	25215
Filer:	Paul J. Palinski/BECKY BALLARD
Filer Authorized By:	Paul J. Palinski
Attorney Docket Number:	1859.029USC4
Receipt Date:	29-JUL-2020
Filing Date:	12-JUN-2019
Time Stamp:	10:55:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	44_NoticeOfOpposition_20180724.pdf	93101 f159e4d105a6d3a03f6cea3a594aea06725fb1c7	no	5

Warnings:

IPR2023-00502
Nespresso USA, Inc. Ex. 1002 Part 3
Page 299 of 429

Information:	
Total Files Size (in bytes):	93101

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Filed via EFS @ USPTO.gov on September 9, 2020
Practitioner's Docket No. 1859.029USC4 (KRÜ0022-WO-US-T4)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Marc Krüger	Art Unit: 1792
Application No.: 16/438,818	Examiner: Smith, Chaim A.
Filed: June 12, 2019	Conf. No.: 8813

For: PORTION CAPSULE HAVING AN IDENTIFIER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Applicant submits this statement in accordance with its duty of disclosure under 37 C.F.R. §§ 1.56, 1.97, and 1.98. The submission made herewith is in no way intended as an admission that the cited items constitute material prior art or otherwise would render the claims unpatentable in any way. The submission also is in no way intended to substitute for the Examiner's own independent investigation.

Copies of foreign patent documents and non-patent literature, together with a listing on form PTO/SB/08a are submitted herewith. This Information Disclosure Statement is being submitted after the mailing of a first Office Action and before a Notice of Allowance. A fee of $240.00 is believed to be due; however, if any additional fee is due with the filing of this paper, please charge the amount to Deposit Account 50-1097.

Date: September 9, 2020

/Paul J. Palinski/

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Pontiac, MI 48342
(248) 292-2920

Customer No. 25215

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16/438,818
	Filing Date	June 12, 2019
	First Named Inventor	Marc Krüger
	Art Unit	1792
	Examiner Name	Smith, Chaim A.
	Attorney Docket Number	1859.029USC4 (KRÜ0022-WO-US-T4)

U.S. PATENTS					
Examiner Initials*	Cite No.	Patent Number	Kind Code	Issue Date	Name of Patentee or Applicant of cited Document
	1.	4,136,202		01/23/1979	Favre
	2.	5,402,707	A	04/04/1995	Fond et al.
	3.	5,656,318	A	08/12/1997	Fond et al.
	4.	5,897,899	A	04/27/1999	Fond

U.S. PATENT APPLICATION PUBLICATIONS					
Examiner Initials*	Cite No.	Publication Number	Kind Code	Publication Date	Name of Patentee or Applicant of cited Document
	1.	2009/0223375	A1	09/10/2009	Verbeek

FOREIGN PATENT DOCUMENTS							
Examiner Initial*	Cite No.	Foreign Document Number	Country Code	Kind Code	Publication Date	Name of Patentee or Applicant of cited Document	T[5]
	1.	0272922	EP	A2	06/29/1988	Bentley et al.	
	2.	0512468	EP	A1	11/11/1992	Fond	
	3.	1882432	EP	A1	01/30/2008	Ohresser et al.	
	4.	2469874	GB	A	11/03/2010	Hansen et al.	
	5.	2004/065258	WO	A2	08/05/2004	Gomez et al.	
	6.	2007/114685	WO	A1	10/11/2007	Verbeek	
	7.	2010/125326	WO	A1	11/04/2010	Hansen et al.	
	8.	2010/125329	WO	A1	11/04/2010	Hansen et al.	

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initial*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1.	Specification NP-C2.03-02-SP-04-2 Membrane	
	2.	Specification NP-C2.03-01-SP-01-4 empty capsule	
	3.	Marketing brochure "Nespresso Varietäten mit 5 neuen Grand Crus"	
	4.	Photo taken in Nespresso store	
	5.	Marketing brochure "i6 Grands Crus – geschaffen um Ihre Sinne zu ilberraschen"	
	6.	RTS online article	
	7.	Invoice for various Nespresso capsules, dated May 04, 2009	
	8.	Invoice for various Nespresso capsules, dated August 10, 2009	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Marc Krüger
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	9.	Invoice for various Nespresso capsules, dated December 02, 2009	
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	12.	Invoice for various Nespresso capsules, dated June 24, 2009	
	13.	Invoice for various Nespresso capsules, dated May 19, 2008	
	14.	Invoice for various Nespresso capsules, dated September 10, 2008	
	15.	Invoice for various Nespresso capsules, dated February 17, 2009	
	16.	Invoice for various Nespresso capsules, dated December 22, 2008	
	17.	User manual for the Tassimo@ brewing machine	
	18.	Web article discussing the T-discs@ cartridges	
	19.	Regulation No. 817.023.21 of the EDI on consumer goods	
	20.	Regulation No.817.022.31of the EDI on the additives permitted in foodstuffs	
	21.	Regulation of the Swiss Federal Council on Foodstuffs and Consumer Goods	
	22.	"European Printing Ink Association " Guideline on Printing Inks	
	23.	leaflet on printing inks for food packages from the division "Printing Inks" of the Association of the German Paint and Printing Ink Industry	
	24.	EuPIA Exclusion List for Printing Inks and Related Products	
	25.	EuPIA Guideline on Good Manufacturing Practices for the Production of Packaging Inks formulated for use on the non-food contact surfaces of food packaging and articles intended to come into contact with food	
	26.	Commission Regulation (EC) No 2023/2006	
	27.	Council Directive 89/109/EEC relating to materials and articles intended to come into contact with foodstuffs	
	28.	Policy Statement on Packaging Inks applied to the non-food contact surface of Food Packaging of the public health committee of the council of Europe	
	29.	Nestle Guidance Note on Packaging Inks	
	30.	Council Directive on the colouring matters authorised for use in foodstuffs intended for human consumption	
	31.	Council Directive 89/107/EEC on the approximation of the laws of the Member States concerning food additives authorized for use in foodstuffs intended for human consumption	
	32.	European Parliament and Council Directive 94/36/EC on colours for use in foodstuffs	
	33.	Excerpt from the textbook "Plastics Packaging – Properties, Processing, Applications and Regulations" by	

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		Selke/Culter/Hernandez	
	34.	"Lexikon Verpackungstechnik" by Bleisch/Goldhahn/Schricker/Vogt;	
	35.	Paper titled "Aromaveranderung von vakuumverpacktem Kaffee bei unterschiedlichen Packstoffen" by Lindner-Steinert/Zou	
	36.	Paper "Die flexible Verpackung von morgen – Anforderungen an die Veredler" by Agulla/Langowski	
	37.	Excerpt from publication "Grundziige der Lebensmitteltechnik" of 2004 by Tscheuschner	
	38.	Excerpt from publication "Produkt-bkobilanz vakuumverpackter Rostkaffee" of 1999 by Diers/Langowski/Pannkoke	
	39.	3rd Party Observations in EP Patent Application No. 19 165 220.5 (3 533 726), dated June 19, 2020.	
	40.	Opposition Against EP Patent No. EP 3 023 362 dated July 13, 2020.	

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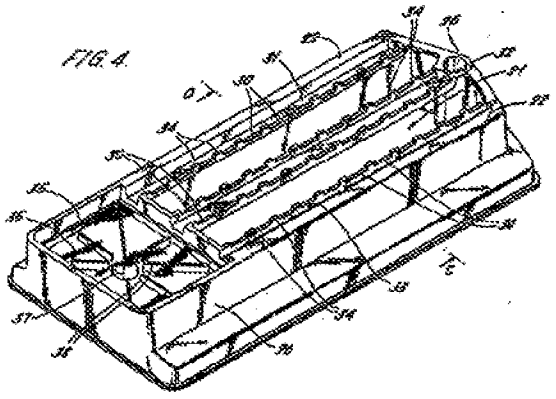
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(54) Beverage packages.

(57) A sealed beverage package containing one or more beverage ingredients and being formed from substantially air- and water-impermeable materials, the said package comprising a body portion having a compartment containing the beverage ingredients and a beverage outlet channel formed therein, the beverage outlet channel and the compartment of the body portion containing the beverage ingredients communicating in such a manner that, in use, the said compartment and the outlet channel co-operate to act as a filter during the preparation of a beverage from the package.



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Description

BEVERAGE PACKAGES

The present invention relates to beverage packages and, in particular, to sealed beverage packages which are formed from a substantially air-and water-impermeable material and which contain one or more beverage ingredients.

The production of freshly brewed tea or coffee involves contacting tea leaves or roast and ground coffee with hot water and separating the beverage from the tea leaves or coffee grounds. Various methods for the production of freshly brewed coffee or tea are well known. For example, tea is prepared traditionally in a teapot, the tea leaves being immersed in boiling water and allowed to stand before being poured from the pot. Freshly brewed coffee may be prepared by the continuous passage of hot water through roast and ground coffee contained in a filter and the coffee collected in a jug or other receptacle, or by percolation which involves the continuous recycling of water through the roast and ground coffee.

It has previously been proposed to seal fresh roast and ground coffee or tea leaves in individual air-impermeable packages. For example, cartridges or capsules containing compacted ground coffee are known for use in certain coffee making machines which are generally termed "espresso" machines. In the production of coffee using these coffee machines the coffee cartridge is placed in a brewing chamber and hot water is generally caused to pass under pressure through the cartridge, thereby extracting the aromatic coffee constituents from the ground coffee and producing a coffee beverage.

Cartridges containing roast and ground coffee in which hot water flows under gravimetric force through the cartridge are also known. A cartridge of this general type is described in British Patent No. 1397116.

The cartridges for use in "espresso" machines and those through which water flows under gravimetric force contain a filter positioned beneath the charge of coffee. In the production of coffee from these cartridges water is generally injected into the coffee containing cartridge through a needle. The cartridge is filled with water which flows through the filter and is collected in a cup or other receptacle.

We have now developed a sealed beverage package containing one or more beverage ingredients which does not require the charge of the beverage ingredients to be placed above a conventional filter.

Accordingly, the present invention provides a sealed beverage package containing one or more beverage ingredients and being formed from substantially air- and water-impermeable materials, the said package comprising a body portion having a compartment containing the beverage ingredients and a beverage outlet channel formed therein, the beverage outlet channel and the compartment of the body portion containing the beverage ingredients communicating in such a manner that, in use, the said compartment and the beverage outlet channel co-operate to act as a filter during the preparation of a beverage from the package.

The body portion of the package of the invention may be provided with an inlet or an inlet may be formed in the package during use. In the embodiment where the inlet is formed in the body portion one or more inlet channels will preferably be provided which communicate with the inlet nozzle and with the compartment containing the beverage ingredients and assist in the distribution of water through the said compartment.

The body portion of the beverage package is preferably made from a rigid plastics material, such as polypropylene. The body portion may be coated with a thin layer of a barrier material, if desired, in order to improve the shelf life of the package.

The beverage package may be formed with a body portion which also acts as the bottom of the package. Alternatively, the body portion may be of an essentially hollow construction in which case the beverage package will have a flexible bottom portion sealed to the body portion adjacent the periphery of the bottom thereof.

Preferably the top portion of the package is made from a flexible material such as aluminium foil or a laminated material, such as a laminate comprising a metal layer laminated to a barrier layer of a plastics material. Many laminates of this type are known in the art and an example thereof is a polyester/aluminium/polypropylene laminate. The optional bottom portion of the beverage package may also be formed from a material of this type.

In one embodiment of the invention the beverage outlet channel is provided in a flange which forms part of the body portion. It is preferred, in this embodiment of the invention, that the flange provided in the body portion should totally surround the compartment containing the beverage ingredients, although it is contemplated that this will not always be necessary. Furthermore, it is also preferred that the beverage outlet channel should extend in the flange around the whole of the periphery of the compartment containing the beverage ingredients. However, the present invention also includes within its scope beverage packages in which the beverage outlet channel extends in the flange only along a part of the periphery of the compartment containing the beverage ingredients. For example, if the beverage package is of elongate form then the beverage outlet channel may extend along the length of one long edge only.

In other embodiment of the invention a beverage outlet channel is formed along at least a part of the periphery of the compartment containing the beverage ingredients. For a package which is of elongate form a beverage outlet channel may be formed along one or both longitudinal edges of the compartment containing the beverage ingredients. Alternatively, or in addition, a beverage outlet channel may span the compartment containing the beverage ingredients.

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The beverage package of the invention may be of any desired shape, although essentially round, rectangular or square packages are preferred. In an embodiment of the invention the package of the present invention preferably has an area which is adapted, when in use, to form an outlet for the beverage from the package. Alternatively, the body portion of the package may also have an outlet formed therein which communicates with the beverage outlet channel. The outlet of the package may be designed to be opened, in use, by the user for example, by means of tear strings, tear strips or peelable tabs. Alternatively, the package of the present invention may be designed for use with a machine in which the outlet of the package is opened automatically by cutting or piercing, or by the pressure of the water introduced into the package and from which the beverage is made. In the embodiment of the invention in which the package has a region which is intended, in use, to form an outlet for the beverage from the package a V-shape channel may be formed which communicates with the beverage outlet channel so that the beverage is funnelled into a narrow stream for collection in an appropriate cup or other receptacle.

The beverage outlet channel formed in the body portion and the compartment containing the beverage ingredients communicate in such a manner that, in use, the compartment and the beverage outlet channel co-operate to act as a filter during the preparation of a beverage from the package. This can be achieved in a variety of ways. For example, when the beverage outlet channel is formed in a flange which surrounds or at least partially surrounds the compartment containing the beverage ingredients, then the top portion of the package may be sealed not only to the body portion adjacent the periphery of the flange, but also at various points along the edge of the outlet channel which communicates with the said compartment. Similarly, when the beverage outlet channel is formed along at least a part of the periphery of the compartment containing the beverage ingredients, the top portion of the package may be sealed to the body portion not only adjacent the periphery thereof, but also at various points along the edge of the outlet channel which communicates with the said compartment, for example by making appropriate spot welds of the top portion of the package package to this edge. The seals along the edge of the outlet channel may be formed by providing castellations in the edge to which the top portion can readily be sealed. In this manner, a plurality of very narrow channels or slots are provided connecting the compartment containing the beverage ingredients to the beverage outlet channel, thereby acting as a filter. It will be understood that the channels or slots should be of a size such that the majority of the roast and ground coffee particles are retained in the coffee bed. This will generally be achieved with castellaton 0.2 to 0.5 millimetres high, depending upon the particular particle size of the coffee contained in the beverage package.

Alternatively, the dimensions of the various parts of the device may be so chosen that the top portion is sealed across the body portion in a relatively taut manner so that only a very narrow passageway remains connecting the compartment containing the beverage ingredients to the beverage outlet channel, thus acting as a filter.

When the body portion also acts as the bottom of the package it may be desirable to form one or more channels in the base of the compartment containing the beverage ingredients, in order to assist in the even distribution of the water used to make the beverage. Baffles may also be incorporated into the compartment containing the beverage ingredients, for example to prevent undue movement of insoluble beverage ingredients such as tea leaves therein, or to improve the water distribution for soluble powdered materials so that they dissolve more readily.

The beverage package of the present invention is designed, as discussed above, in order to incorporate a primary filter therein. This primary filter acts to retain at least the majority of any particles of insoluble beverage ingredients in the compartment containing the said ingredients. However, it may be desirable also to incorporate a secondary filter into the beverage package. In particular, when the beverage package contains leaf tea it may be difficult to prevent leaves of tea from escaping from the beverage compartment through the primary filter. Similarly, using a secondary filter for the preparation of coffee from roast and ground coffee enables any fine coffee particles which have passed through the primary filter to be collected and this results in coffee of less turbidity which may be preferred by the consumer.

A secondary filter may be positioned between the compartment containing the beverage ingredients and the beverage outlet channel, or immediately above the outlet from the package. The secondary filter may be formed from any conventional filter sheet material such as cellulose, a spun-bonded polypropylene or a random weave polyester.

It is believed that a beverage package containing both a primary and secondary filter is novel and, accordingly, in a further aspect the present invention provides a sealed beverage package containing one or more beverage ingredients and being formed from substantially air-and water-impermeable materials, which package incorporates therein a primary filter which is formed by the particular mode of construction of the package and a secondary filter. The secondary filter is preferably formed from a conventional filter material.

When the beverage package contains roast and ground coffee, it may also be desirable to provide a layer of roast and ground coffee particles at the top of the compartment of such a size that they are too large to escape from the compartment into the filter channel. In this aspect of the invention it is preferred that this upper layer of coffee particles has a particle size in the range of from 100 micrometres to 1 millimetre.

The remainder of the package may be filled with a lower layer of ground coffee adjacent the first layer. The lower layer preferably has a particle size such that 98% by weight of the ground coffee passes a 75 micrometre mesh. The particles of the upper layer

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act essentially as a filter and prevent the very small particles of the lower layer of coffee from escaping from the package.

The roast and ground coffee of the upper layer is prepared by the dry grinding of roasted coffee beans to relatively coarse grounds which is a well known operation in the coffee industry.

The particle size distribution of the coffee particles of the lower layer of the coffee is preferably 99.9% less than 100 micrometres, 98% less less than 75 micrometres, 95% less than 60 micrometres, 90% less than 45 micrometres and 50% less than 20 micrometres.

It will be understood that the variety or blend of coffee beans which are fine ground to produce the coffee particles of the lower layer need not be the same as the variety or blend of coffee beans ground to produce the upper layer of coffee particles.

The package of the present invention, when filled with roast and ground coffee, preferably contains from 5 to 10 grams of roast and ground coffee, preferably about 7 grams for the preparation of a single cup. However, packages which are intended to provide multiple servings of coffee will contain an appropriate amount of roast and ground coffee, for example, packages intended to provide say five cups of coffee will contain from 20 to 50 grams of roast and ground coffee, preferably about 30 grams.

It will be understood that the very fine particles of ground coffee, which may be contained in a package in accordance with the present invention which contains roast and ground coffee, enable an improved extraction (i.e. higher yields) of the aromatic coffee constituents to be obtained from the roast and ground coffee. Alternatively, it is possible using a package of the present invention filled with roast and ground coffee as discussed above to reach a desired level of extraction of aromatic coffee constituents from the package in a shorter period of time.

The packages of the present invention are preferably flushed with an inert gas, such as nitrogen, prior to sealing and this ensures a long shelf life for the contents of the package.

The package may contain any desired beverage ingredients, for example, roast and ground coffee, leaf tea, chocolate powder and, according to individual taste, powdered milk or creamer, sugar and/or an artificial sweetener. Alternatively, the package may contain liquid beverage ingredients for one preparation of hot or cold beverages, for example a syrup concentrate from the preparation of a carbonated cold beverage therafrom.

It will be understood that it may be convenient for the compartment containing the beverage ingredients to be separated into two or more sections, for example, one section containing roast and ground coffee and another section containing powdered milk or creamer.

The present invention also includes within its scope a method for preparing a beverage which comprises positioning a sealed beverage package as described above at a brewing station, injecting water through water introduction means into the package, allowing the water to filter through the beverage ingredients contained in the package, allowing the beverage so-formed to filter into the beverage outlet channel and collecting the beverage so-formed through an outlet formed in the package.

The water is preferably injected into the beverage package under pressure, for example at a pressure of up to 150 psi (1034 KPa). For the preparation of hot beverages the water which is used for injection may either be boiling or may be at a temperature substantially below boiling and then be heated up during the beverage preparation, for example by means of a heating element. For the preparation of cold beverages, the water which is used for injection will be cold or chilled. It is also contemplated that the package of the invention could contain ingredients for the preparation of carbonated beverages and in this case carbonated water will be injected into the package.

The water under pressure may be injected into the beverage package through an inlet formed in the package or through a slot of an appropriate size and shape formed, in use, in the base of the compartment containing the beverage ingredients. For example, a cruciform cut may be made in the base and water forced under pressure through the cut into the beverage package. The water injection may then be followed by compressed air in order to force the water through the package. It may also be convenient to be able to regulate the amount of water injected into the package so that a smaller quantity of a stronger beverage can be produced. For example it would be possible to inject a quantity of water sufficient for a half or whole cup of coffee, as desired. It may also be desirable to brew a small amount of a stronger beverage and then dilute this with a separate supply of water since this will avoid all of the volume of water having to pass through the package. To prepare a cup of coffee from a beverage package of the invention containing roast and ground coffee will take about 15 seconds and this is a very acceptable brewing time for the consumer.

It is also contemplated that a plurality of packages may be connected together in the form of a strip. In this embodiment of the invention the packages would preferably be attached to one another at the ends thereof. It will be understood that a line of weakness may be incorporated between adjacent packages during the manufacture thereof, this making the separation of individual packages from a strip a relatively easy matter. Furthermore, if desired several strips of the packages may be joined together along the longitudinal edges thereof to form a block of packages from which individual packages may be removed as desired.

The filled beverage package of the present invention, and the preparation of a beverage therefrom, will be further described by way of example and with reference to the accompanying drawings, in which:-

Figure 1 is a top plan partially broken away view of a package in accordance with the invention;

Figure 2 is a section through the package of Figure 1 taken along the line A-A;

Figure 3 is a section along the line A-A of

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Figure 1 showing the manner in which a beverage is prepared therefrom;

Figure 4 is a perspective view of the topside of the body portion of another package in accordance with the invention;

Figure 5 is a perspective view of the underside of the body portion of Figure 4; and

Figure 6 is a section taken along the line C-C of Figure 4 of a capsule incorporating the body portion of Figure 4.

Referring to the drawings, a package 1 comprises a body portion 2 formed from rigid polypropylene and a top portion 3 which is formed from a laminated material. The body portion 2 has a compartment 4 which contains the beverage ingredients therein, in the embodiment as shown the beverage ingredient being roast and ground coffee particles. The compartment 4 is also provided with a recess 5 which is adapted for the injection of water under pressure therethrough. The body portion has a flange 6 formed around the compartment 4, the flange having a beverage outlet channel 7 formed therein. As best shown in Figure 1, the top portion 3 is sealed to the body portion 2 around the periphery of flange 6, as shown generally at 8. The top portion is also sealed along rib 9 formed in the flange and to the crenellations 10 which are formed along the edges of the beverage outlet channel 7 which communicates with compartment 4. Slots 11 are thus formed by the space between the top portion 2 and the edge of the beverage outlet channel 7.

The package as shown is also provided with an essentially V-shaped channel 12 which assists in collecting liquid during the preparation of the beverage. The V-shaped channel is formed in tab 14 which is, essentially, a triangular extension of the flange 6.

In the preparation of a beverage from the package of the invention reference should be made to Figure 3 in which the arrows marked on the drawing indicate the route which the water will take during passage through the bed of roast and ground coffee. Water is injected under pressure through recess 5 in the direction of arrow B through a cut or injection hole in the recess (not shown). The water under pressure contacts the roast and ground coffee and a coffee infusion is made therefrom. The coffee beverage then passes through slots 11 into the beverage outlet channel 7. The pressure of the beverage builds up in the beverage outlet channel and causes the seal formed between the top portion 3 and rib 9 to break. The beverage thus flows over rib 9 into the collection channel 12 which funnel the beverage to form a stream thereof which can be readily collected in a cup or other receptacle. It will be appreciated that at least the uppermost layer of the roast and ground coffee particles are of a size such that they cannot ingress through slots 11 into the beverage outlet channel 7.

Figures 4, 5 and 6 illustrate an alternative embodiment of the package of the invention. Referring to these drawings, a body portion 20 is formed from a rigid plastics material such as polypropylene. The body portion comprises a compartment 21 which contains the beverage ingredients, for example roast and ground coffee particles (not shown). The body portion 20 has an upper edge 22 as shown in Figure 4 and a lower edge 23 as shown in Figure 5. In use a laminated foil is sealed both along the upper edge 22 of the body portion and the lower edge 23 of the body portion. The upper and lower laminated foils 24 and 25, respectively, are shown in Figure 6. The body portion 20 is provided with an inlet 26 through which water is injected under pressure. The water passes via inlet 26 to an inlet channel 27 as is best shown in Figure 5. The water passes through the slots 28 formed in the side wall of channel 27 into the bed 21 of roast and ground coffee. The slots 26 are separated one from another by castellations 29 which are also sealed to the lower foil 25. The water passes through the bed of beverage ingredients contained in compartment 21 and then filters through the slots 30 which are formed at the edge of the beverage outlet channels 31, 32 and 33, respectively. The slots 30 are separated one from another by castellations 34 which are sealed to the upper foil 24. A satisfactory primary filtration of roast and ground coffee particles having a mean particle size of 350 micrometres can be obtained when the slots 30 are separated by castellations 34 approximately 0.3 millimetres high.

The path of flow of the water through the package is illustrated in Figure 6 by means of the arrows as shown on the drawing.

The beverage is collected via the beverage outlet channels 31, 32 and 33 via a collection chamber 35 which has a secondary filter 36 positioned above an outlet 37. The collection chamber 35 is strengthened by a plurality of ribs 38 positioned beneath filter 36 as shown in Figure 4. The outlet 37 is separated from the beverage compartment 21 by means of a transverse wall 39. The outlet may also be strengthened by means of flanges 40 attached thereto which serve to space the outlet 37 from the wall 39 and the edge 41 of body portion 20.

It will be appreciated that in use the package shown in Figures 1 to 3 of the drawings will be positioned vertically and when used in this manner the tab 14 which has the V-shaped channel 12 formed therein will be lowermost. The water, preferably just below boiling point and preferably under pressure will be injected into compartment 4 horizontally through recess 5.

In the embodiment as shown in Figures 1 to 3 of the drawings the outlet from the package is formed by the rupture of the seal between the top portion 3 and rib 9. It will be appreciated, however, that in other embodiments of the invention the outlet could be formed by cutting or piercing the package either manually or automatically in an appropriately designed vending machine.

The shape of the package as shown in Figures 1 to 3 of the drawings is of particular advantage for use in an automatic vending machine since the tab portion 14 makes it easy to locate the package in an appropriate housing provided in the machine.

The package as shown in Figures 4 to 6 of the drawings is designed to be used horizontally and, when used in this manner, the outlet 37 will project downwards so that the beverage prepared may be

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collected in a cup or other receptacle.

It is also possible to inject different volumes of water into the package and this is of particular importance in relation to the preparation of coffee from roast and ground coffee particles. Thus it is possible to inject a small volume of water into the package containing roast and ground coffee in order to prepare an "espresso" cup of coffee, or alternatively to inject a larger quantity of water into the package containing roast and ground coffee and thus to prepare a standard cup of coffee. It will also be appreciated that packages can be produced which contain sufficient roast and ground coffee for the preparation of a larger quantity of coffee, for example several cups and is of particular importance in the catering trade.

Claims

1. A sealed beverage package containing one or more beverage ingredients and being formed from substantially air- and water-impermeable materials, the said package comprising a body portion having a compartment containing the beverage ingredients and a beverage outlet channel formed therein, the beverage outlet channel and the compartment of the body portion containing the beverage ingredients communicating in such a manner that, in use, the said compartment and the outlet channel co-operate to act as a filter during the preparation of a beverage from the package.

2. A beverage package as claimed in claim 1 wherein the body portion is made from a rigid plastics material.

3. A beverage package as claimed in claim 1 or claim 2 wherein the top portion is made from a flexible material, preferably aluminium foil or a laminated material.

4. A beverage package as claimed in any one of the preceding claims wherein the beverage outlet channel is formed along at least a part of the periphery of the compartment containing the beverage ingredients.

5. A beverage package as claimed in claim 4 wherein the body portion is of elongate construction and beverage outlet channels are formed along one or both longitudinal edges of the compartment containing the beverage ingredients.

6. A package as claimed in any one of the preceding claims wherein the top portion is sealed both to the body portion adjacent the periphery thereof and also at various points along the edge of the beverage outlet channel which communicates with the compartment containing the beverage ingredients.

7. A package as claimed in claim 6 wherein the edge of the beverage outlet channel which communicates with the compartment containing the beverage ingredients has a plurality of castellations formed therein onto which the top portion is sealed.

8. A package as claimed in any one of the preceding claims wherein the compartment for the beverage ingredients comprises an upper layer of roast and ground coffee particles having a particle size in the range of from 100 micrometres to 1 millimetre and a lower layer of roast and ground coffee particles having a particle size such that 98% by weight of the coffee passes a 75 micrometre mesh.

9. A package as claimed in any one of the preceding claims which is sealed under an inert gas.

10. A package as claimed in any one of the preceding claims wherein the compartment containing the beverage ingredients also has one or more channels formed therein to assist in the even distribution of water through the package.

11. A package as claimed in any one of the preceding claims wherein the body portion is provided with an inlet for water.

12. A package as claimed in claim 11 wherein the inlet communicates with the compartment containing the beverage ingredients by means of one or more inlet channels.

13. A package as claimed in any one of the preceding claims wherein the body portion is provided with an outlet for the beverage.

14. A package as claimed in claim 13 wherein the outlet communicates with the beverage outlet channel or channels.

15. A package as claimed in any one of the preceding claims which incorporates a secondary filter therein.

16. A package as claimed in claim 15 when dependent upon claim 13 wherein the secondary filter is positioned above the outlet formed in the body portion.

17. A sealed beverage package containing one or more beverage ingredients and being formed from susbtantially air-and water-impermeable materials, which package incorporates therein a primary filter which is formed by the particular mode of construction of the package and a secondary filter.

18. A package as claimed in claim 17 wherein the secondary filter is formed from a conventional filter material.

19. A plurality of packages as claimed in any one of the preceding claims which are connected together to form a strip.

20. A method for preparing a beverage which comprises positioning a sealed beverage package as claimed in any one of claims 1 to 14 at a brewing station, injecting water through water introduction means into the package, allowing the water to filter through the beverage ingredients contained in the package, allowing the beverage so-formed to filter into the beverage outlet channel and collecting the beverage so formed through an outlet formed in the package.

21. A method as claimed in claim 20 wherein the water is introduced into the package under a pressure of up to 150 psi.

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22. A method as claimed in claim 21 wherein the water under pressure causes a part of the seal between the top portion and base portion to rupture, thus forming an outlet in the package.

23. A method as claimed in any one of claims 20 to 22 wherein the water is introduced into the package through an inlet formed therein.

24. A method as claimed in any one of claims 20 to 23 wherein the water injection is followed by the injection of compressed air into the package.

FIG. 1.

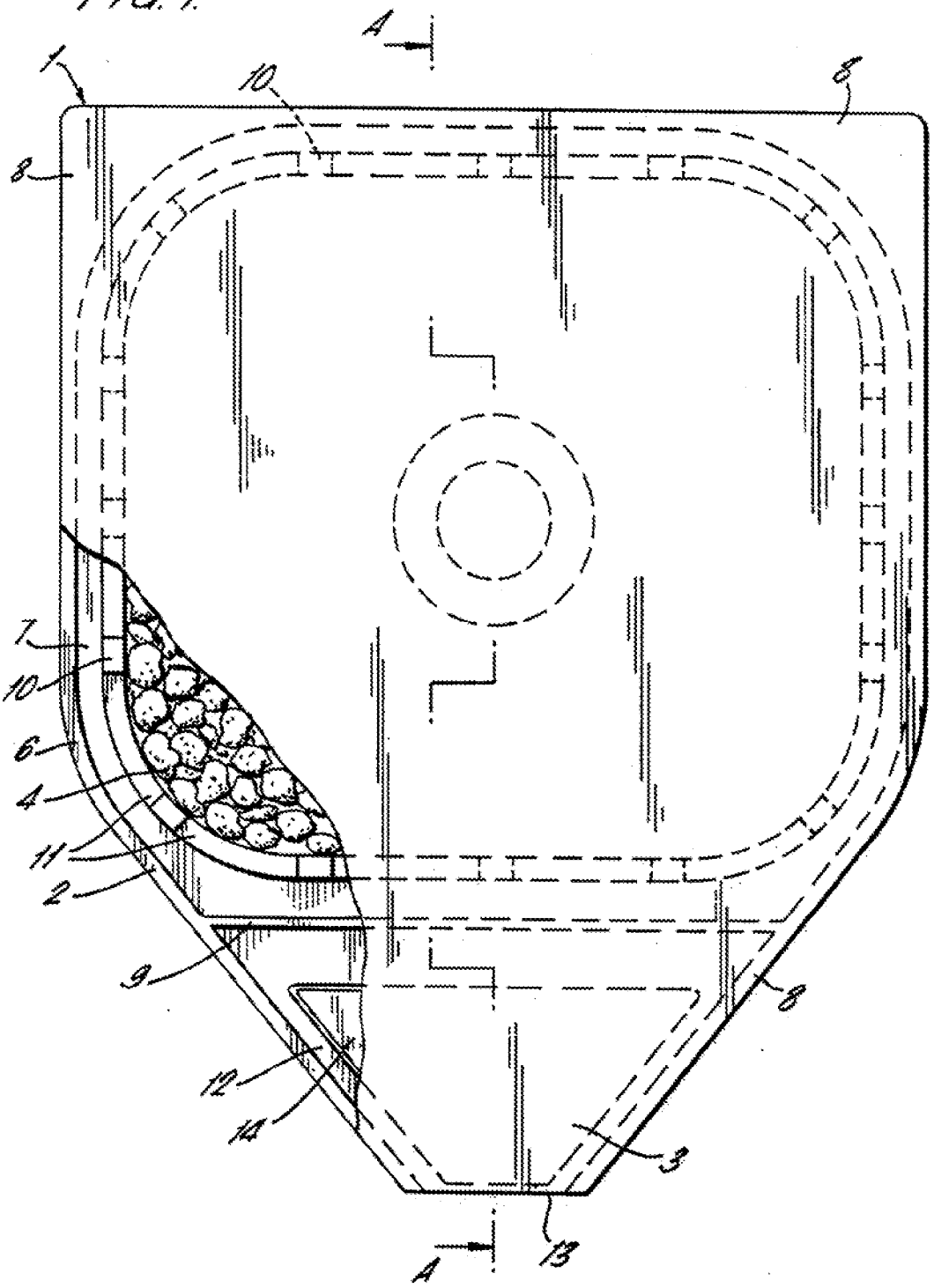


FIG. 2.

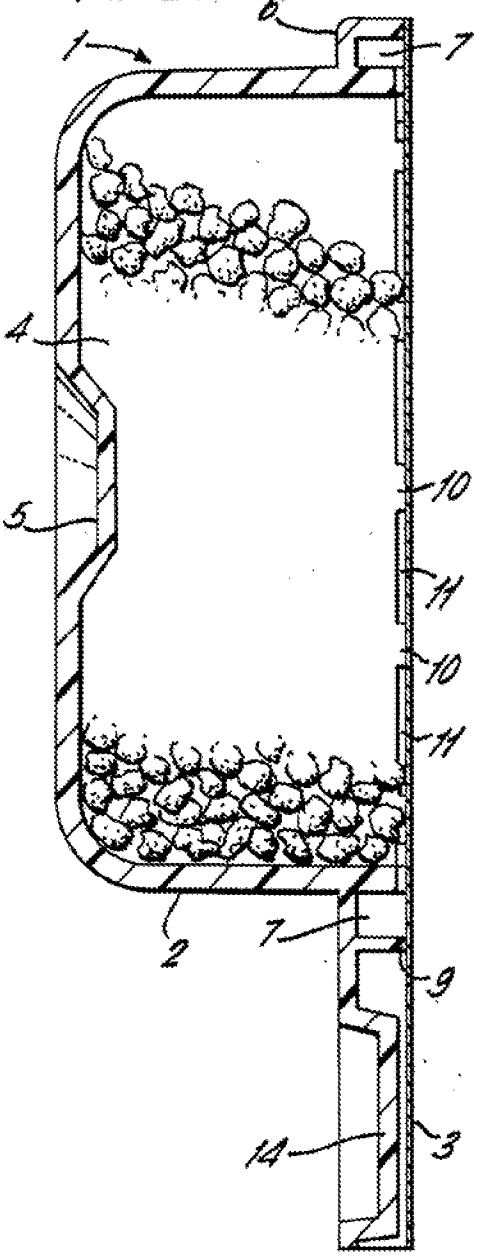
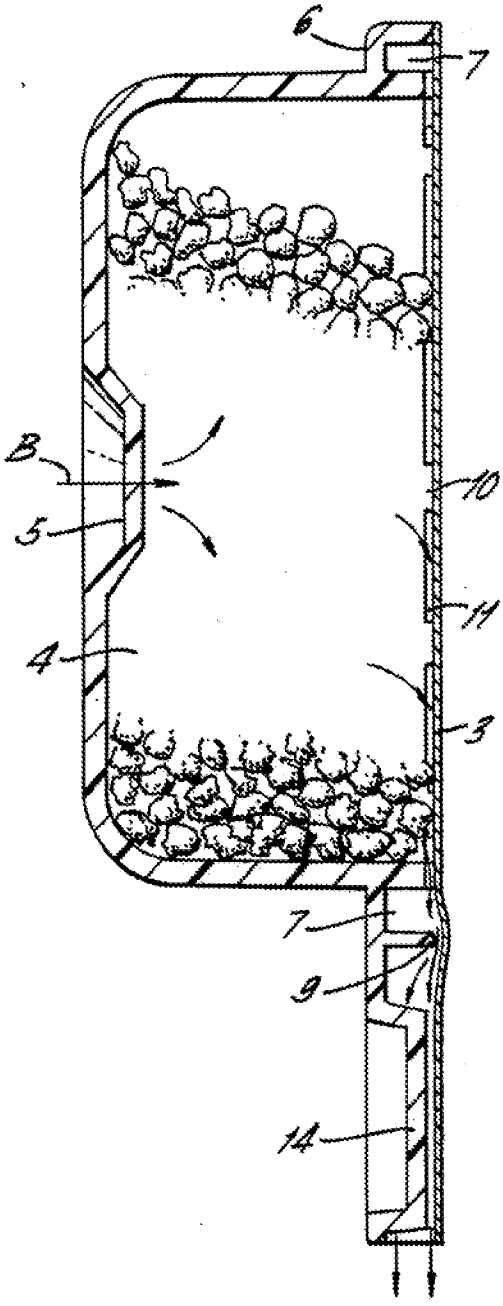


FIG. 3.



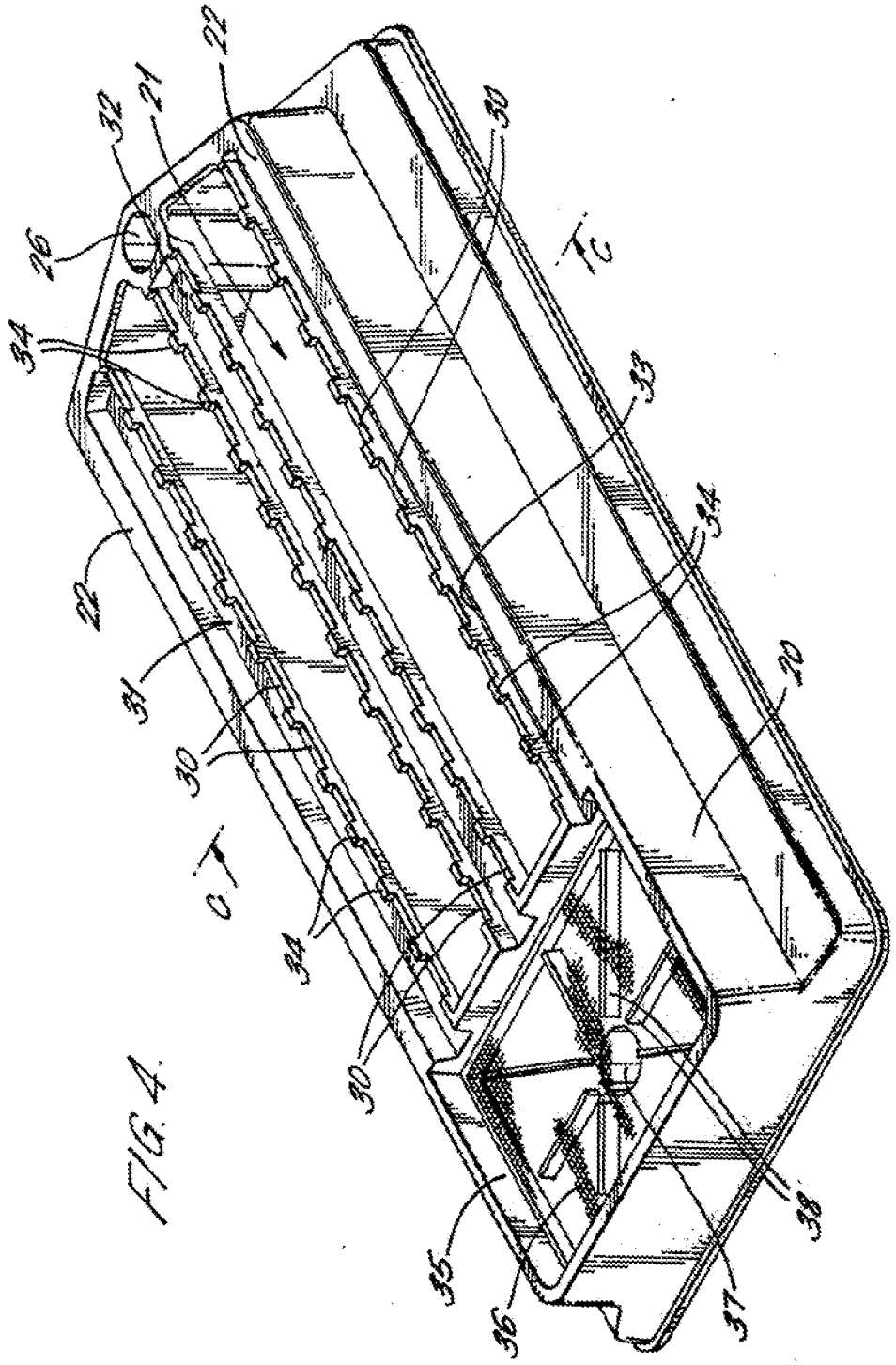


FIG. 4.

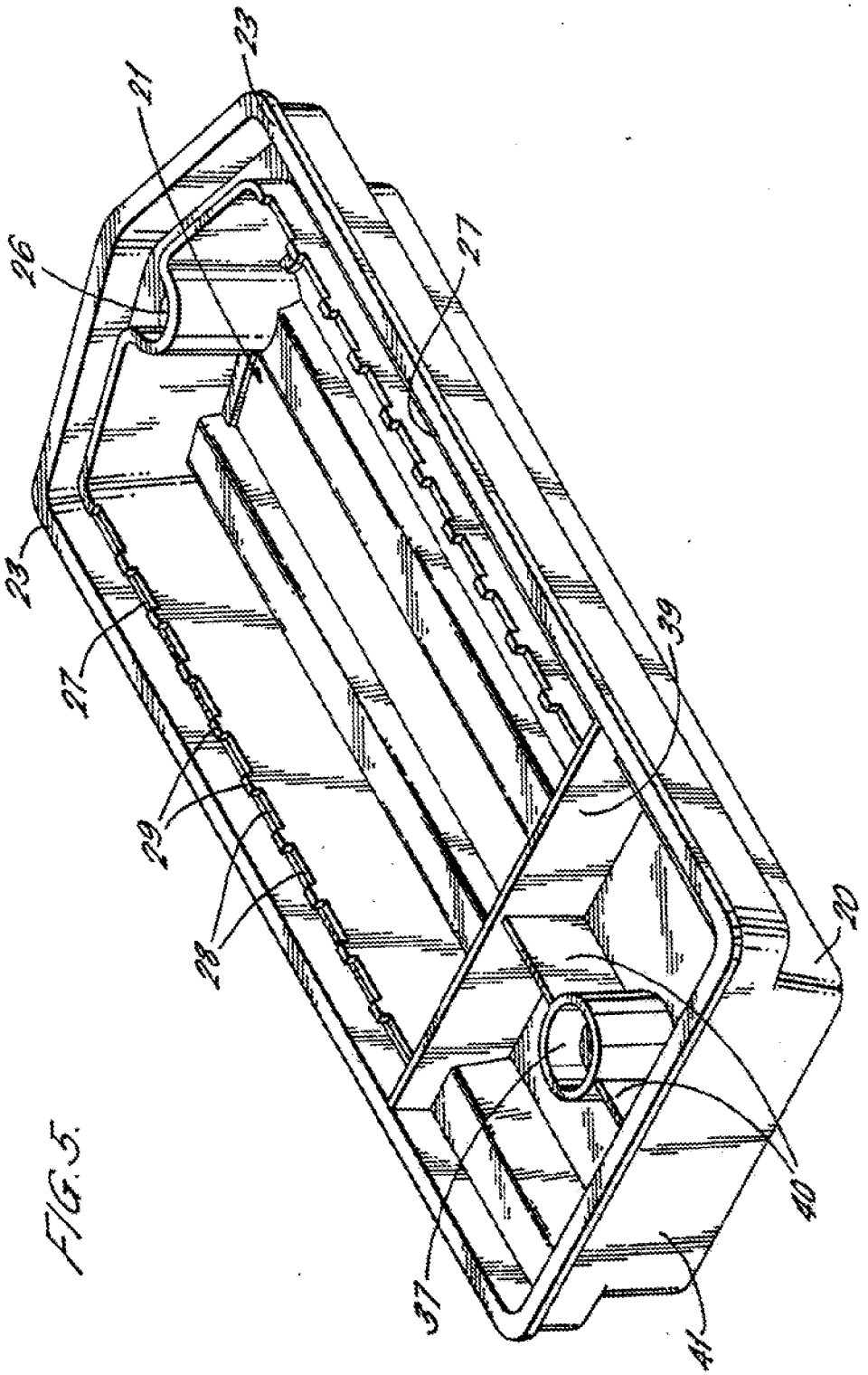
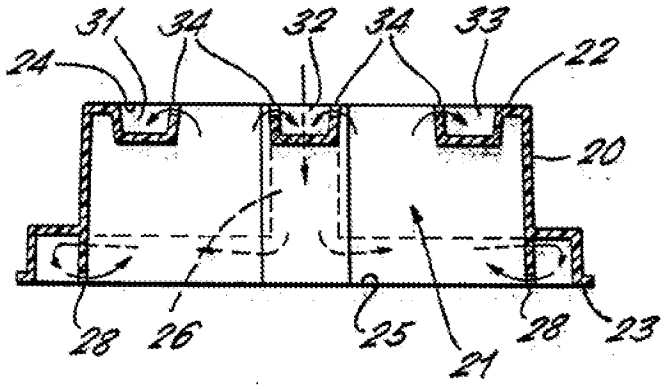


FIG. 5.

FIG. 6.



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(54) Cartouche fermée pour la confection d'une boisson.

(57) L'invention concerne une cartouche fermée prévue pour être extraite sous pression, contenant une substance (3) pour la préparation d'une boisson, comprenant une coupelle (2) avec face supérieure et paroi latérale ayant sensiblement la forme d'un tronc de cône et une face inférieure (4) de diamètre supérieur à la face supérieure, dans laquelle la face inférieure est un opercule soudé sur le pourtour du rebord inférieur de la coupelle et est constitué d'une matière souple imperméable à l'oxygène, choisie dans le groupe constitué par l'aluminium, un composite aluminium/plastique, un composite aluminium/plastique/papier, du plastique pur ou multicouches.

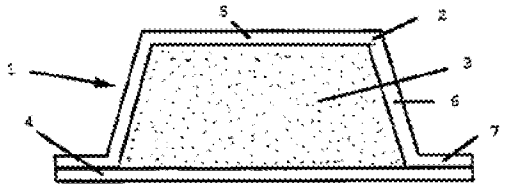


FIGURE 1

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L'invention concerne une cartouche fermée, prévue pour être extraite sous pression, contenant une substance pour la préparation d'une boisson, comprenant une coupelle avec un fond et une paroi latérale ayant sensiblement la forme d'un tronc de cône et un rebord circulaire de diamètre supérieur au fond.

Le brevet GB 938617 concerne une cartouche avec filtre intérieur ménageant deux compartiments et destinée à être extraite par un dispositif qui la perce sur ses faces inférieures et supérieures avant ladite extraction. L'inconvénient d'une telle cartouche est qu'elle nécessite en raison de l'épaisseur desdites faces l'utilisation d'un dispositif de percement relativement dangereux ne garantissant pas une parfaite propreté lors de ladite extraction et un dégagement aisé à la fin.

L'utilisation de capsules pour la préparation d'une boisson, surtout dans le domaine des cafés type espresso extraits sous pression, est motivée par plusieurs raisons: hygiène, conservation optimale du café, facilité d'usage, meilleure maîtrise de la qualité du café obtenu et bonne reproductibilité des conditions d'extraction. Parmi l'ensemble des capsules disponibles, seules les capsules fermées, s'ouvrant sous l'effet de la pression d'eau injectée, répondent plus complètement aux arguments énoncés ci-dessus. Ces capsules se distinguent par leur système d'ouverture.

Celles faisant l'objet du brevet CH 605 293 présentent des zones affaiblies qui se déchirent préférentiellement sous l'effet de la pression. Cette solution présente le désavantage d'augmenter la complexité et le prix de la capsule car les matières employées doivent être traitées de manière très précise pour que l'ouverture soit correcte et reproductible.

La cartouche, objet de la présente invention, est d'un prix nettement plus faible et sa fabrication considérablement plus aisée, tout en permettant d'avoir une cartouche pour la confection d'une boisson, en particulier un café espresso, c'est-à-dire dans laquelle on effectue une extraction du café sous une pression comprise entre 1 et 15 bars.

L'invention concerne une cartouche fermée selon le préambule de la revendication 1, comportant un opercule soudé sur le pourtour du rebord de la coupelle, ledit opercule étant constitué d'une matière souple imperméable à l'oxygène, choisie dans le groupe constitué par l'aluminium, un composite aluminium/plastique, un composite aluminium/plastique/papier, du plastique pur ou multi-couches et l'opercule ou le fond étant destiné à être déchiré sous le seul effet de la poussée du fluide d'extraction au début de l'extraction. L'intérêt de cette cartouche est qu'elle ne comprend pas à proprement parler de filtre ni de zone d'affaiblissement.

La cartouche selon l'invention, peut être extraite selon le procédé et avec le dispositif faisant l'objet de la demande de brevet européen No. 91107482.3. Le dispositif d'extraction, prévu dans cette demande de brevet, permet d'extraire dans de bonnes conditions cette capsule simplifiée. Pour l'extraction de la capsule c'est soit l'opercule, soit le fond de la coupelle qui est déchiré sous l'effet du fluide d'extraction. Si c'est l'opercule, le fond de la coupelle est d'abord ouvert par l'organe d'injection d'eau lors de la mise en place de la cartouche dans le dispositif d'extraction et l'opercule est déchiré dans ledit dispositif lors de la montée en pression et après usage, ladite cartouche peut être retirée facilement et intégralement avec un minimum de déchet de marc ou de matière d'emballage.

L'opercule est normalement soudé sur le pourtour de la coupelle. Le soudage se fait par thermosoudage, les parties à souder comportent sur leurs faces en regard une laque de soudage. On peut également replier le rebord inférieur de la coupelle sur l'opercule et réaliser ainsi un sertissage. Aussi bien avec le soudage seul que combiné avec le sertissage, on obtient une cartouche résistant à des pressions pouvant aller jusqu'à 15 bars au moment de l'extraction.

La cartouche est remplie d'une substance pour la préparation d'une boisson. Cette substance est de préférence du café torréfié et moulu, mais peut être aussi du thé, du café soluble, un mélange de café moulu et de café soluble, un produit chocolaté ou toute autre substance comestible déshydratée.

Par coupelle, on entend aussi bien un élément tronconique, hémisphérique ou troncpyramidal. Il est bien entendu que le fond de la coupelle n'est pas obligatoirement plan, mais peut également présenter les géométries ci-dessus.

Le corps principal de la capsule, à savoir la coupelle, de forme tronconique et de nature semi-rigide, peut être constitué d'aluminium d'une épaisseur de 20 à 100 µm, de plastique pur ou multi-couches avec éventuellement une couche barrière à l'oxygène telle que l'EVOH ou le PVDC, d'un film multi-couches tel que carton, aluminium, plastique ou carton, plastique avec éventuellement une couche barrière à l'oxygène telle que l'EVOH ou le PVDC.

L'opercule de la capsule, de nature souple, peut être constitué d'aluminium d'une épaisseur de 15 à 60 µm, ou d'un film multi-couches comprenant, soit du papier de 20 à 60 g/m2, du plastique tel que le polyéthylène d'une épaisseur de 20 à 60 µm et de l'aluminium d'une épaisseur de 5 à 20 µm, soit de l'EVOH ou du PVDC d'une épaisseur de 5 à 30 µm et du plastique (PP, PE, PA) de 20 à 100 µm, soit du PET (5 à 30 µm) et du plastique

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(PP, PE) de 20 à 100 µm, soit du PET métallisé ou muni d'une couche haute barrière telle que SiO2. La combinaison multi-couches - papier aluminium peut également être envisagée.

Parmi ces matières, l'aluminium se déchire le plus facilement et le plus nettement en employant un film multi-couches, la présence des fibres de papier et l'étirement de la couche plastique permet de constituer un treillis à l'emplacement des déchirures, ce qui est favorable pour maintenir l'intégrité du fond de la capsule et réduire la dispersion du marc tout en assurant une extraction homogène du lit de café.

Pour éviter toute dispersion du marc sur la grille d'écoulement, on prévoit une couche supplémentaire à base de papier filtre ou de fibres tissées ou non tissées à base de PET ou de PP. Selon une configuration, cette couche peut être intercalée entre le corps de la capsule et l'opercule et liée ou soudée à ces deux éléments. Cette matière peut être d'une densité de 20 à 50 g/m^2. Selon une autre configuration de la capsule, la couche de papier filtre ou de fibres tissées ou on tissées peut être placée à l'extérieur de la capsule et liée ou soudée à l'opercule.

La cartouche selon l'invention peut être de taille variable suivant le volume de café que l'on souhaite préparer. La dose de café contenue peut varier entre 5 et 20 g, le diamètre de la cartouche est compris entre 2,5 et 6 cm et l'épaisseur du lit de café entre 10 et 25 mm.

La suite de la description est faite en référence aux dessins sur lesquels:

Fig. 1 est une représentation schématique de la cartouche selon l'invention;

Fig. 2 est une représentation schématique selon une seconde forme de réalisation et

Fig. 3 est une représentation schématique selon une troisième forme de réalisation.

La cartouche (1) comporte une coupelle (2) avec un fond (5) et une paroi latérale de forme tronconique (6). La coupelle est en aluminium d'épaisseur 50 µm. La cartouche contient du café torréfié (3) et elle est fermée par un opercule (4) en composite aluminium/papier. Cet opercule est soudé sur le pourtour (7) du rebord de la coupelle.

La cartouche (8) de la Fig. 2 comporte une coupelle (2) identique à celle de la Fig. 1, sauf que le rebord (9) de la coupelle est plus large permettant ainsi un rabattement, c'est-à-dire un sertissage sur le pourtour de l'opercule (4). Le matériau utilisé est le même que celui de la Fig. 1.

La cartouche (30) de la Fig. 3 comporte sur l'opercule (4) un papier filtre (31) soudé contre le pourtour dudit opercule et le pourtour de la coupelle (2).

La cartouche selon l'invention est de type s'ouvrant sous l'effet de la pression mais est de conception et de fabrication plus simple et plus économique que celle de la technique antérieure.

Explication des abréviations:

PVDC	= Polychlorure de vinylidène
EVOH	= Copolymère d'éthylène et d'alcool de vinyle
PP	= Polypropylène
PE	= Polyéthylène
PET	= Polyester
PA	= Polyamide

Revendications

1. Cartouche fermée, prévue pour être extraite sous pression, contenant une substance pour la préparation d'une boisson, comprenant une coupelle avec un fond et une paroi latérale ayant sensiblement la forme d'un tronc de cône et un rebord circulaire de diamètre supérieur au fond, caractérisée en ce qu'elle comporte un opercule soudé sur le pourtour du rebord de la coupelle, ledit opercule étant constitué d'une matière souple imperméable à l'oxygène, choisie dans le groupe constitué par l'aluminium, un composite aluminium/plastique, un composite aluminium/ plastique/papier, du plastique pur ou multi-couches et l'opercule ou le fond étant destiné à être déchiré sous le seul effet de la poussée du fluide d'extraction au début de l'extraction.

2. Cartouche selon la revendication 1, caractérisé en ce que l'opercule est serti sur le rebord de la coupelle.

3. Cartouche selon l'une des revendications 1 ou 2, caractérisée en ce que la coupelle est en un matériau choisi parmi l'aluminium ayant une épaisseur de 20 à 100 µm, un plastique pur ou multi-couches, un composite carton/aluminium/plastique et un composite carton/plastique.

4. Cartouche selon l'une des revendications 1 à 3, caractérisée en ce que l'opercule est en un matériau choisi parmi l'aluminium d'une épaisseur de 15 à 60 µm et un multi-couches comprenant, soit du papier de 20 à 60 g/m2, du plastique d'une épaisseur de 20 à 60 µm et de l'aluminium d'une épaisseur de 5 à 20 µm, soit de l'EVOH ou du PVDC d'une épaisseur de 5 à 30 µm et du plastique (PP, PE ou PA) de 20 à 100 µm, soit du PET (5 à 30 µm) et du plastique (PP, PE) de 20 à 100 µm, soit du PET métallisé ou muni d'une couche haute barrière telle que SiO2.

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5. Cartouche selon l'une des revendications 1 à 4, caractérisé en ce qu'elle a un diamètre compris entre 2,5 et 6 cm et une épaisseur comprise entre 10 et 25 mm.

6. Cartouche selon l'une des revendications 1 à 5, caractérisé en ce qu'il est prévu dessus ou dessous l'opercule une couche supplémentaire à base de papier filtre ou de fibres tissées ou non tissées à base de PET ou de PP.

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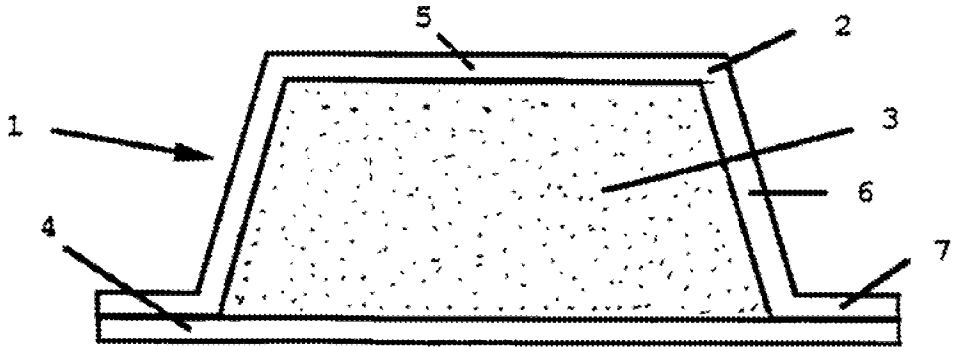


FIGURE 1

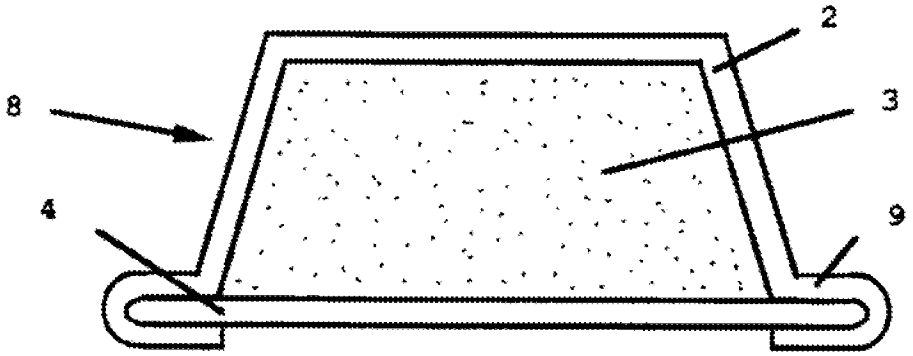


FIGURE 2

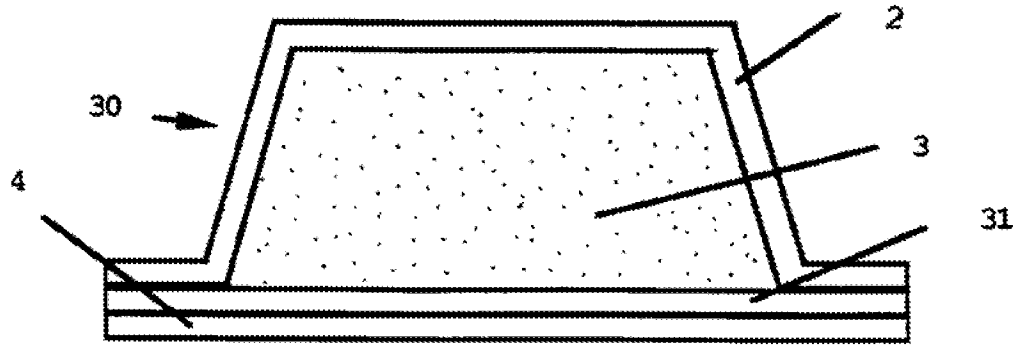


FIGURE 3

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Office européen des brevets

RAPPORT DE RECHERCHE EUROPEENNE

Numero de la demande

EP 92 10 7536

DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (Int. Cl.5)
X,D	CH-A-605 293 (SOCIETE DES PRODUITS NESTLE S.A.) * le document en entier *	1-4,6	B65D81/34
X	FR-A-2 211 924 (BATTELLE MEMORIAL INSTITUTE) * le document en entier *	1-2	
A		5	
A	EP-A-0 344 541 (BREVETTI SANVITALE S.R.L.) * colonne 5, ligne 22 - ligne 45 *	1,6	
A,D	GB-A-938 617 (SEALPAK CORPORATION) * page 2, ligne 4 - ligne 44; figure 3 *	3	
A	US-A-2 778 739 (ROOTH) * colonne 2, ligne 31 - ligne 66; figure 1 *	1,4	
A	EP-A-0 272 922 (GENERAL FOODS LIMITED) * colonne 2, ligne 14 - ligne 18 * * colonne 2, ligne 26 - ligne 34 *	3-4	
A	EP-A-0 389 141 (GENERAL FOODS LIMITED) * colonne 3, ligne 6 - ligne 9 *	4	DOMAINES TECHNIQUES RECHERCHES (Int. Cl.5)
			B65D

Le présent rapport a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	13 JUILLET 1992	BRIDAULT A.A.Y.

CATEGORIE DES DOCUMENTS CITES

X : particulièrement pertinent à lui seul
Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie
A : arrière-plan technologique
O : divulgation non-écrite
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T : théorie ou principe à la base de l'invention
E : document de brevet antérieur, mais publié à la date de dépôt ou après cette date
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& : membre de la même famille, document correspondant

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(54) Method for delivering faster a short coffee extract from capsule

(57) Method for delivering a short coffee extract faster from a closed capsule containing ground coffee by injecting water under pressure within the capsule. The capsule is filled with ground coffee, has a delivery membrane and is extracted in a coffee extraction device and pressurized water is injected in the capsule under pressure. The coffee beverage is released through the beverage delivery membrane of the capsule with engaging means engaging in and/or against the membrane. The pressure loss is reduced in the coffee bed by providing ground coffee having a reduced percentage of fines (F) depending on the average particle size ($D_{4,3}$). The extraction yield is maintained between 15 and 30% and the coffee extract of 25 or 40 grams is delivered in a flow time of 20 seconds or less.

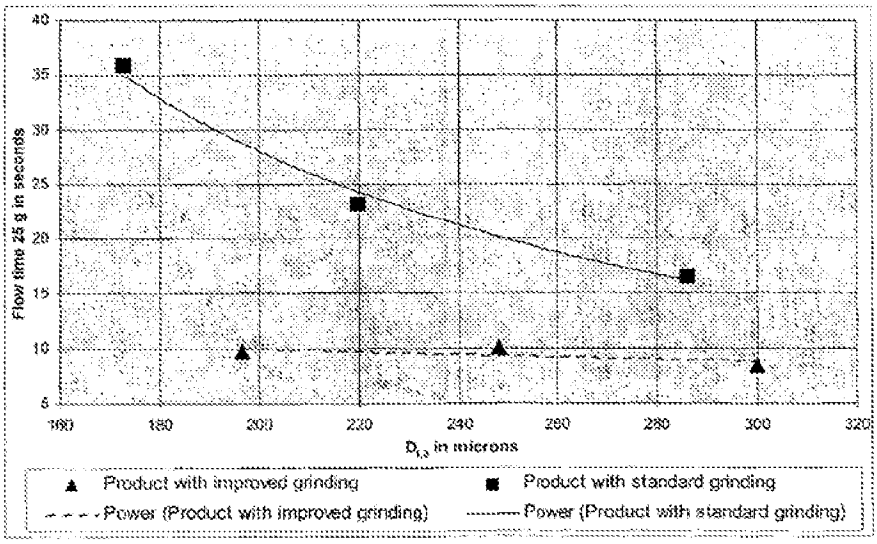


FIG. 2

EP 1 882 432 A1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a method for delivering coffee beverages from capsules designed to be extracted under pressure and containing a substance for the preparation of a coffee beverage.

[0002] Coffee cups can be produced from filter coffee machines. However, as a result of a "light" extraction of the coffee, the resulting extract usually has low coffee solids concentration, a low aroma profile, and little or no "crema" on the top.

[0003] Capsules designed to be extracted under pressure and containing a substance for the preparation of a beverage exist on the market. They provide a better extraction of coffee, i.e., a higher "extraction yield", more aroma and a better "crema", more convenience in operation and they ensure freshness of the substance contained therein. As a result, the delivery of freshly extracted beverages of constant quality is better ensured.

[0004] For instance, the actual system commercialized under the trademark "Nespresso®" is appreciated for producing good quality short cups of coffee and long cups of coffee. A short cup of coffee extract is defined as containing less than 50 grams of coffee liquid extract in the cup and more specifically about 40 g for the espresso type and about 25 g for the ristretto type. Due to the high pressure extraction conditions maintained in the capsule, in the order of 10-20 bar the liquid extract which is delivered can be given desirable quality attributes in term of coffee yield, coffee solids and "crema" and within a delivery flow time which is found acceptable for the user. Therefore, typically a short coffee extract can be delivered within a flow time of between 20 and 45 seconds in order to provide a desired body, taste, flavour and crema.

[0005] There is a need to deliver a short coffee extract in a reduced flow time however maintaining the quality attributed relatively unchanged.

[0006] There is also a need to deliver a short coffee extract with a stronger taste. The present invention aims at a significant improvement to the capsule system of the prior art. In particular, a main object is to reduce flow time when delivering a short coffee extract from the capsule while at the same time maintaining or even improving the quality attributes of the coffee, in particular, a desirable strength (e.g. expressed by its "extraction yield") and also a sufficient thickness and texture of crema.

[0007] The invention is thus based on the finding that the granulometry of the coffee bed with a control of the fines content in the coffee bed plays a key role in the reduction of the pressure loss in the coffee bed while maintaining the desired coffee extraction. The reduction of the fines content provides a reduction of the pressure loss in the coffee bed. The pressure loss being reduced, the coffee extract can be delivered at a higher flow rate.

[0008] The invention is thus based on the principle of reducing the level of fines in the coffee ground; such level of fines providing a faster flow while not significantly affecting the extraction yield of the resulting coffee.

[0009] Therefore, the invention relates to a method for delivering a short coffee extract faster or with a higher yield from a closed capsule containing ground coffee by injecting water under pressure within the capsule,
wherein the capsule is filled with ground coffee and has a delivery membrane;
wherein the capsule is extracted in a coffee extraction device and pressurized water is injected in the capsule under pressure;
wherein the coffee beverage is released through the beverage delivery membrane of the capsule with engaging means engaging in and/or against the membrane;
wherein the pressure loss is reduced in the coffee bed by providing in the capsule ground coffee having a controlled percentage of fines (F) depending on the average particle size ($D_{4,3}$) within the following limits:

F is lower than 16% when $D_{4,3}$ is measured between 300 and 350 microns,
F is lower than 18% when $D_{4,3}$ is measured between 250 and 299 microns
F is lower than 21% when $D_{4,3}$ is measured between 200 and 249 microns,
F is lower than 28% when $D_{4,3}$ is measured between 150 and 199 microns, and wherein the extraction yield is maintained between 15 and 30%; and,

wherein a coffee extract of 25 or 40 grams is delivered in a flow time of 20 seconds or less.

[0010] Preferably, the pressure loss in the coffee bed is reduced by providing in the capsule ground coffee having a percentage of fines (F) depending on the particle size within the following limits:

F is between 12 and 16% when $D_{4,3}$ is measured between 300 and 350 microns,
F is between 14 and 18% when $D_{4,3}$ is measured between 250 and 299 microns,
F is between 17 and 21% when $D_{4,3}$ is measured between 200 and 249 microns,
F is between 22 and 28% when $D_{4,3}$ is measured between 150 and 199 microns.

[0011] A control of the level of fines as determined as function of the size particle of the coffee grind enables to decrease the pressure loss in the coffee bed, consequently significantly reduces the flow time.

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[0012] Preferably, a single grinding within the aforementioned specific ranges of $D_{4,3}$, is dosed and filled in the capsule to achieve the method of the invention.

[0013] For a short coffee extract, an attribute that is distinctive of the character or strength of the coffee in the cup relates to the extraction yield. It has been found that the extraction yield must preferably be maintained within a certain range. If the extraction yield is too high, the coffee is usually over-extracted and considered as bitter and harsh because non-desirable compounds have been extracted. Conversely, if the extraction yield is too low, the coffee tastes watery and is also not found acceptable for the average consumer. Therefore, surprisingly, the invention provides a method wherein while the flow time is significantly reduced, the extraction yield is further maintained or even increased through finer grinding within a range preferably comprised between 16 and 30%, most preferably between 19 and 25%.

[0014] The amount of ground coffee contained in the capsule remains reasonably low; preferably of from 4.5 to 6.5 grams, more preferably, of from 5 to 6 grams.

[0015] It has been surprisingly found that within a preferred average particle size of $D_{4,3}$ ranging of from 200 to 300 microns, the flow time for delivering 25 g or 40 g of coffee extract can be reduced significantly to 15 seconds or even less, even at approximately 10 seconds. The flow time is also surprisingly relatively constant within a $D_{4,3}$ range of 190-300 microns.

[0016] Despite a faster extraction, coffee flavour profile as well as body and aftertaste can be improved compared to the same average particle size with higher fines level. For instance, the extraction yield within an average particle size, $D_{4,3}$, between 200 and 300 microns, can be maintained or increased within 20 and 23%.

[0017] Crema is also sought in a short extract of coffee as a key quality attribute. The crema should be thick and stable. It should cover the whole surface of the beverage in the cup without leaving any black hole. Therefore, quality of crema is determined by a test consisting of layering crystal sugar and measuring the time before sugar sinks in the coffee extract. Surprisingly, also a short coffee extract delivered in a faster time has a crema of excellent characteristics. For example, a coffee extract delivered in reduced time of about 10 seconds, at an average particle size of $D_{4,3}$ of from 200 to 300 microns, the crema exhibits a stability at the sugar test of more than 10 seconds, even more than 12 seconds, preferably between 12 and 15 seconds.

[0018] In addition, the pressure loss at the membrane/ engaging means interface can be controlled to provide improved quality attributes.

[0019] Pressure loss at the membrane/ engaging means interface can be controlled by having a membrane which has a higher puncture resistance of at least 1.1 mJ. Even preferably the membrane has a puncture resistance of between 1.1 mJ and 3.5 mJ. Most preferably, the membrane has a puncture resistance of between 1.35 and 3.2 mJ. The membrane can be made of different material such as aluminium, aluminium alloy and/or plastic.

[0020] In a preferred example, when the membrane is made of aluminium or aluminium alloy, the membrane has a thickness comprised between 26 and 40 microns, even more preferably of about 30 microns. The membrane is preferably torn under the effect of the extraction pressure in contact with the engaging means. The engaging means may comprise a plurality of reliefs or alternatively a single one. The capsule may contain an internal filter if necessary to retain the coffee ground inside the capsule after opening of the membrane. The water pressure at the injection side of the capsule can reach a value that exceeds 11 bar, even higher than 14 bar.

[0021] In order to obtain a reduction of the fines in the capsules, one possible method may consist in grinding the coffee beans (before filling the capsules) by using a grinder, which comprises at least one pair of rolls having radial corrugations in the fine grinding section as opposed to longitudinal corrugations. Good results have been obtained by grinding coffee using at least 3 stages, preferably 4 stages with at least one roll being radially corrugated. The best results have been obtained by at least 4 stages using only grinding rolls with radial corrugations, in particular 6 stages.

[0022] The coffee in the capsule can be filled in a loose state in the capsule, i.e., without compacting step before or after filling it in the capsule. Alternatively, the coffee can be densified before the filling step using a densifying device. However, the coffee is not compacted in a solid block in the capsule but remains in a flowing state in the capsule.

[0023] In a preferred example, the opening plate for the delivery membrane is formed of a network of protruding reliefs, preferably, a number comprised between 20 and 50 ; each relief having a flat upper surface of individual surface area comprised between about 0.5 and 5 mm^2. More preferably, the upper surface of each individual surface area of the relief is comprised between 0.8 and 3 mm^2. Such an opening arrangement may also participate to generate a pressure loss that is sufficient to form a better crema.

Brief Description of the Drawings:

[0024]

Fig. 1 is a graphic showing the relation between the average particle size of ground coffee and fines levels for standard grinding and improved grinding of the invention;

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Fig. 2 is a graphic showing the relation between the granulometry and the flow time for delivering 25g of coffee extract;

Fig. 3 is a graphic showing the relation between the flow time for delivering 25 g of coffee extract and the extraction yield for standard blends and blends of the invention;

Fig. 4 is a graphic showing the relation between the flow time for delivering 25g of coffee extract and the quality of crema obtained as determined by the sugar test;

Fig. 5 is another graphic showing the relation between the average particle size of ground coffee between 190 and 250 microns and the flow time for delivering a short coffee extract;

Fig. 6 is another graphic showing the relation between the flow time for delivering 25-g coffee extract and the flow time for grinding between 245 and 275 microns;

Fig. 7 is another graphic showing the relation between flow time and crema stability for grinding between 245 and 275 microns;

Fig. 8 shows a schematic representation of the system of the invention before insertion of the capsule;

Fig. 9 shows a schematic representation of the system; the device being closed and a cartridge being extracted in the device.

Detailed Description of the Preferred Embodiments

[0025] In the present application, terms are utilized for which the definitions are given as a preamble below.

[0026] The "extraction yield" refers to the strength of the extract and is defined as the weight of total solids in the liquid extract divided by the total weight of starting coffee ingredients in the capsule (e.g., roast and ground coffee). This value is typically expressed as a percentage.

[0027] The "total solids" is defined as the weight of extracted solids contained in the extract divided by the total weight of the extract. This value is typically expressed as a percentage.

[0028] The "injection pressure" is defined as the maximal pressure expressed in bar and measured at the injection point(s) in the capsule during extraction.

[0029] The "flow time" is defined as the time from the first moment of fluid dropping into the coffee cup to the moment the extracts has been delivered into the cup with the desired weight, strength and character.

[0030] "Short coffee extract" is defined as the liquid extract as obtained from the capsule with a weight of about 25g (+/-2) for "ristretto" and 40g (+/-2) for "espresso".

[0031] The average particle size "$D_{4,3}$" represents the mean volumetric diameter of the coffee grind as obtained by laser diffraction method using a Malvern® optical instrument and butanol as dispersing agent for the particles.

[0032] The "fines" are considered as being coffee particles having a diameter of less than 88.91 microns when measured by the Malvern® laser diffraction method.

[0033] A "stage" for grinding coffee in a grinder represents a pair of rolls.

[0034] The "delivery membrane" is meant to be the wall of the capsule from which the coffee is delivered comprising at least one beverage outlet provided after opening by any suitable method including cutting, puncturing and/or tearing or eventually pre-formed outlet (e.g., a filter).

[0035] The "puncture resistance", expressed in milli-Joules, is defined as the energy needed to puncture the membrane of the capsule by using a MTS Synergie 400 tensile equipment supplied by Fuch Industrievertretungen (Switzerland) as further described in EP 1566127 A2; the content of which is included here by reference.

[0036] The "granulometry" of the ground coffee is defined as the average particle size of the coffee particles and fines level as resulting after grinding as explained in the examples.

[0037] The "crema" is defined as the head of foam created on the coffee extract with a texture of substantially small bubbles. The crema attribute can be measured by an empirical sugar test as defined in example 6, which consists in arranging a well defined crystal sugar layer on top of a freshly prepared cup of coffee and measuring the elapsing time between the start of overlaying and the main part of sugar's sinking. The "sugar test value" is thus a number of seconds.

[0038] The "engaging means" represents an element of the extraction device or capsule having the function of engaging in or pressing against the membrane to provide a certain pressure loss that enables to delay the release of coffee out of the capsule. The engaging means can take various forms able to provide in conjunction with the membrane a certain pressure loss such as a central needle or multiple needles or a plate with multiple protrusions and/or bumps, or a filter plate or other physical obstacles.

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[0039] The present invention relates to a system that uses closed capsules and their attached benefits, as aforementioned, to provide coffee beverages of short volume.

[0040] Figures 5 and 6 schematically illustrate an exemplary system of the invention. The device D of the invention comprises an extraction module 10 for extracting coffee from one capsule at a time. The extraction module comprises receiving means in the form of a support base or collector 11 and an injection part 12. The support base and injection part defines an internal volume upon closing of the two parts to receive the capsule. In the support base is located engaging means 13 arranged to engage with a retaining part of the capsule when pressure of fluid is built inside the capsule. The engaging means 13 may be piercing means such as a series of protruding elements such as pyramids, a network of elongated ribs or needles which are provided on the surface of a plate. The coffee extract is primarily filtered by the very narrow spacing produced between the protruding elements and the edges of the openings of the membrane. The plate comprises a series of apertures to drain the extract and eventually retain any solid coffee particles. The apertures may be provided through the plates in channels formed between the protruding elements or alternatively, be provided through the protruding elements themselves.

[0041] The device further comprises at least one fluid line 72 to which the fluid can be supplied in the capsule via at least one injector 70. The injector may comprise one or more needles or blades which create one or more passages for water to enter in the capsule. The fluid is supplied under pressure in the line by means of a pump 73. The pump may be an electromagnetic piston pump or any suitable water pumping mechanism such as a diaphragm pump or pressurized head systems. A reservoir of fluid 74 can be installed upstream the pump 73 to enable fluid to be supplied in sufficient amount for delivering fluid to extract more than a capsule. Preferably, the reservoir holds more than 750 ml of water so as to eliminate the inconvenience of repeatedly refilling the reservoir after a few extraction cycles. A heating system 75 can be installed along the line between the reservoir and the extraction module 10 to heat the fluid at a required temperature. The heater is configured to heat the water to a temperature of extraction of between 70 to 100°C. It can be a thermoblock or an instant heating device such as ceramic heating cartridges. The reservoir could also be such as a boiler that can keep the fluid warm or hot. A control board with switches is also usually helpful to automatically start the extraction cycle. Different controls can be added such as temperature sensors, timers, flow meters, pressure sensors, vanes, probes and so on for controlling and monitoring the extraction operations. The device could also encompass many other variants.

[0042] The coffee capsule S has a body 20 and a membrane 21 made of a material such as aluminium and/or plastic. The capsule can take many different shapes without departing from the scope of the invention. The membrane could also be formed as the bottom of the body itself. The membrane can take a predefined shape before (e.g. convex or concave) and deforms against the engaging means 13 during extraction.

[0043] According to one important aspect of the invention, the capsule is filled with ground coffee of controlled particle size and reduced amount of fines.

[0044] The capsule may be flushed at a slight overpressure with an inert gas to increase the shelf life of the coffee inside. The membrane can take a slight convex shape as a result of the internal pressure of gas. Inert gas is typically nitrogen but other inert gas could be used. Carbon dioxide gas from the coffee also participates to the inside building of pressure as a result of ground coffee de-gassing inside the capsule after filling and sealing of the capsule. Therefore, the membrane should be sufficiently resistant to withstand the internal pressure of gas including the gas from de-gassing inside the capsule.

[0045] When the extraction module 10 is closed around the capsule 2 and the capsule is positioned in the module, as shown in figure 6, the retaining member, i.e., hereafter called "membrane", is positioned adjacent or at a short distance from the engaging means 13 of the device. The membrane of the capsule is not opened until a certain opening pressure is built within the capsule by virtue of water coming in the capsule. The membrane and engaging means are so arranged to not create an accidental opening before extraction begins. Therefore, as water is entering within the capsule pumped by the pump means 75, the internal pressure builds up inside the capsule which makes the membrane 21 to deform and press on the engaging means 13 up to a point where it becomes pierced or torn open. The capsule starts opening at a certain opening pressure but pressure usually continues increasing due to the compaction of the bed of ground coffee inside the capsule and also due to the pressure drop created by the narrow openings torn or pierced through the membrane of the capsule. Then, the pressure level usually flattens to a pressure of extraction, which is typically of several bars above the opening pressure and then drops when the pump is shut off. The overall pressure loss is usually the addition of the pressure loss created by the compacted coffee bed and the pressure loss created by the conjunction of the small openings through the membrane and the engaging plate 13 of the device. It can be noted that the engaging plate could be a part of the capsule itself. It can be noted that the membrane of the capsule can be pre-opened before water injection such as by one or more needles of the engaging plates.

[0046] The pump has a fixed performance characteristic curve which means that it delivers a certain flow rate of water when downstream the pump has to overcome a certain pressure depending on the characteristics of the capsule (granulometry, membrane, etc.).

[0047] The invention is based on the principle that the pressure loss in the coffee bed has been significantly reduced

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as compared to the pressure loss of the coffee bed in the capsules of the existing systems while at the same time substantially maintaining the extraction characteristics (i.e., the extraction yield).

[0048] For that, the granulometry of the coffee ground in the capsule has been modified with reduced level of fines. Preferably, the percentage of fines (F) is related to the measured range of particle size ($D_{4,3}$). When the particle size increases, the amount of fines usually inversely decreases. The finer the coffee is ground, the more fines are created. According to one preferred aspect of the invention, the percentage of fines F is determined as a function of $D_{4,3}$ within the following preferred limits:

F is between 12 and 16% when $D_{4,3}$ is measured between 300 and 350 microns,
F is between 14 and 18% when $D_{4,3}$ is measured between 250 and 299 microns,
F is between 17 and 21% when $D_{4,3}$ is measured between 200 and 249 microns,
F is between 22 and 28% when $D_{4,3}$ is measured between 160 and 199 microns.

[0049] Preferably, the capsule is filled with one single selected grinding having a selected particle size $D_{4,3}$. In other words, two or more grindings having different particle sizes ($D_{4,3}$) are not mixed for filling a capsule.

[0050] The granulometry with a reduced amount of fines, as defined above, enables to control the flow time for short coffee extracts. In particular, a flow time of less than 20 seconds, preferably 15 seconds or less, can be successfully obtained for delivering 25 or 40 grams of a coffee extract with an extraction yield comprised between 15 and 30%, preferably between 18 and 30%.

[0051] The following examples further illustrate the invention in a non-limiting manner.

EXAMPLES

[0052] In the following test results presented in Examples 1 to 4 below, Nespresso® coffee capsules of standard volume and shape were filled loose with 5.0 grams of ground coffee. The capsules made of aluminium were sealed with an aluminium beverage delivery membrane of 30 microns. The coffee characteristics were compared in view of the extraction yield and crema quality ("sugar test").

Example 1. Grinding technology:

[0053] The graphic of figure 1 illustrates the relation between the average diameter $D_{4,3}$ and the percentage of fines considering different grinding technologies.

[0054] The curve "Standard grinding" was obtained by grinding coffee beans, at different average particle sizes, using a standard grinding technology utilizing only axial corrugated rolls.

[0055] The curve "Improved grinding" was obtained by grinding coffee beans at different average particle sizes, using a grinding technology utilizing six stages including 10 corrugated rolls on the five first stages and two smooth rolls on the last stage. The grinding technique has led to obtain a reduced amount of fines as compared to the standard grinding.

[0056] As shown by the lower curve for the improved grinding, the level of fines can be lowered to a value of about 21% at an average particle size of 199 microns, about 19% for an average particle size of about 240 microns and about 15% for an average particle size of 299 microns.

Example 2. Impact of granulometry (average particle size/fines) on flow time:

[0057] The graphic of Fig. 2 shows the impact of the average particle size ($D_{4,3}$) on flow time through the capsule for blends having reduced particle sizes obtained by the improved grinding and standard blends obtained by a standard grinding. Surprisingly, in the range from 200 to 300 microns, the flow time is approximately constant (about 10 seconds) with a ground coffee having fewer fines as opposed to the standard coffee blend having the usual fines content. In general, the flow time of the coffee extract can be significantly reduced with coffee blends having reduced levels of fines.

Example 3. Impact of flow time on extraction yield:

[0058] The graphic of Fig. 3 shows the impact of the flow time for delivering 25g of coffee extract on the extraction yield using, respectively, capsules of the invention containing ground coffee with reduced fines content ("Improved") for three different average particle sizes, respectively, 200, 250 and 300 microns. The capsules of the invention were compared to capsules containing ground coffee with normal fines content ("Standard") for same average particle sizes. The extraction yield of the resulting coffee extracts was calculated according to the procedure explained in Example 9. Surprisingly, the results show that the improved blends with a reduced fines level provide a significantly lower flow time compared to the standard blends while at the same time the extraction yield remains within the desired range. All blends

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of the invention within the range of 200 to 300 microns experienced a flow time for delivering 25g of coffee extract which is significantly lower than 15 seconds. It is also surprising to notice that the highest yield (about 23%) is achieved with the finer grind for the improved grind. This is the opposite with the standard blends, where the lowest yield (about 16.5%) is achieved with the finer grind. The finer the average particle size, the slower the flow with the standard blends. With the standard blends, the flow resistance through coffee bed is presumably too high to assure a thorough extraction of the whole amount of coffee ("channel effect") in particular at a particle size of 200 microns.

Example 4. Impact of flow time on crema:

[0059] The chart of Fig. 4 represents the results obtained with blends having respectively reduced fines content ("Improved") and normal fines content ("Standard industrial product"). The capsules were filled with 5.0 grams of ground coffee. The blends were ground at, respectively, 200, 250 and 300 microns. The capsules were extracted for delivering 25g of coffee extract. The results show that the crema remains relatively stable, at least above 12 seconds, more particularly, between 12 and 15 seconds, for the improved blends with reduced fines content. The flow time could be reduced to less than 15 seconds with the improved grinding.

Example 5. Impact of average particle size on flow time with average particle size between 200 and 240 microns:

[0060] The chart of Fig. 5 show additional results within an average particle size of between 200 and 240 microns. Improved grindings with lower levels of fines are compared to an industrial "Roma" coffee grinding of about 230-micron average particle size. The samples ground with a radially corrugated grinder have approximately the same or finer particle sizes. The samples were densified using a normalizer as described in EP 1 566 127 A2. The capsules were filled with 5 grams of ground coffee. Flow time can be reduced to less than 20 seconds with the improved grinding.

Example 6. Impact of flow time on extraction yield with average particle size between 200 and 240 microns:

[0061] The chart of Fig. 6 shows additional results within an average particle size of between 200 and 240 microns. The extraction yield of the improved grinding is higher than the standard especially for finer grinding. For a flow time of between about 12 to 20 seconds, the extraction yield can be increased to values comprised between about 20.5 to 22.5%.

Example 7. Additional results

[0062] Additional results are presented in the following tables 1:

Table 1

Physical properties of blends				Flow properties and coffee attributes			
	$D_{4,3}$ [µm]	Fines [%]	Coffee weight [g]	flow time (mean) [s]	stdev [s]	foam [s]	% Yield (mean) %
Standard Blends	200	36.2	5.0	36	7	14	17.5
	250	26.7	5.0	23	3	17	21.1
	300	20.9	4.8	17	4	17	22.3
Improved Blends	200	21.4	5.0	10	3	14	22.9
	250	15.8	5.0	10.2	3	15	21.7
	300	13.8	5.0	8.5	2	12	20.5

[0063] Additional results are also represented in the following table 2 for various coffee blends within an average particle size ranging of from about 160 microns to about 375 microns.

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Table 2

	Membrane [µm]	Coffee weight [g]	Product/Blend	sugar test (s)	$D_{4,3}$ [µm]	fines <89 in %	Flow [sec]	Yield %
Standard	30	5.0	Blend A 40g	16	372.86	17.77	16	23.3
	30	5.0	Decaffeinated 40g	16	245.09	21.32	19	20.5
	30	5.5	Decaffeinated Intense 40g	13	283.94	22.45	13	20.7
	30	5.5	Blend B 40g	16	240.16	24.46	15	26.9
Improved	30	5.0	Decaffeinated 40g	15.3	249.29	16.41	12.5	20.2
	30	5.0	Decaffeinated 40g	16.7	258.25	16.24	14.6	20.7
	30	5.0	Decaffeinated 40g	15	194.5	21.39	13.3	21.5
	30	5.0	Decaffeinated 40g	14.8	186.29	21.6	13.9	21.5
	30	5.5	Decaffeinated Intense 40g	15.2	282.32	15.15	12.2	20.3
	30	5.5	Decaffeinated Intense 40g	14.5	271.23	14.75	13	20.5
	30	5.5	Decaffeinated Intense 40g	15.5	215.54	19.82	11.8	21.7
	30	5.5	Decaffeinated Intense 40g	13.3	211.71	18.75	12.8	21.8
	30	5.0	Blend A 40g	16.5	337.27	12.75	13.2	22.3
	30	5.0	Blend A 40g	13.9	340.35	12.46	14.7	22.8
	30	5.0	Blend A 40g	19.3	308.08	14.06	12	22.9
	30	5.0	Blend A 40g	9.6	317.29	12.56	14.5	23.4
	30	5.5	Blend B 25g	14.9	161.98	28.21	17.5	26.6
	30	5.5	Blend B 25g	14.9	161.98	28.21	17.5	26.7

Example 8. Granulometry:

[0064] The particle size distribution was determined by laser diffraction using a "Mastersizer S" instrument from Malvern® equipped with a 1000mm optical lens. 1-2g of powder are dispersed in 1 litre of butanol and recirculated in front of the laser beam in order to obtain an obscuration between 15 and 20%. The particle size distribution is obtained by Fraunhofer approximation of the diffraction pattern. The complete experiment is repeated 3 times (or until the StDev < 5%) and the results are averaged.

Example 9. Sugar Test for crema measurements:

[0065] The mechanised sugar test device is composed of a small sugar-containing silo. The prismatic V-shape of this silo comprising a defined slit (2mm x 40mm) at the bottom edge can create a uniform sugar curtain as long as the slit is free and a minimum of sugar remains in the silo. This silo can be moved horizontally, with controlled speed (~40 mm/s) from one point "A" to a point "B" (distance between A and B is 20 cm). In the end position at both points a baffle prevents the sugar from flowing out if the device is in stand-by mode. When the silo is moved, the sugar curtain is produced all the way between the two points "A" and "B". The crema in a cup that is placed at 60 mm below this path within the two

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points will be topped with a uniform layer of sugar when the silo passes over it. The chronograph is started when the sugar layer is positioned on the foam's layer. The amount of sugar (a thickness of the layer to obtain a precise weight of 5 g of sugar) deposed in the cup is adjustable by varying the speed of the silo or the dimensions of the slit. The sugar is crystal sugar of $D_{4,3}$ equal to 660 microns.

[0066] A precise waiting period (20 sec. for small cups) must be observed between the end of extraction and the start of the sugar test.

[0067] The sugar layer remains some time on top of the crema. Later, when the main part of the sugar sinks suddenly the observing operator must stop the chronograph.

[0068] The "sugar test value" is the number of seconds shown by the chronograph.

Example 10. Extraction Yield:

[0069] The extraction yield is calculated by the relation:

$$\text{Yield (\%)} = M_e \times Tc/M_s$$

where M_e represents the weight of the coffee extract, and M_s represents the weight of the ground coffee contained in the capsule and Tc represents the percentage of total coffee solids in the coffee extract obtained after oven drying of the coffee extract.

Claims

1. Method for delivering a short coffee extract faster from a closed capsule containing ground coffee by injecting water under pressure within the capsule,
   wherein the capsule is filled with ground coffee and has a delivery membrane;
   wherein the capsule is extracted in a coffee extraction device and pressurized water is injected in the capsule under pressure;
   wherein the coffee beverage is released through the beverage delivery membrane of the capsule with engaging means engaging in and/or against the membrane;
   wherein the pressure loss is reduced in the coffee bed by providing in the capsule ground coffee having a controlled percentage of fines (F) depending on the average particle size ($D_{4,3}$) within the following limits:

   F is lower than 16% when $D_{4,3}$ is measured between 300 and 380 microns,
   F is lower than 18% when $D_{4,3}$ is between 250 and 299 microns,
   F is lower than 21% when $D_{4,3}$ is measured between 200 and 249 microns,
   F is lower than 28% when $D_{4,3}$ is measured between 150 and 199 microns, and wherein the extraction yield is maintained between 15 and 30%;

   wherein a coffee extract of 25 or 40 grams is delivered in a flow time of 20 seconds or less.

2. Method according to claim 1, wherein the pressure loss in the coffee bed is reduced by providing in the capsule ground coffee having a percentage of fines (F) depending on the particle size within the following limits:

   F is between 12 and 16% when $D_{4,3}$ is measured between 300 and 350 microns,
   F is between 14 and 18% when $D_{4,3}$ is measured between 250 and 299 microns,
   F is between 17 and 21% when $D_{4,3}$ is measured between 200 and 249 microns,
   F is between 22 and 28% when $D_{4,3}$ is measured between 160 and 199 microns.

3. Method according to claim 1 or 2, wherein the extraction yield (Y) is maintained between 18 and 30%.

4. Method according to claim 3, wherein the extraction yield (Y) is between 19 and 25%.

5. Method according to claim 3, wherein the capsule is filled with a coffee grinding having the average particle size is comprised between 190 and 300 microns.

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6. Method according to claim 3 or 4, wherein the capsule is filled with a coffee mass of from about 4.5 to 6 grams.

7. Method according to claim 6, wherein the capsule is filled with a coffee mass of about 5 grams.

8. Method according to any one of claims 4 to 7, wherein the flow time is reduced to less than about 15 seconds.

9. Method according to claim 5, 6 or 7, wherein the coffee extract has a crema which is stable at the sugar test for at least 10 seconds, preferably between 12 and 15 seconds.

10. Method according to any of the preceding claims wherein the pressure loss at the interface of the membrane/ engaging means is increased by selecting a membrane of a puncture resistance of at least 1.1 mJ.

11. Method according to any of the preceding claims wherein the pressure loss at the interface of the membrane/ engaging means is increased by selecting a membrane of a puncture resistance between 1.1 and 3.5 mJ.

12. Method according to any of the preceding claims, wherein the pressure loss at the interface of the membrane/ engaging means is increased by selecting a membrane made of aluminium of a thickness comprised between 26 and 40 microns.

13. Method according to any of the preceding claims, wherein the level of fines is controlled by having coffee beans ground before the filling in the capsule using a grinder comprising at least one pair of radially corrugated rolls in the fine grinding section.

14. Method according to any of the preceding claims, wherein water pressure of extraction reaches a value higher than 11 bar at the injection side.

15. Method according to any of the preceding claims, wherein the ground coffee is not compacted in the capsule after filling.

16. Method according to claim 15, wherein the ground coffee is densified before filling or is filled loose.

17. Method according to any of the preceding claims, wherein the membrane is torn against engaging means by effect of the pressure of extraction for release of the coffee extract our of the capsule.

18. Method according to claim 17, wherein the engaging means comprises a plurality of reliefs.

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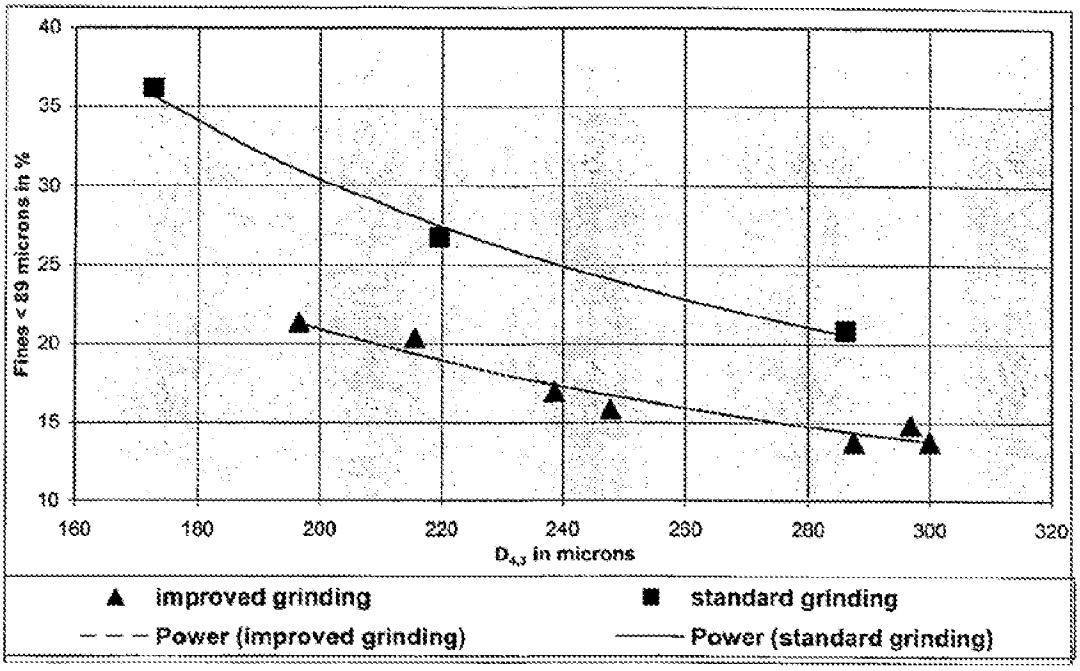


FIG. 1

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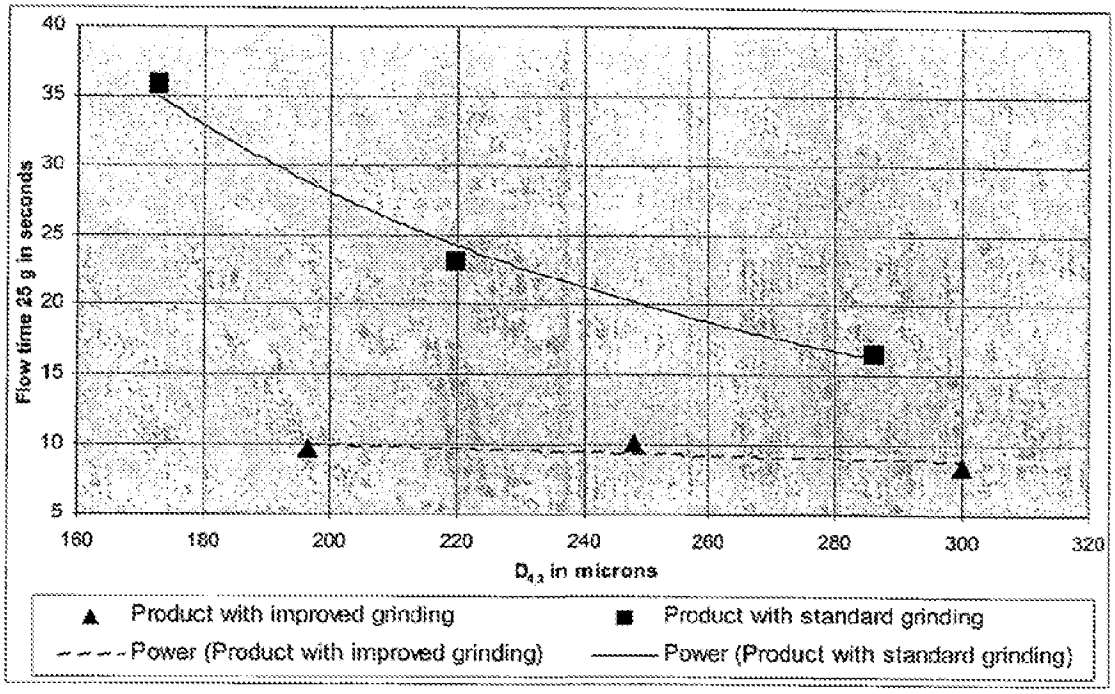


FIG. 2

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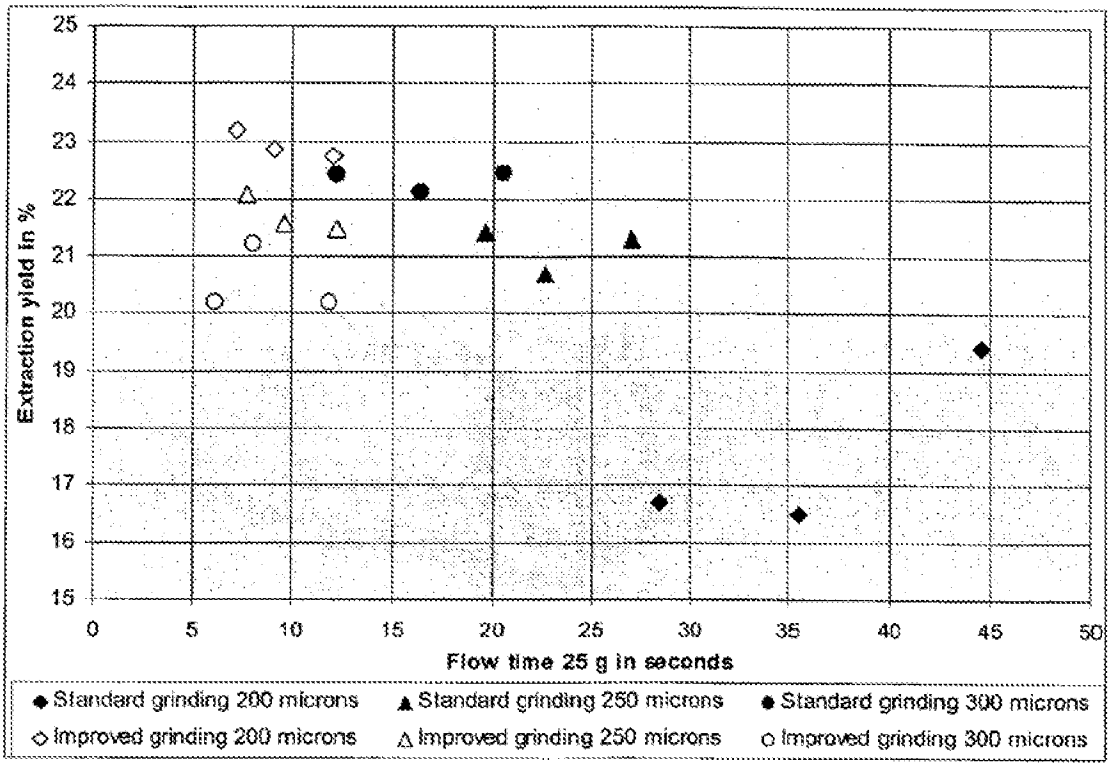


FIG. 3

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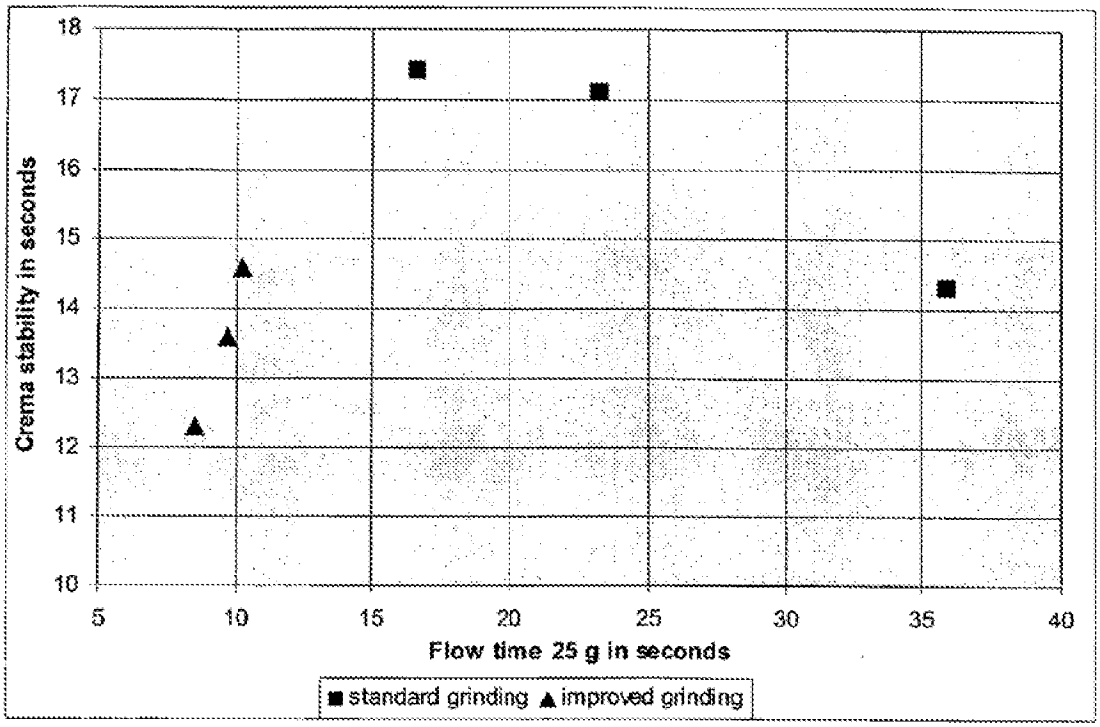


FIG. 4

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Nespresso USA, Inc. Ex. 1002 Part 3
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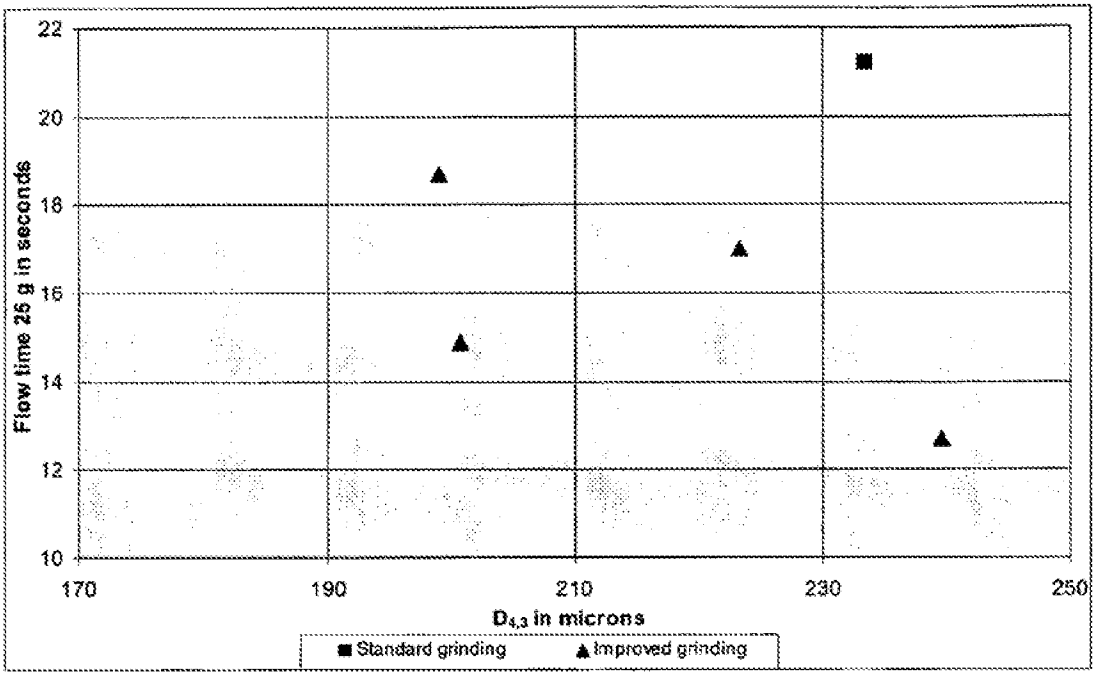


FIG. 5

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Nespresso USA, Inc. Ex. 1002 Part 3
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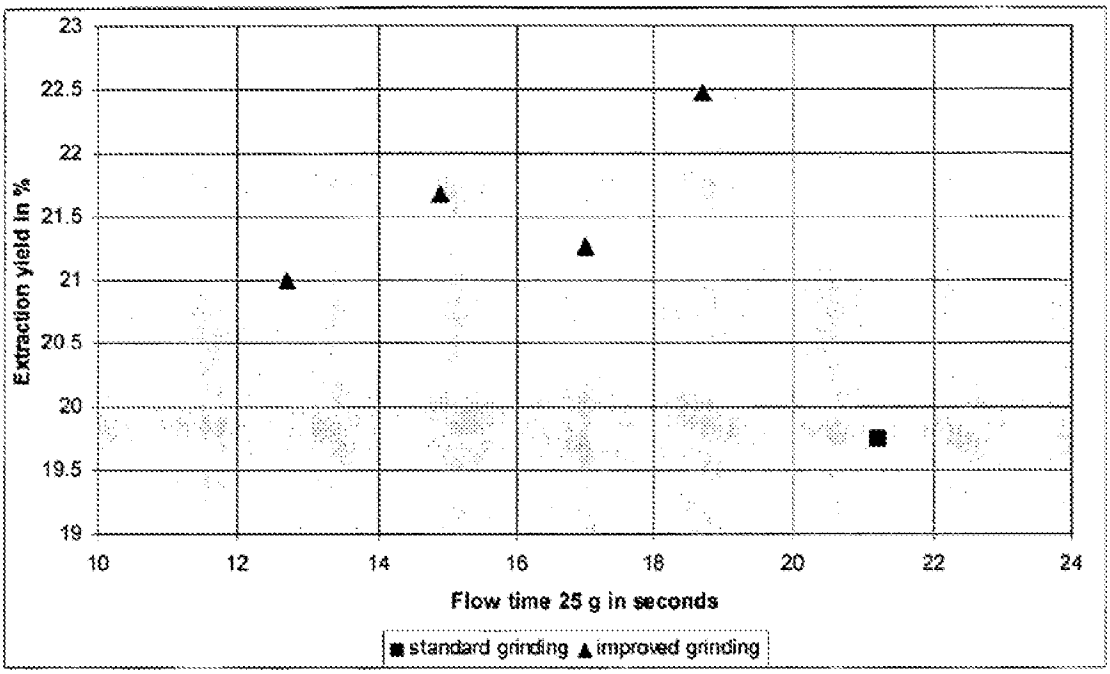


FIG. 6

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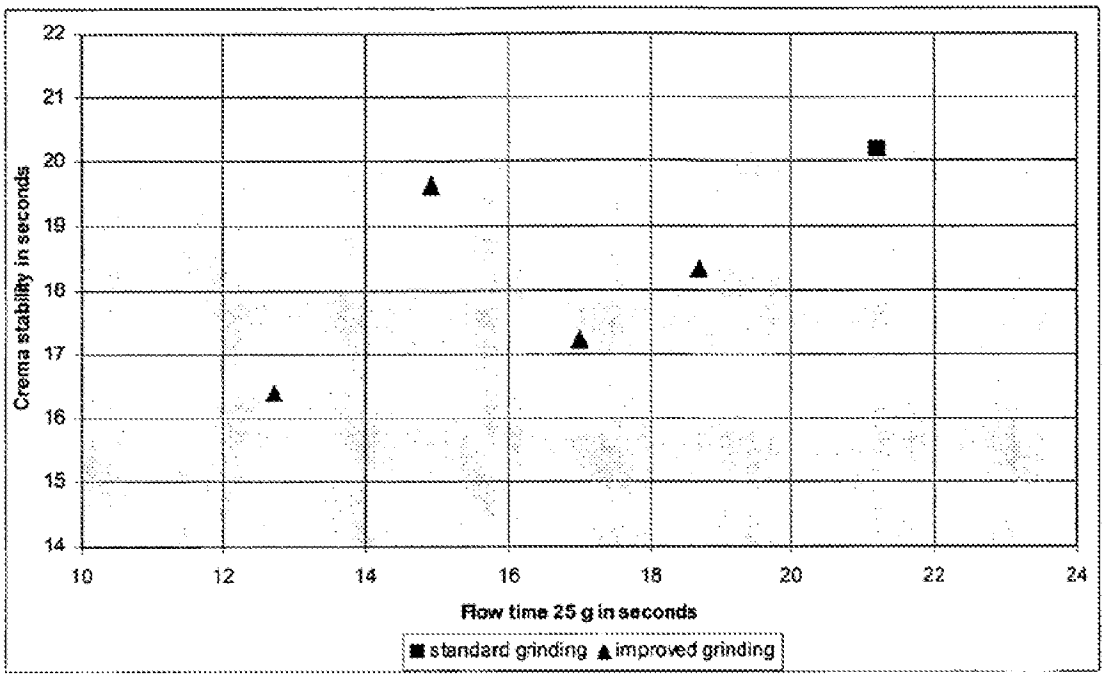


FIG. 7

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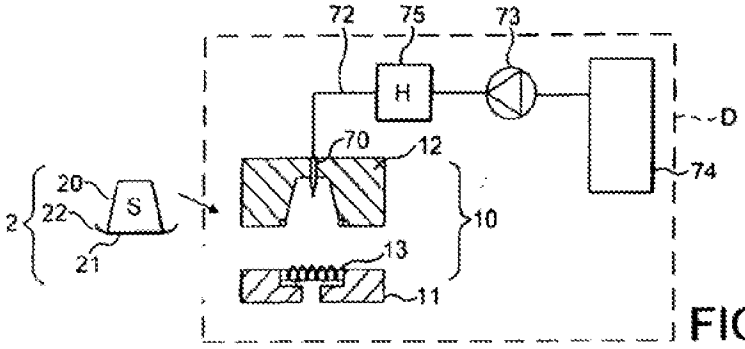


FIG. 8

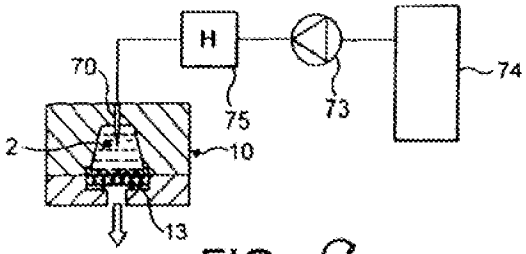


FIG. 9

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 01 5331

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 566 127 A2 (NESTEC SA [CH]) 24 August 2005 (2005-08-24) * abstract; figure 1 * -----	1-18	INV. A47J31/40 A23F5/08
A	EP 0 844 195 A1 (NESTLE SA [CH]) 27 May 1998 (1998-05-27) * claim 1; example 1 * -----	1-18	
A	US 5 082 676 A (LOVE GRAHAM [DE] ET AL) 21 January 1992 (1992-01-21) * examples 1-10 * -----	1-18	

TECHNICAL FIELDS SEARCHED (IPC)

A47J
A23F
B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 December 2006	Saunders, Thomas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 01 5331

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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20-12-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1566127 A2	24-08-2005	NONE	
EP 0844195 A1	27-05-1998	AT 207443 T	15-11-2001
		DE 69616346 D1	29-11-2001
		DE 69616346 T2	18-04-2002
US 5082676 A	21-01-1992	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1566127 A2 **[0035] [0060]**

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Nespresso USA, Inc. Ex. 1002 Part 3
Page 345 of 429

(12) UK Patent Application (19) GB (11) 2469874 (13) A

(43) Date of A Publication 03.11.2010

(21) Application No: 0907612.6

(22) Date of Filing: 01.05.2009

(51) INT CL:
A47J 31/06 (2006.01) *A47J 31/24* (2006.01)

(58) Documents Cited:
EP 1208781 A3
WO 2006/053016 A3
WO 2009/008700 A1
US 20060288874 A1

(58) Field of Search:
INT CL A47J
Other: EPODOC, WPI

(71) Applicant(s):
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Three Lakes Drive, Northfield, Illinois 60093, United States of America

(72) Inventor(s):
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Andrew Bentley
Elizabeth Hinckley
Mark Norton

(74) Agent and/or Address for Service:
Boult Wade Tennant
Verulam Gardens, 70 Gray's Inn Road, LONDON, WC1X 8BT, United Kingdom

(54) Title of the Invention: **Beverage preparation machines**
Abstract Title: **Beverage preparation machine for producing crema**

(57) A beverage preparation machine 10 for preparing a beverage from one or more beverage ingredients, characterised by the provision of means for controlling the volume of gas or air in at least part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage. The volume of gas may be controlled by inducting additional gas into the delivery system 10, venting gas from the delivery system 10 or purging the delivery system 10. The control system can calculate the volume of gas resident in the machine. By controlling the gas to liquid ratio a high quality crema can be achieved.

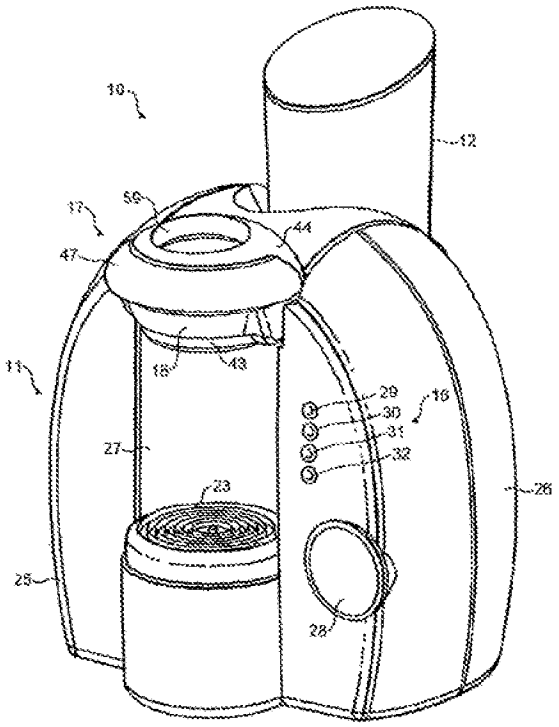


FIG. 1

GB 2469874 A

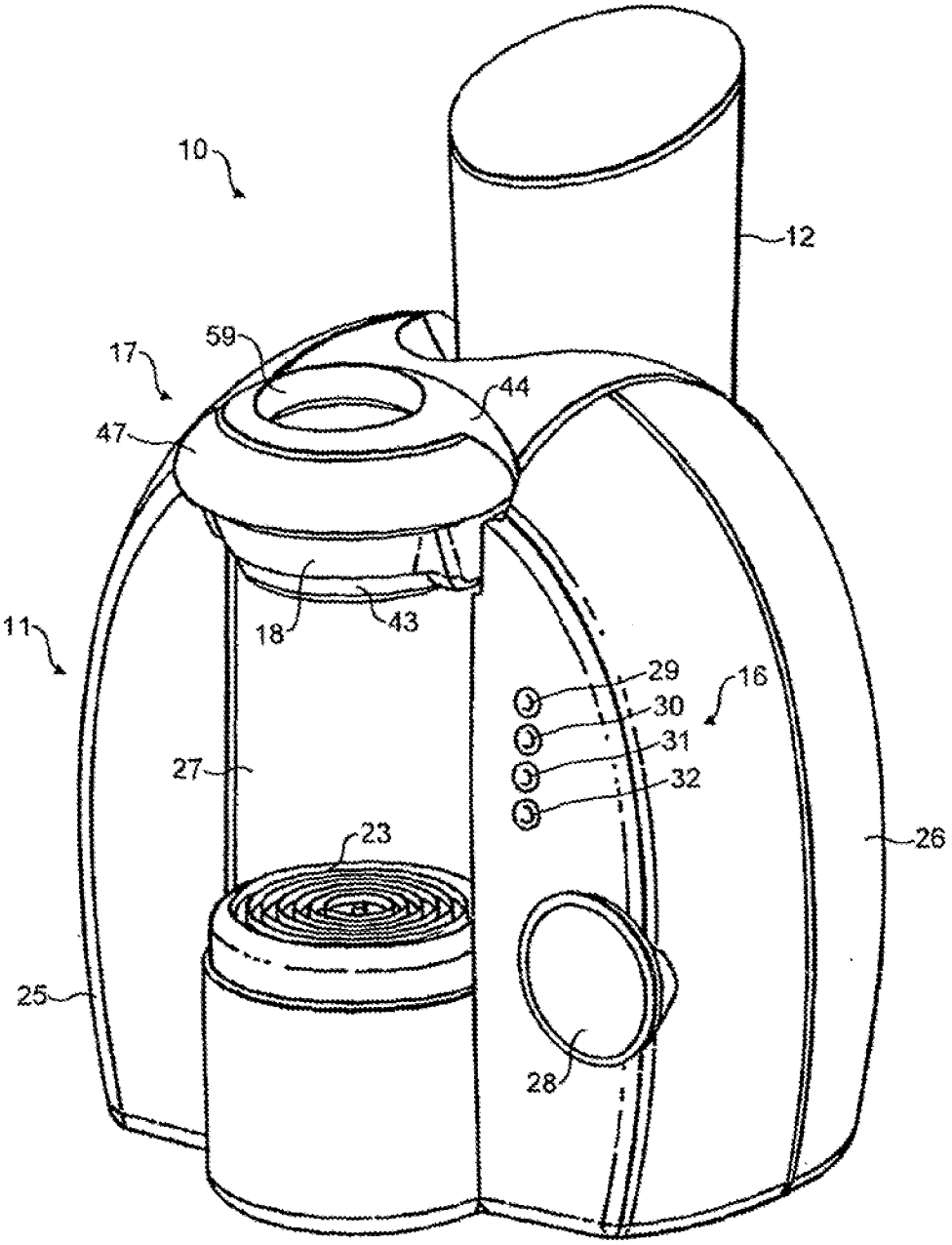


FIG. 1

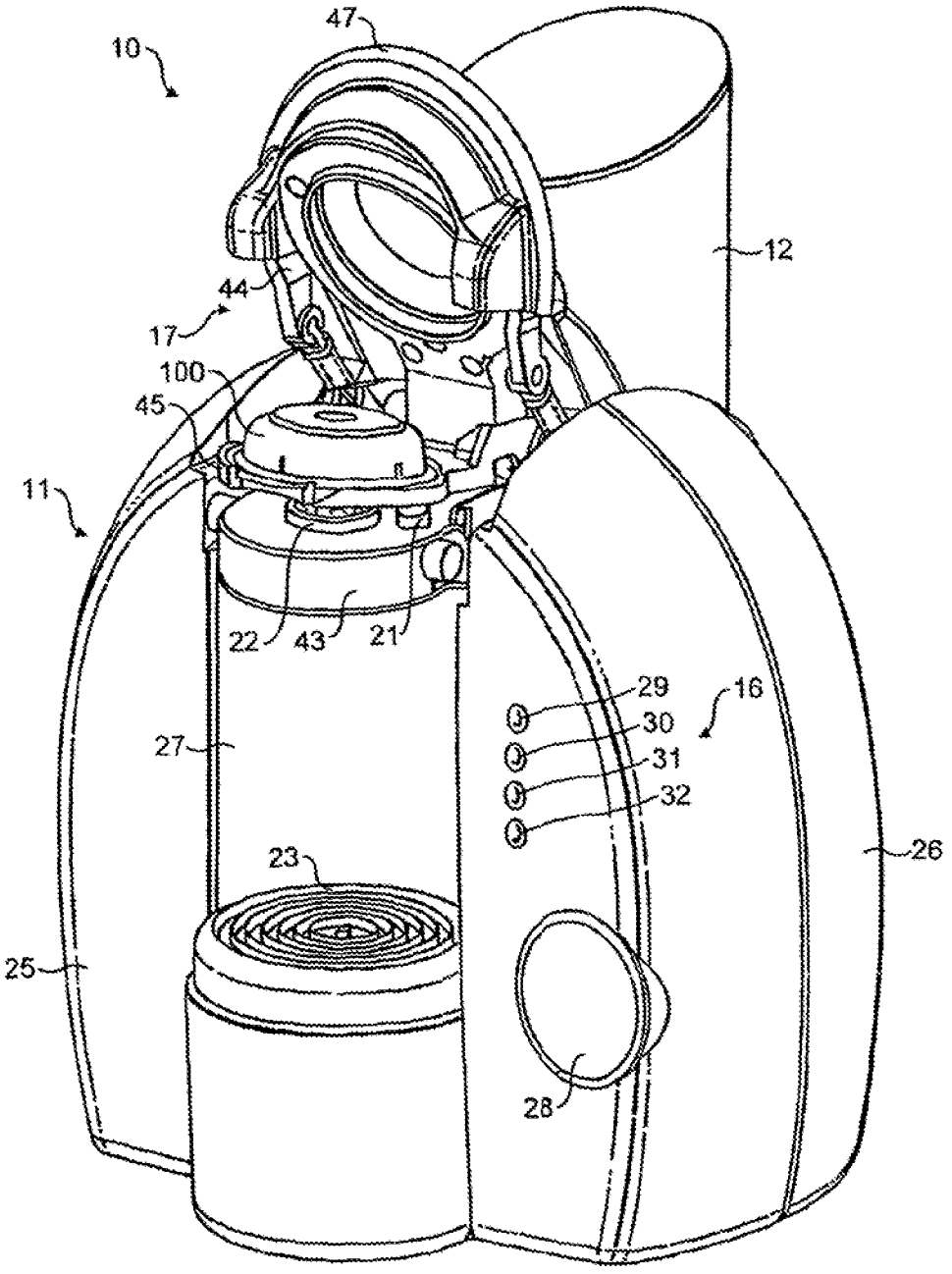


FIG. 2

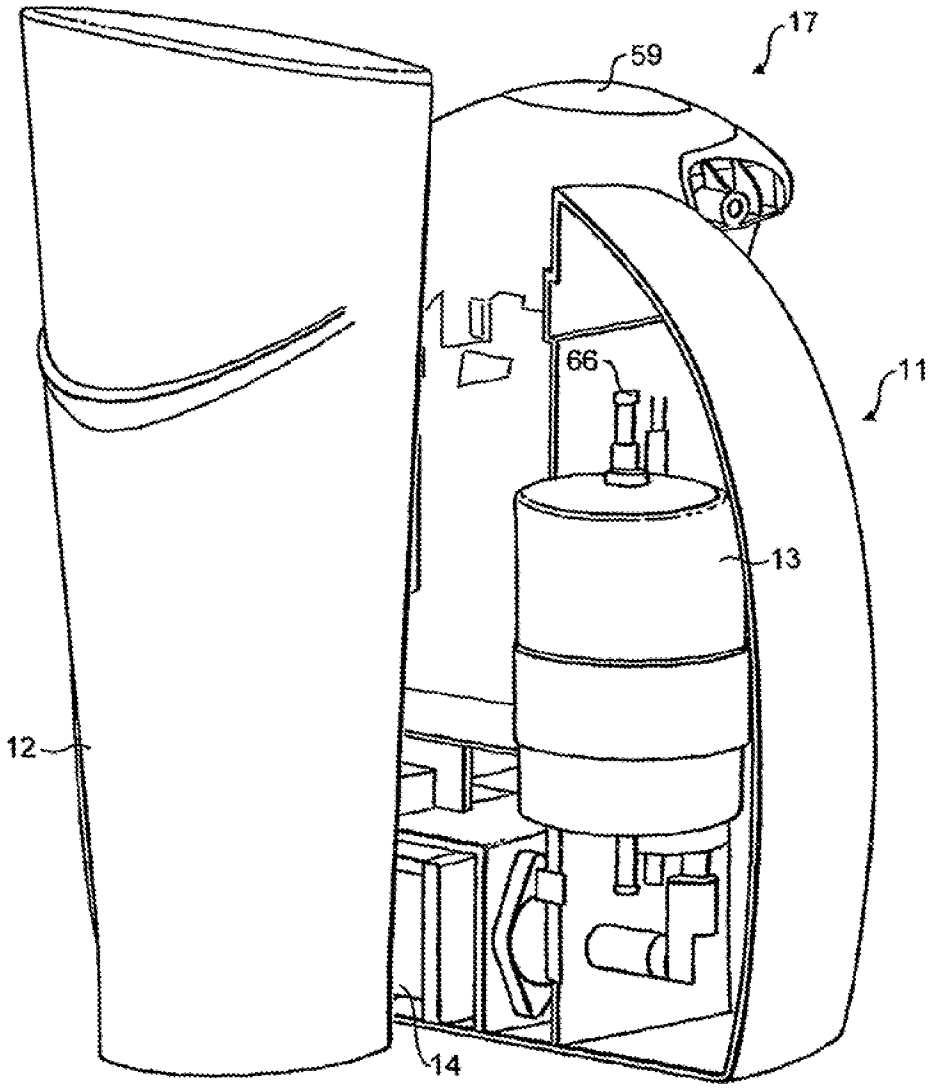


FIG. 3

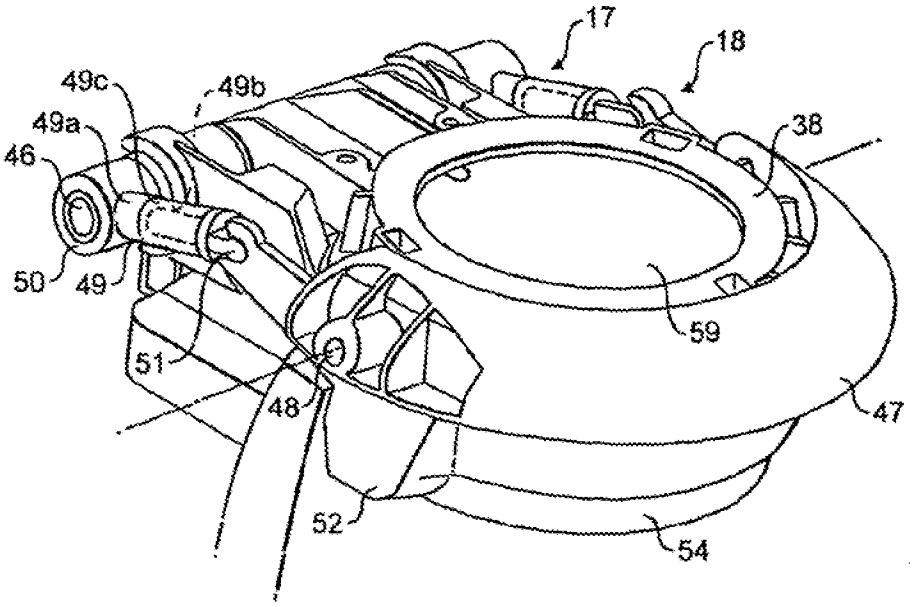

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FIG. 4

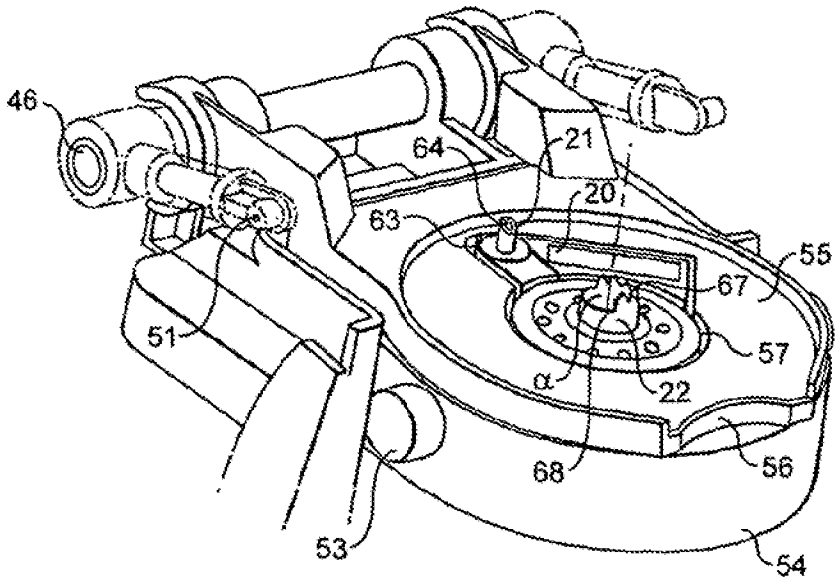

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FIG. 5

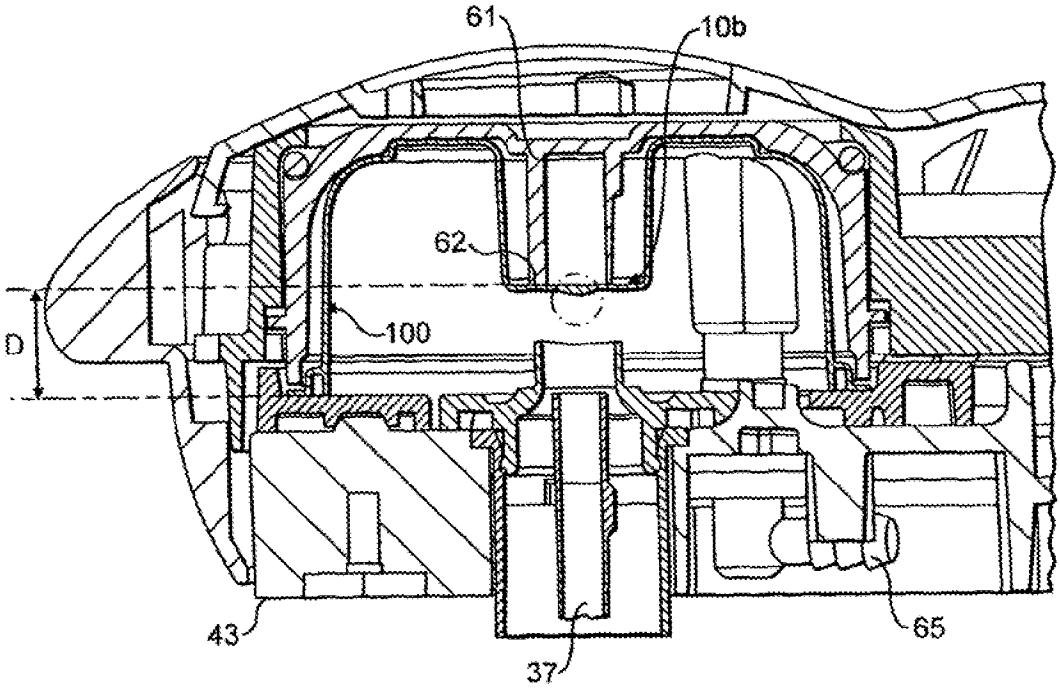


FIG. 6

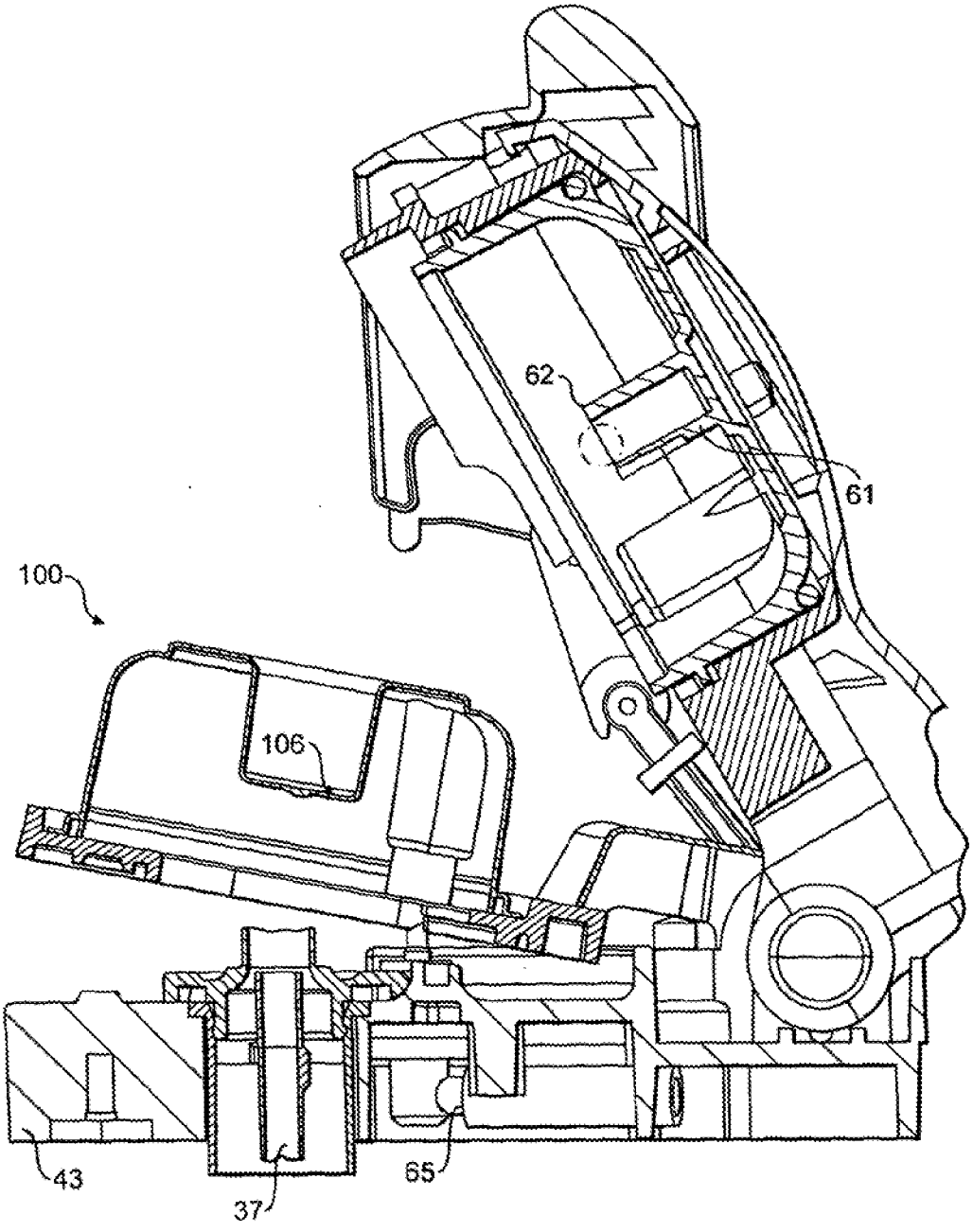


FIG. 7

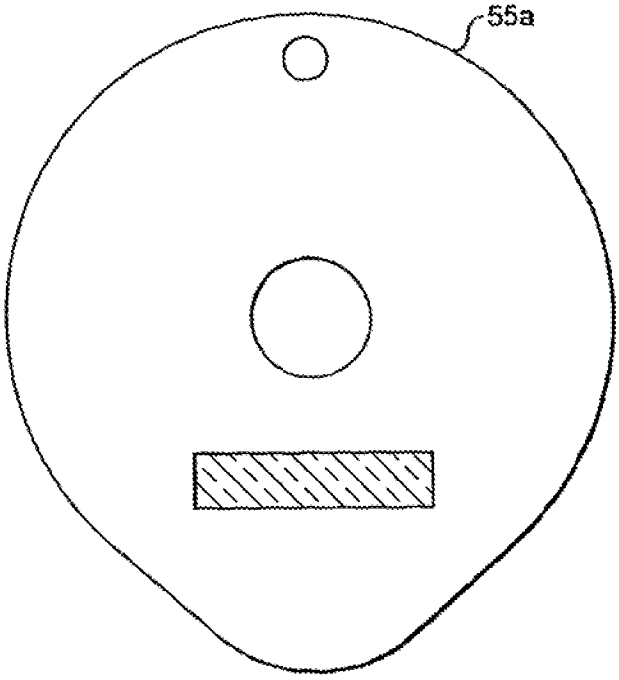


FIG. 7a

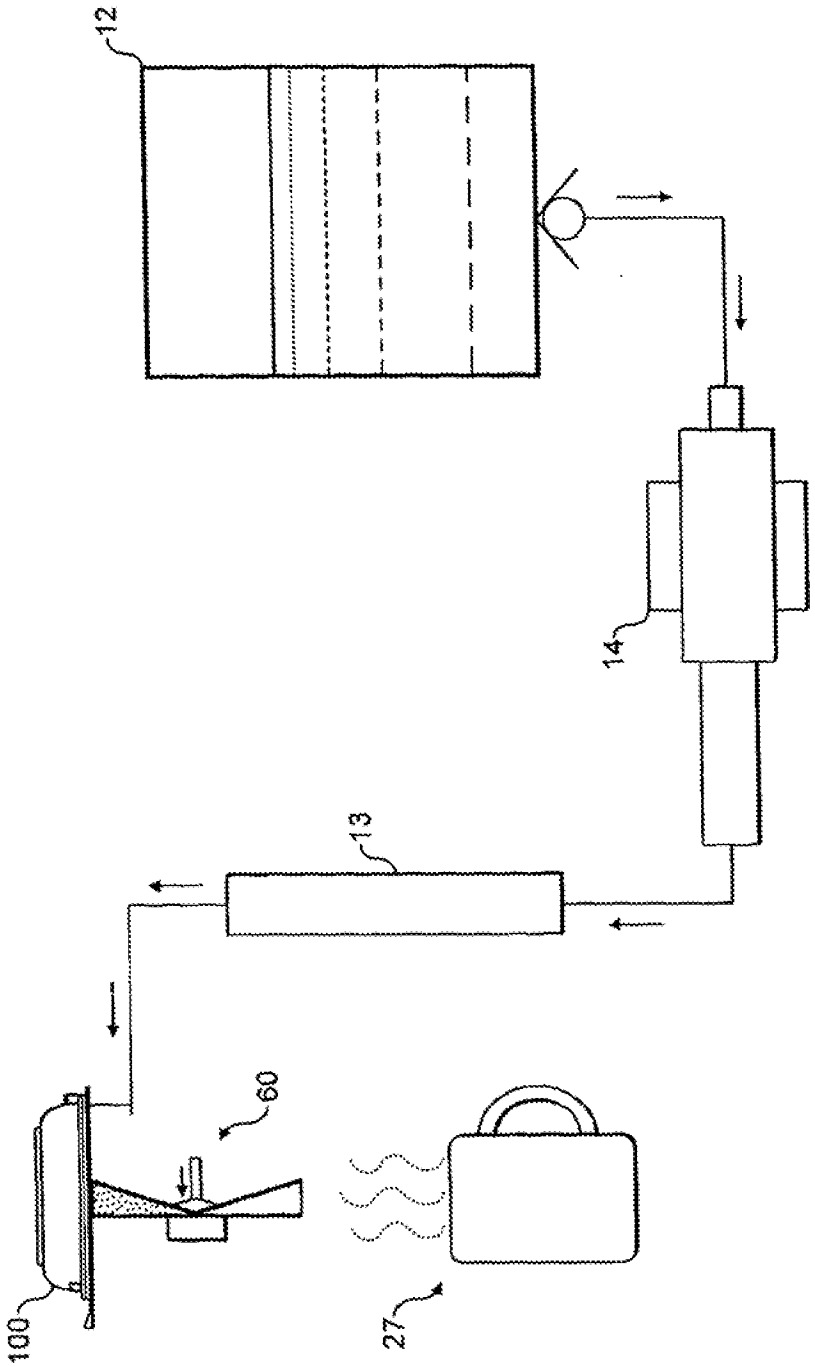


FIG. 8

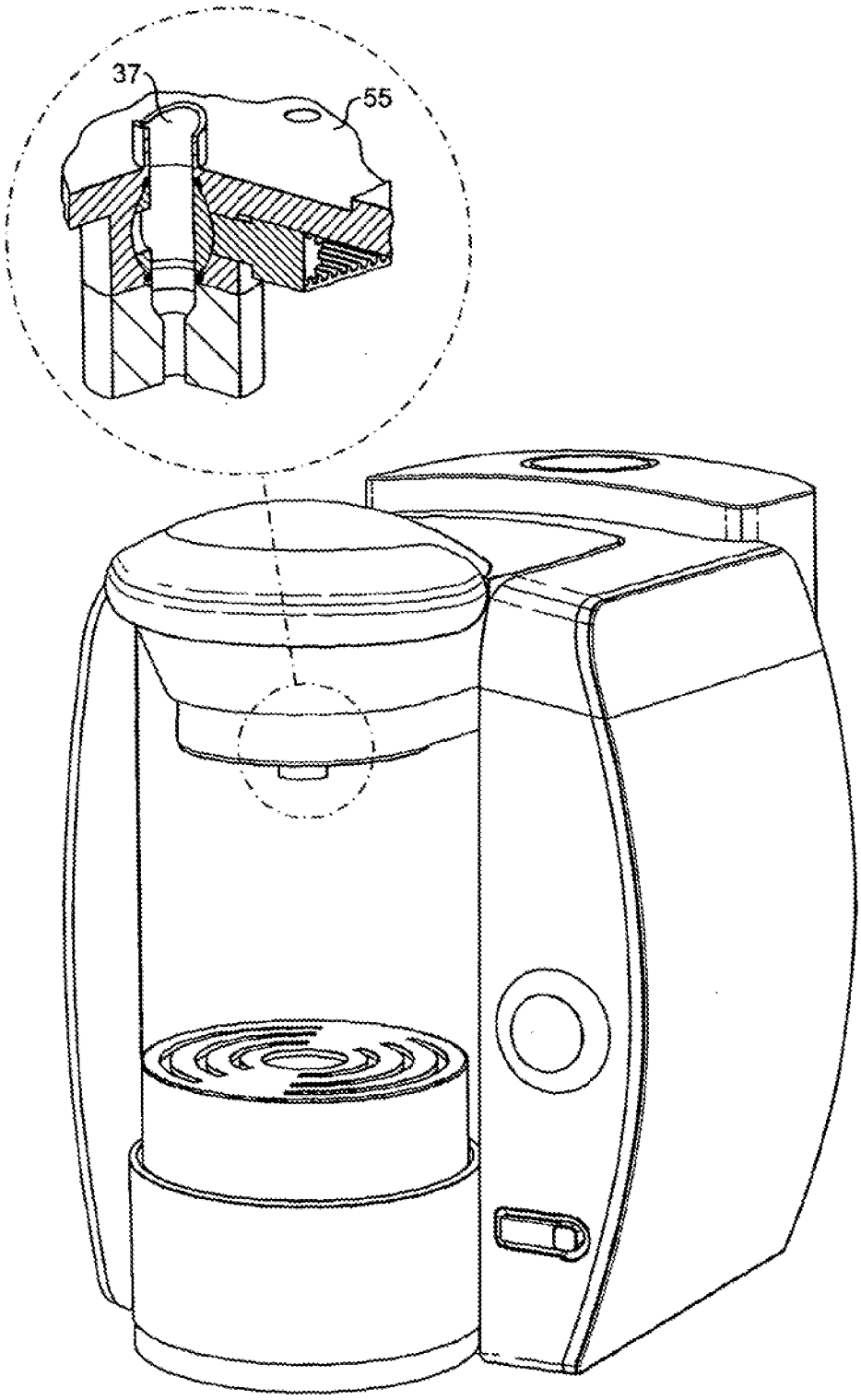


FIG. 9

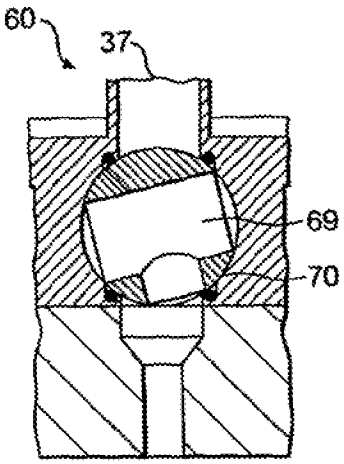


FIG. 10

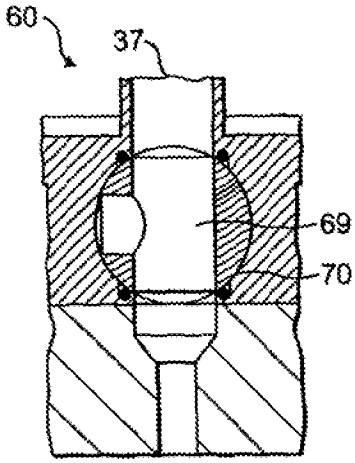


FIG. 11

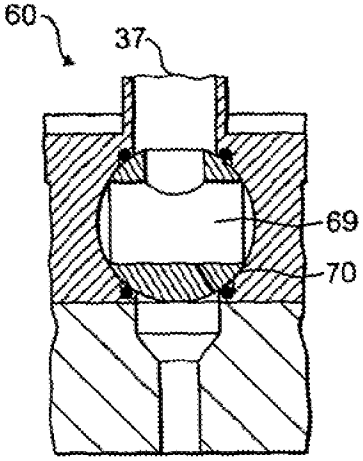


FIG. 12

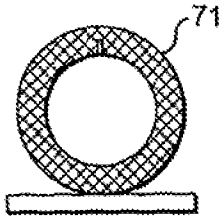


FIG. 13a

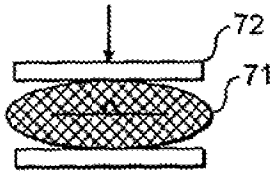


FIG. 13b

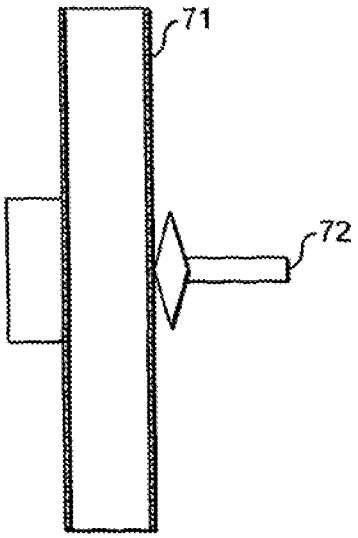


FIG. 14

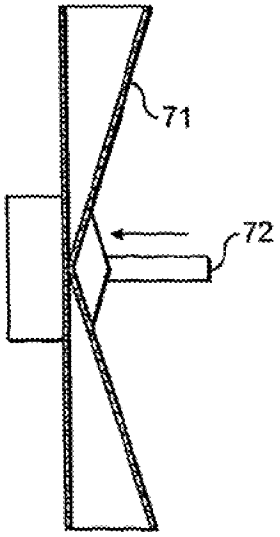


FIG. 15

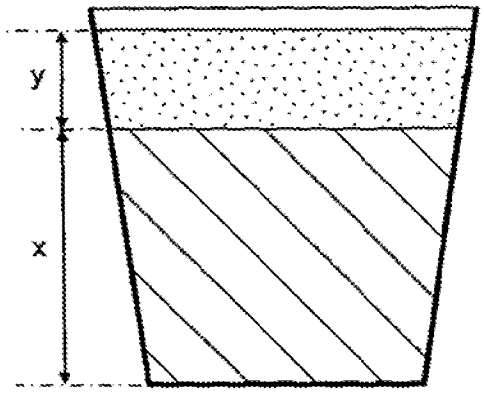


FIG. 16a

STEP	WATER PUMP STATE/SPEED	AIR PURGE PUMP/PWM	RECIRCULATION VALVE STATE	RESTRICTION BYPASS VALVE STATE	STOP CONDITION/DURATION OF STEP
Set valves	No change/0	Stop/0	Recirculate	Open	Time >=1 second
Heat	Stop/0	Stop/0	Recirculate	Open	Boiler temperature >=97°C
Set valves	No change/0	No change/0	Brew	Open	Time >=1 second
Remove gas	Run/50	No change/0	No change	Open	Time >=2 seconds
Set valves	Stop/0	No change/0	No change	Closed	Time >=5 seconds
Pressure wet	Run/100	No change/0	No change	No change	Disc inlet pressure >=2 bar
Soak	Stop/0	No change/0	No change	No change	Time >=10 seconds
Brew	Run/30	Stop/0	No change	No change	Time >=32 seconds
Stop pump	Stop/0	Stop/0	No change	No change	Time >=0.5 seconds
Open purge	Stop/0	Stop/0	No change	Open	Time >=3 seconds
Pause	No change/0	No change/0	No change	Open	Time <=1 seconds
Air purge	Stop/0	Run/50	No change	Open	Time >=8 seconds
Pause	Stop/0	Stop/0	Recirculate	No change	Time >=2 seconds
Reset	Stop/0	Stop/0	Recirculate	Closed	Time >=0 seconds

FIG. 16b

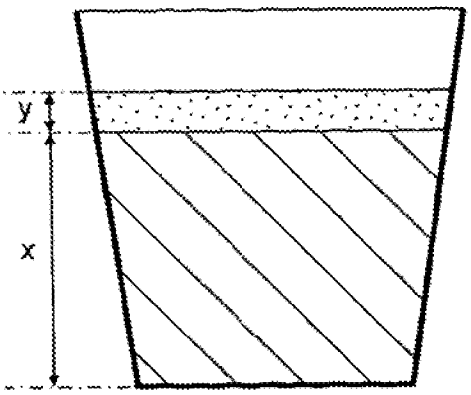


FIG. 17a

STEP	WATER PUMP STATE/SPEED	AIR PURGE PUMP/PWM	RECIRCULATION VALVE STATE	RESTRICTION BYPASS VALVE STATE	STOP CONDITION/DURATION OF STEP
Set valves	No change/0	Stop/0	Recirculate	Open	Time >=1 second
Heat	Stop/0	Stop/0	Recirculate	Open	Boiler temperature >=97°C
Set valves	No change/0	No change/0	Brew	Open	Time >=1 second
Remove gas	Run/70	No change/0	No change	Open	Time >=8 seconds
Set valves	Stop/0	No change/0	No change	Closed	Time >=5 seconds
Pressure wet	Run/100	No change/0	No change	No change	Disc inlet pressure >=2 bar
Soak	Stop/0	No change/0	No change	No change	Time >=10 seconds
Brew	Run/30	Stop/0	No change	No change	Time >=32 seconds
Stop pump	Stop/0	Stop/0	No change	No change	Time >=0.5 seconds
Open purge	Stop/0	Stop/0	No change	Open	Time >=3 seconds
Pause	No change/0	No change/0	No change	Open	Time <=5 seconds
Air purge	Stop/0	Run/50	No change	Open	Time >=8 seconds
Pause	Stop/0	Stop/0	Recirculate	Open	Time >=2 seconds
Reset	Stop/0	Stop/0	Recirculate	Open	Time >=0 seconds

FIG. 17b

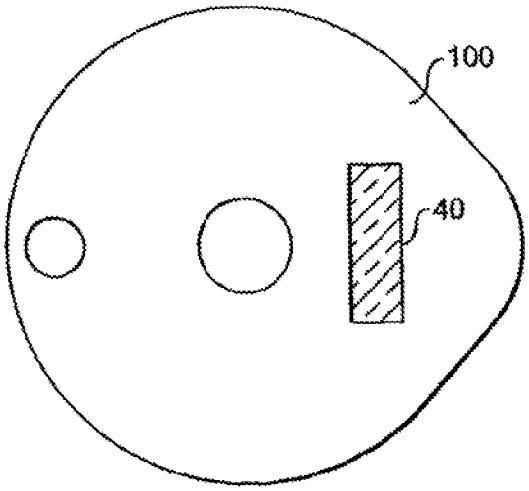

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FIG. 18

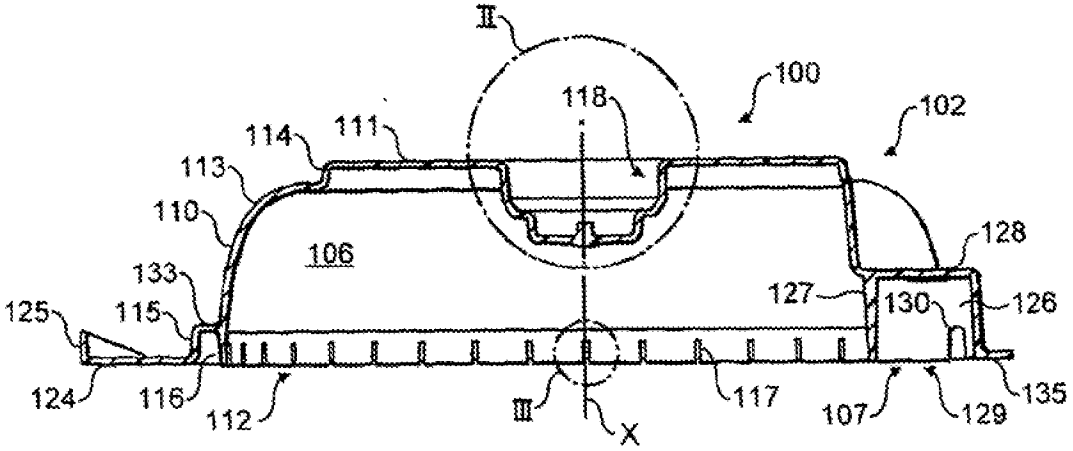

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FIG. 19

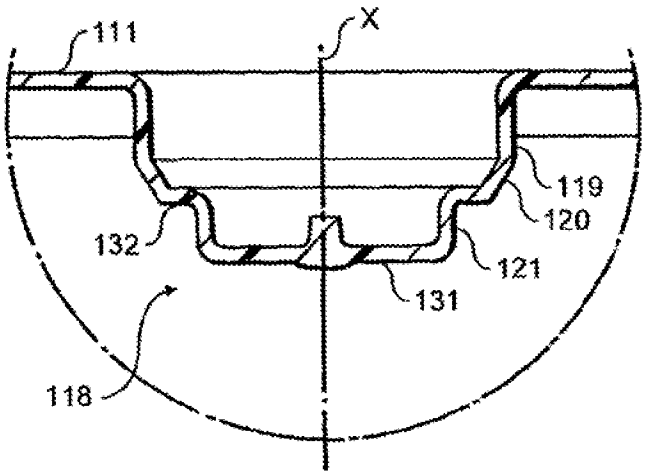


FIG. 20

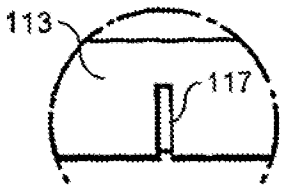


FIG. 21

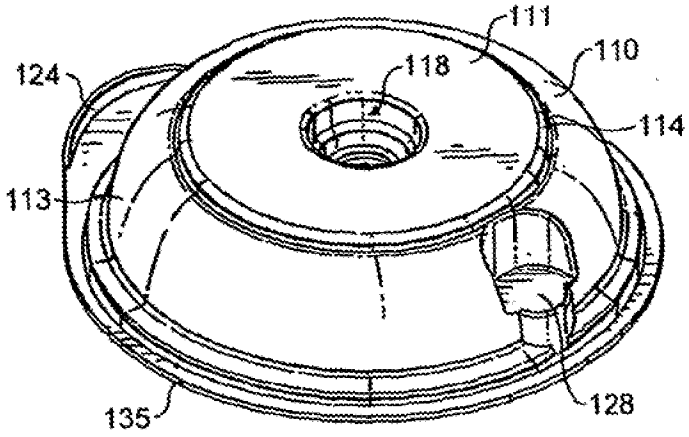


FIG. 22

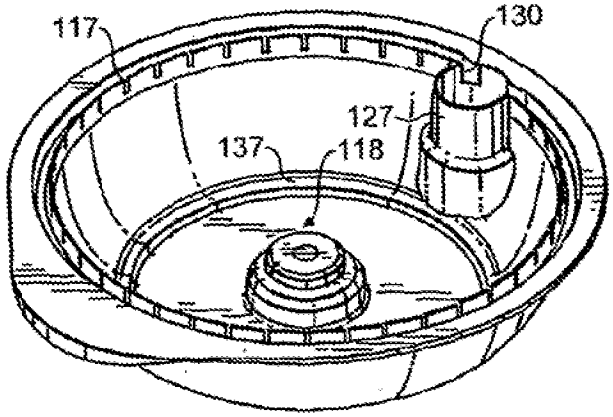


FIG. 23

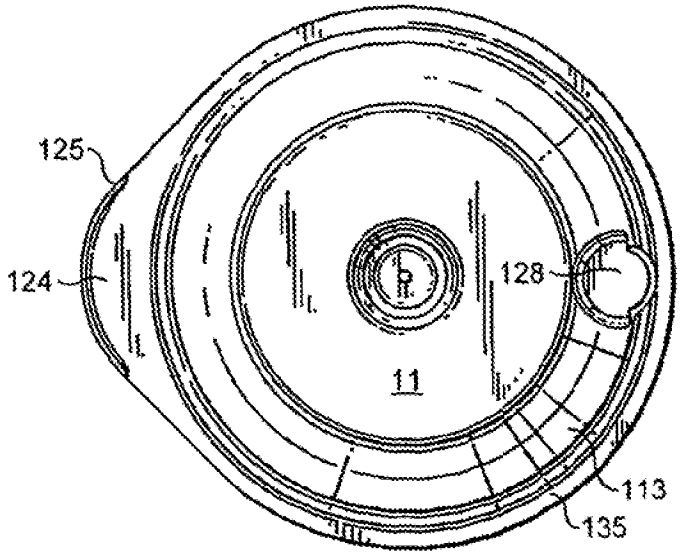


FIG. 24

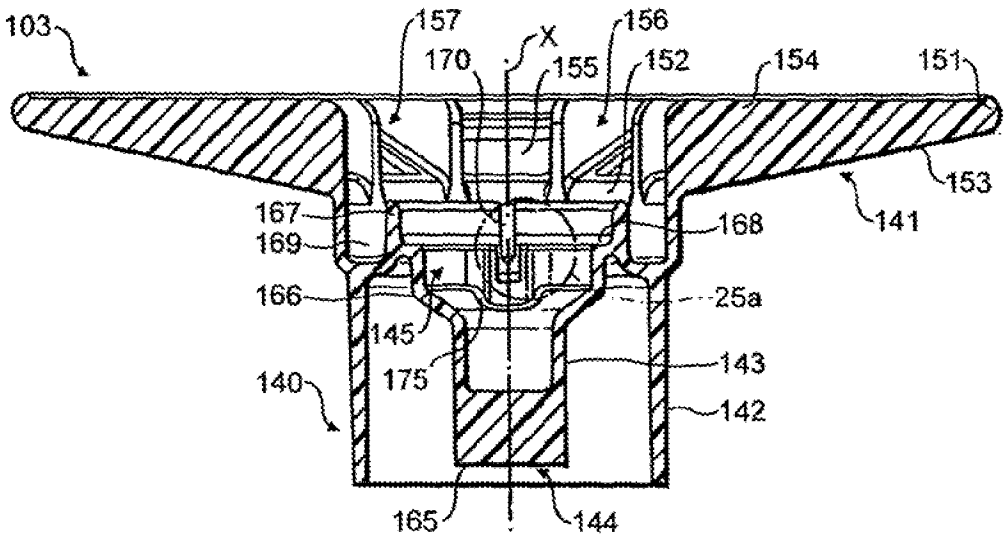


FIG. 25

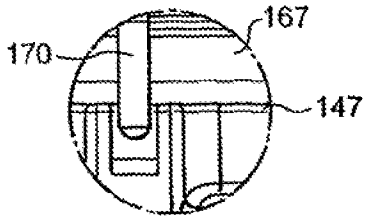


FIG. 25a

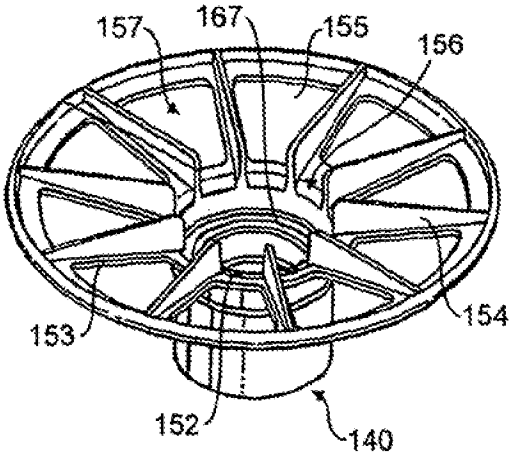


FIG. 26

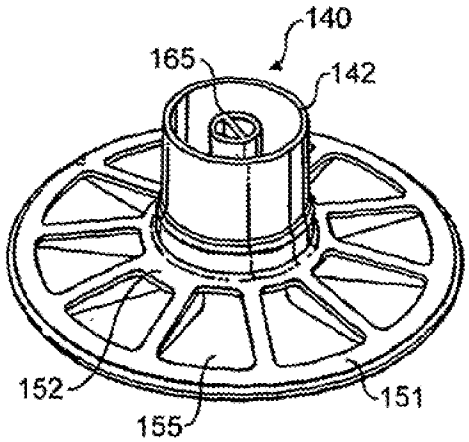


FIG. 27

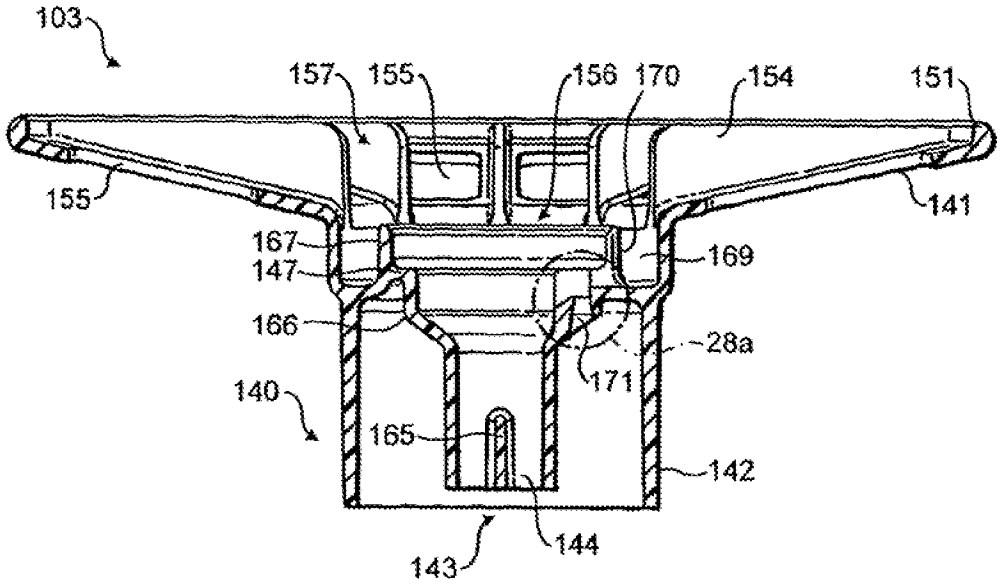


FIG. 28

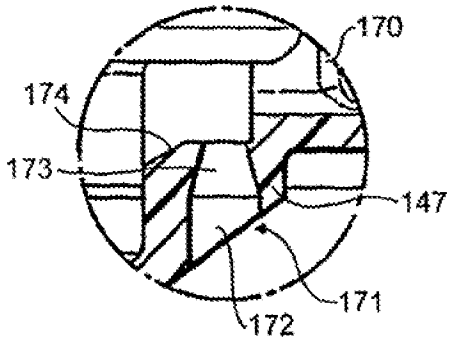


FIG. 28a

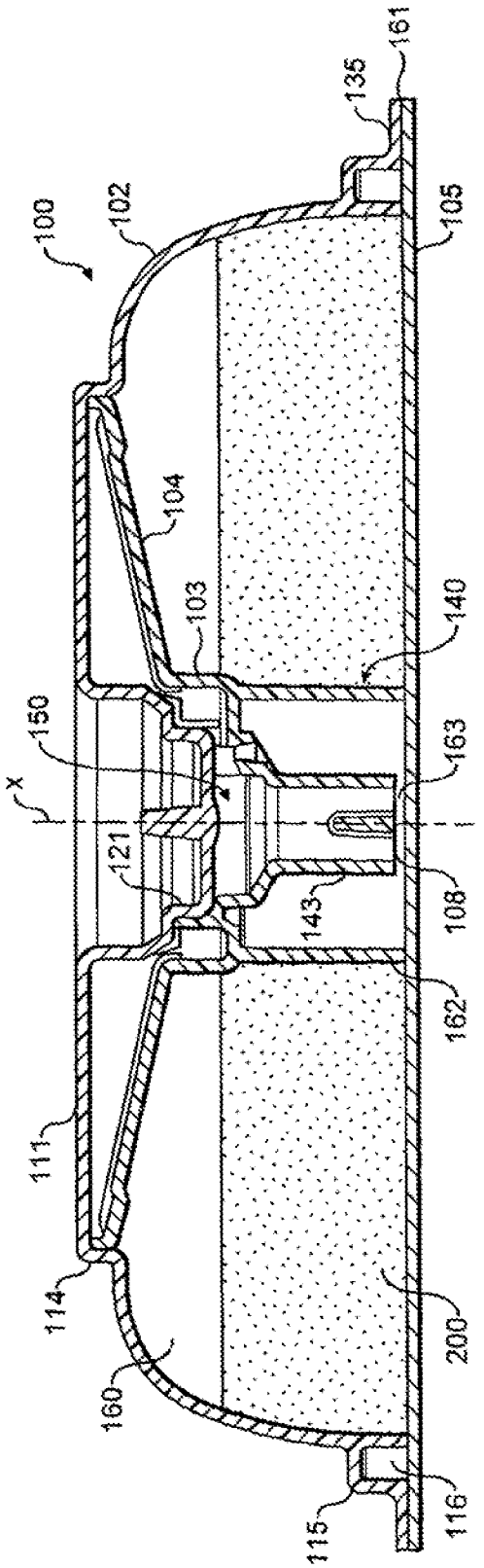

161
135
100
102
105
104
103
140
150
163
X
121
143
108
162
111
114
200
160
115
116

FIG. 29

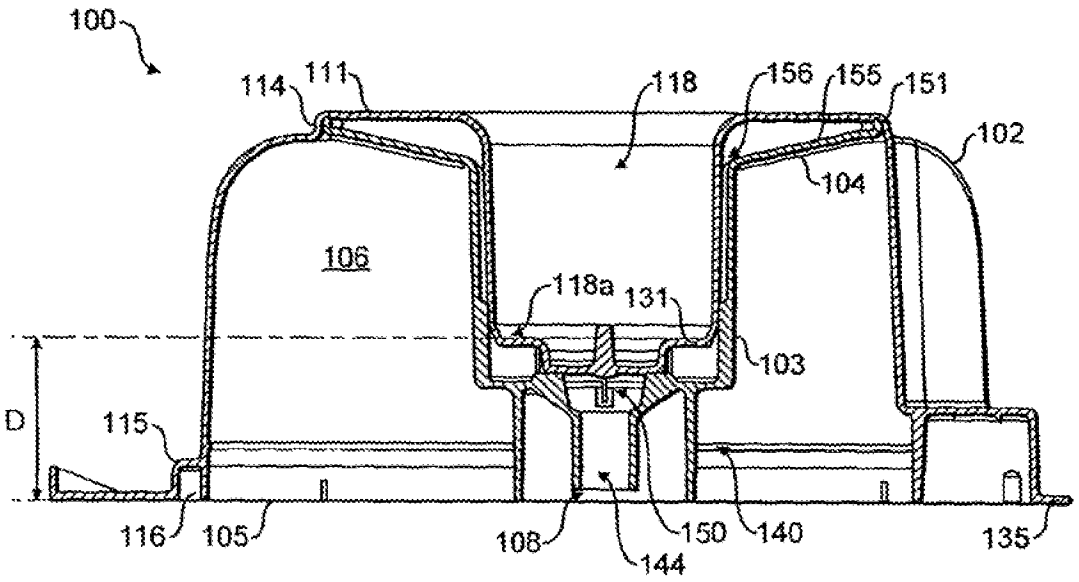

100
114
111
118
156
155
151
102
104
106
118a
131
103
D
115
116
105
108
144
150
140
135

FIG. 30

BEVERAGE PREPARATION MACHINES

The present invention relates to improvements in beverage preparation machines and in particular to a beverage preparation machine of the type which uses pre-packaged containers of beverage ingredients.

Coffee houses have been a part of the "coffee culture" since the 17th century. Throughout the years methods of making coffee have been refined and skilled people trained to produce the best coffee beverages. The first coffee machines were developed in the early 1800s and an automatic espresso machine was invented in the 1930s. The automation of the coffee making process has, in turn, lead to a rapid growth, particularly in the last ten years, in the number of coffee houses/shops with more specialist drinks, such as espresso and cappuccino, being in high demand. These types of beverages have historically been regarded as luxury items because of the need for expensive, complex machines capable of producing the high pressures necessary for making them, which had to be properly operated and maintained by a trained barista to produce good quality. Coffee aficionados agree that an espresso can be spoiled by a badly trained operator despite the use of a good quality machine and good quality coffee. This trend, however, has not only lead to an increased demand from consumers for luxury top quality beverages, but also a desire for a greater variety of speciality beverages, and the ability to make such beverages in the comfort of one's own home.

Although there is no agreed technical definition, it is generally understood that, compared to drip coffee, barista quality espresso has a thicker consistency, due to a higher amount of dissolved solids and fine oil droplets suspended throughout the drink. It has a smooth, yet thick, dark reddish brown crema making up 10 to 30% of the beverage. The crema is a polyphasic emulsion of air and the oils, proteins and sugars extracted from the coffee which is produced at a high pressure, traditionally in the region of 9 to 10 bar. The higher pressures increase the rate of coffee wetting and improve extraction as well as being responsible for the development of the crema.

It is acknowledged, by discerning espresso drinkers, that espresso produced using water which is cooler than the optimum temperature tastes sour and that produced with water which is hotter than this temperature tastes bitter. The optimum temperature is claimed to be between 92 and 96°C. Other factors which affect the quality of the espresso include the roasting and age of the coffee beans, the grind size, the compaction of the grinds prior to brewing, and the brew time. The "best" espresso is achieved by balancing these key elements of the brewing process.

Domestic coffee machines have also developed significantly since the first filter machines were invented in the 1960s and coffee machines are now essential pieces of kitchen equipment in many households. Some such machines dispense individual servings of a beverage directly into a drinking receptacle, and derive the beverage from a bulk supply of beverage ingredients or from individual packages

of beverage ingredients such as pods, pads or cartridges. In the following specification such packages will be referenced by the general term cartridges. Machines which use such cartridges eliminate the need for cleaning and can enable the user to make a selection of beverages. An example of one type of such cartridge is described in EP-A-1440903. The beverages are formed from brewing, mixing, dissolving or suspending the beverage ingredients in water. For example, for coffee beverages, heated water is forced through the cartridges to form the extracted solution. The use of cartridges in such machines has become increasingly popular due to their convenience and the quality of the beverage produced.

An example of a machine for preparing beverages using this type of cartridge is described in EP-A-1440644. This type of machine provided, inter alia, an improvement over the prior art known at the time in that it operated at a lower pressure than the previously known machines, which were designed for the commercial or industrial markets rather than the domestic market. Hence it was more suitable for the domestic market in terms of cost, reliability and performance. However, the problem that faces systems that operate at a lower pressure is that they are generally not capable of producing barista quality espressos, which require a significantly higher pressure.

With the change in consumer trends, however, there is a desire for domestic machines which are capable of producing barista quality espresso and a range of other beverages,

for which no training is necessary, which are affordable and which require little or no cleaning.

Some machines available on the market claim to produce higher quality beverages but for various reasons, they are comparatively expensive machines. Examples of such machines are the Gaggia L'Amante ™, the Gaggia Evolution ™, the Nespresso Delonghi Latissimma 660 ™, and the Krups XN2101 ™.

Most of these machines require specially designed cartridges of increased complexity and a particular specification of materials to cope with the high pressures involved in the brewing process for espresso. These cartridges generally incorporate filters and the process uses the geometry of the cartridge to enable the desired quality of the beverage to be produced under high pressure. This constrains the use of the cartridges in the machine for which it is designed.

It is, however, desirous to provide an improved beverage preparation machine capable of making a selection of beverages, including a premium quality espresso as well as non-espresso beverages, preferably using pre-packed beverage cartridges. The machine may also be a bulk brewer or other non-cartridge machine

It is also desirous to provide a machine which is backwardly compatible with existing cartridges, such as those described in EP-A-1440903, which are used in existing low pressure beverage preparation machines.

Accordingly, the present invention provides a method of preparing beverages using a beverage preparation machine for preparing beverages from one or more beverage ingredients, characterised by controlling the volume of gas in at least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

The volume of gas is preferably actively controlled by increasing the volume to increase the gas:liquid ratio in the beverage produced, decreasing the volume to decrease the gas:liquid ratio or maintaining the volume.

Preferably the volume of gas in the delivery system is controlled by inducting additional gas into the delivery system, venting gas from the delivery system and/or purging the delivery system.

The method preferably further comprises the step of measuring the actual volume of gas resident in the delivery system.

An actual volume of gas resident in the delivery system may be calculated from stored parameters relating to a volume of gas remaining in the delivery system after a last operation of the machine.

Control of the volume of gas is preferably effected on a beverage by beverage basis and is preferably effected automatically according to the type of beverage being produced.

Alternatively the control of the volume of gas is effected manually.

The volume of gas upstream and/or downstream of the beverage ingredients may be controlled.

Preferably the volume of gas is controlled by selectively opening and/or closing valve means in the delivery system prior to and/or during beverage preparation.

The invention also provides a beverage preparation machine for preparing a beverage from one or more beverage ingredients, characterised by the provision of means for controlling the volume of gas in at least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

The machine preferably comprises means for determining the actual volume of gas resident in the delivery system.

The means for determining the actual volume of gas resident in the delivery system may comprise means for calculating the actual volume from stored parameters relating to a volume of gas remaining in the delivery system after a last operation of the machine.

Preferably the stored parameters comprise a basic volume parameter stored in the control means, said basic volume being the actual volume of gas which resides in the delivery system of an unused machine or a machine after a purging cycle has been run.

The stored parameters may comprise parameters relating to the actual volume of gas remaining in the delivery system after each type of beverage which the machine is programmed to prepare.

The means for determining the actual volume of gas resident in the delivery system preferably comprise means for measuring the actual volume of gas in the delivery system.

Parameters relating to predetermined volumes of gas required to be present in the delivery system for preparing a predetermined range of beverages are preferably stored in the control means, said control means being programmed to calculate the difference between the predetermined volume required for a beverage in preparation and the actual volume present.

The means for controlling the actual volume of gas may comprise valve and/or purge means for venting gas and/or pump means for injecting additional gas into the delivery system.

Preferably the valve means comprise an outlet valve downstream and/or a valve upstream of the beverage ingredients.

Operation of the valve means is preferably controlled relative to the beverage preparation cycle to vary the actual volume of gas present in the delivery system.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a front perspective view of a prior art beverage preparation machine with the cartridge head in a closed position;

Figure 2 is a front perspective view of the machine of Figure 1 with the cartridge head in an open position;

Figure 3 is a rear elevation of the machine of Figure 1 with some parts omitted for clarity;

Figure 4 is a front perspective view of a cartridge head of the machine of Figure 1 with some parts omitted for clarity;

Figure 5 is another front perspective view of the cartridge head of Figure 4, with some parts omitted for clarity;

Figure 6 is a cross-sectional view of the cartridge head of Figure 4 in a closed position accommodating a version of a beverage cartridge;

Figure 7 is a cross-sectional side elevation of the cartridge head of Figure 4 in an open position accommodating the beverage cartridge;

Figure 7a is a plan view of a rubber seal for the cartridge head of Figure 4;

Figure 8 is a schematic showing the various component parts of the machine of Figure 1 incorporating a new variable outlet valve;

Figure 9 is a section of schematic of an outflow from the cartridge head incorporating the variable outlet valve of Figure 8;

Figures 10-12 are cross-sectional front elevations of one embodiment of the variable valve in the outflow of Figure 9 showing it's closed, open and restricted positions respectively;

Figures 13a and 13b are cross-sectional end elevations of an alternative variable outlet valve used in the outflow of Figure 9 in its open and closed position respectively;

Figures 14 and 15 are cross-sectional side elevations of the valve of Figures 13a and 13b;

Figure 16a is a side elevation of a beverage receptacle containing a coffee beverage having a large volume of crema produced using an improved gas management system;

Figure 16b is a chart showing the brew parameters used in producing the beverage illustrated in Figure 16a;

Figure 17a is a side elevation of a beverage receptacle containing a coffee beverage having a small volume of crema produced using the improved gas management system;

Figure 17b is a chart showing the brew parameters used in producing the beverage illustrated in Figure 17a;

Figure 18 is a plan view of a beverage cartridge suitable for use in the beverage preparation machine of Figure 1;

Figure 19 is cross-sectional side elevation of an outer member of the cartridge of Figure 18;

Figure 20 is a cross-sectional side elevation of a detail of the outer member of Figure 19 showing an inwardly directed cylindrical extension;

Figure 21 is a cross-sectional side elevation of a detail of the outer member of Figure 19 showing a slot;

Figure 22 is a perspective view from above of the outer member of Figure 19;

Figure 23 is a perspective view from above of the outer member of Figure 19 in an inverted orientation;

Figure 24 is a plan view from above of the outer member of Figure 19;

Figure 25 is a cross-sectional drawing of an inner member of the cartridge;

Figure 25a is a cross-sectional drawing of a detail of the inner member of Figure 25 showing an aperture;

Figure 26 is a perspective view from above of the inner member of Figure 25;

Figure 27 is a perspective view from above of the inner member of Figure 25 in an inverted orientation;

Figure 28 is another cross-sectional drawing of the inner member of Figure 25;

Figure 28a is a cross-sectional drawing of another detail of the inner member of Figure 25 showing an air inlet;

Figure 29 is a cross-sectional side elevation of the cartridge in an assembled condition; and

Figure 30 is a cross-sectional side elevation of another version of cartridge.

In order to cater for the desired wide selection of good quality beverage types, having different characteristics, the present invention involves one or more significant improvements to known beverage preparation machines. These improvements enable sufficiently high pressures to be generated and maintained for the production of good quality espressos, and the pressure to be varied in a manner which is invisible to the user and requires no

manual intervention. Furthermore they enable the crema to be improved in a way not previously possible.

These improvements, which will be described in more detail below, include:-

1. providing a variable geometry valve downstream of the beverage cartridge to enable the beverage preparation machine to operate at a range of pressures; and

2. providing greater control over the end appearance of the dispensed beverage, in particular beverages with crema, by controlling the volume of gas passed through the beverage ingredients.

The aforementioned improvements will be described with reference to a known beverage preparation machine 10 which is illustrated in Figures 1 to 7 of the accompanying drawings. It should be noted, however, that the improvements find application in a wide range of beverage preparation machines capable of using a wide range of cartridges which, as noted above, include pods, pads, rigid and semi-rigid cartridges.

The beverage preparation machine 10 of Figures 1 to 3 generally comprises a housing 11, a tank 12, a water heater 13, a control processor (not shown), a user interface 16 and a cartridge head 17. The cartridge head 17 in turn generally comprises a cartridge holder 18 for holding, in use, a beverage cartridge 100 and cartridge recognition means 20. The cartridge head 17 further comprises inlet and outlet

piercers 21,22 for forming in the beverage cartridge 100, in use, an inlet 107 for liquid to enter the cartridge 100 and an outlet 108 for the prepared beverage to exit the beverage cartridge 100.

Although water is likely to be the most common liquid used in preparing beverages such as coffee, the machine 10 is also capable of handling other liquids, such as milk or milk preparations, for mixing with the beverage ingredients 200. Any references herein to water should also be taken to include any form of liquid used in preparing beverages.

The housing 11 is preferably made in whole or in part from a suitable plastics material or metal. The housing 11 preferably comprises a clam-shell design having a front half 25 and a rear half 26 which allow access during assembly for fitting of the machine 10 components.

The front half 25 of the housing 11 defines a dispensing station 27 where dispensation of the beverage takes place, which includes a cupstand 23 with a drip tray located beneath. The machine user interface 16 is also located on the front of the housing 11 and comprises a plurality of control switches, for example, a start/stop button 28, and a number of status indicators 29-32. The status indicators 29-32 are preferably light emitting diodes (LED) which, for example, indicate readiness of the machine 10, whether an error has occurred in the machine 10 operation, and the mode of operation of the machine 10. The LEDs 29-32 may be controlled to illuminate at a constant intensity, to flash intermittently, or both depending on the

status of the machine 10. The LEDs 29-32 may have a variety of colours including green, red and yellow. The start/stop button 28 controls commencement of the dispense cycle and is preferably a manually operated push-button, switch or similar.

The tank 12 is located to the rear of the housing 11 and is preferably incorporated in, or connected to, the rear half 26 of the housing 11. The tank 12 has an inlet for filling the tank 12 with water, or other liquid, which is closed off when the tank 12 is in position in the machine 10. An outlet is provided towards a lower end of the tank 12 which communicates with the pump 14. The tank 12 may be made from a transparent or translucent material to allow a consumer to view the quantity of water remaining in the tank 12. Alternatively, the tank 12 may be made from an opaque material but have provided a viewing window therein. In addition, or in place of the above, the tank 12 may be provided with a low level sensor which prevents operation of the pump 14 and optionally triggers a warning indicator, such as an LED, when the liquid level in the tank descends to a preselected level. The tank 12 preferably has an internal capacity of approximately 1.5 litres.

The pump 14 is operatively connected between the tank 12 and the water heater 13, as shown schematically in Figure 8, and is controlled by the control processor. A suitable pump provides a flow rate of 900 ml/min of water at a pressure of 6 bar. The flow rate of water through the machine 10 can be controlled by the control processor to be a percentage of the maximum flow rate of the pump 14 by

cycle chopping the electrical supply to the pump. Preferably the pump can be driven at any of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% or 100% of the maximum rated flow rate. The accuracy of the volume of water pumped is preferably + or - 5% leading to a + or - 5% accuracy in the final volume of the dispensed beverage. A volumetric flow sensor (not shown) is preferably provided in the flow line either upstream or downstream of the pump 14. Preferably, the volumetric flow sensor is a rotary sensor.

The heater 13 is located in the interior of the housing 11. One suitable heater 13 has a power rating of 1550 W and is able to heat water received from the water pump 14 from a starting temperature of approximately 20 °C to a nominal operating temperature of around 85°C in under 1 minute. Preferably the dwell time between the end of one dispense cycle and the heater 13 being able to commence a subsequent dispense cycle is less than 10 seconds. The heater maintains the selected temperature to within + or - 2 °C during the dispense cycle. The water for the dispense cycle is delivered to the cartridge head 17 at a predetermined temperature. The heater 13 is able to quickly adjust the delivery temperature to the required temperature, generally between 80°C and 98°C and possibly higher from the incoming water temperature. Where desired, the machine 10 can incorporate a steam purge. The preferred means of generating the steam purge is to utilise a water heater 13 in the form of a flash (also known as an instantaneous or flow) heater. Typically such flash heaters comprise a tube through which the water passes wherein the tube is heated by one or more resistive elements. The flash heater can be used not only

for heating water for forming beverages but also, at higher power settings, for generating a steam purge by boiling off water remaining with the flash heater tube after the beverage has been formed. An advantage of flash heaters is that there is no significant delay whilst water in a boiler heats up. Flash heaters heat water on demand and switch off immediately after each brewing cycle and are therefore very energy efficient.

Water output from the heater 13 is fed via a suitable delivery system to the cartridge head 17 and cartridge 100 by means of a valve. If the pressure of the water flow is acceptable, the water is passed to the cartridge 100. If the pressure is below or above predetermined limits then the water is diverted by means of the valve to a waste recovery receptacle.

The delivery system comprises conduits which connect the tank 12, the water pump 14, the water heater 13 and the cartridge head 17 (as shown in Figure 8) to transport the water from the tank 12 to the cartridge 100.

The cartridge holder 18 is designed to be capable of handling the opening forces generated by the pressure inside the cartridges 100, which is around 250kg for espresso beverages. During operation of the machine 10 the cartridges 100 attempt to expand, but the integrity of the cartridges 100 must be maintained. In addition the user must not be able to open the holder 18 whilst the system is pressurised and suitable locking mechanisms are provided to achieve this.

One suitable design of cartridge head 17, as described in WO-A-2006/014936, is shown in Figures 4 to 7. The cartridge holder 18 of the cartridge head 17 comprises a fixed lower part 43, a rotatable upper part 44 and a pivotable cartridge mount 45 positioned between the fixed lower part 43 and the rotatable upper part 44. The upper part 44, lower part 43 and cartridge mount 45 are rotated about a common hinge axis 46. Figures 4 to 7 show the holder 18 with some components of the machine 10 omitted for clarity.

The rotatable upper part 44 and pivotable cartridge mount 45 are moved relative to the fixed lower part 43 by means of a clamping mechanism. The clamping mechanism comprises a clamping lever having first and second members or parts 47 and 48. The first part 47 of the clamping lever comprises a U-shaped arm which is pivotably mounted to the upper part 44 at two first pivot points 48, one on each side of the holder 18.

The second part of the clamping lever comprises two over-centre arms 49, one on each side of the holder 18 which are each pivotably mounted to the upper part 44 at a second pivot point 50 located on the hinge axis 46 coupling the upper part 44 to the fixed lower part 43. Each over-centre arm 49 is a reciprocal member comprising a cylinder 49a, a stem 49b and a resilient sleeve 49c. The cylinder 49a has an internal bore and is rotatably mounted at one end at the hinge axis 46. A first end of the stem 49b is slidingly received in the bore of the cylinder 49a. The opposite end of the stem 49b is rotatably mounted to the U-shaped arm 47

at a third pivot point 51. The third pivot points 51 are unconnected to, and freely moveable relative to, the upper part 44 and lower part 43. The resilient sleeve 49c is mounted externally on the stem 49b and extends, in use, between abutment surfaces on the cylinder 49a and stem 49b. The resilient sleeve 49c accommodates shortening of the over-centre arm 49 but biases the over-centre arm 49 into an extended configuration. Movement of the third pivot points 51 towards and away from the hinge axis 46 is thus possible by relative movement of the stems 49b in the cylinders 49a. The resilient sleeves 49c are preferably formed from silicone. Whilst the illustrated embodiment uses two over-centre arms 49, it will be apparent that the closure mechanism may be configured with only one over-centre arm 49.

The U-shaped arm 47 extends around the front of the holder 18 and comprises two downwardly dependant hook members 52, one on each side of the holder 18, each comprising a cam surface facing the hinge axis 46. The fixed lower part 43 of the holder 18 is provided with two bosses 53, or detents, located one on each side of the lower part 43 at or near a front edge 54 thereof aligned generally with the hook members 52.

As shown in Figure 4, the U-shaped arm 47 may be formed from a one piece plastics moulding comprising an ergonomic hand grip and the hook members 52 integral to the arm 47.

The cartridge mount 45 is rotatably mounted between the upper and lower parts 43, 44 of the holder 18. The mount 45

is provided with a substantially circular recess 55 which receives in use the beverage cartridge 100 (which is described in greater details below). The recess 55 includes an irregularity 56 for accommodating the handle portion 24 of the beverage cartridge 100 which also acts to prevent rotation of the beverage cartridge 100 in the holder 18. The cartridge mount 45 is sprung relative to the fixed lower part 43 such that in the open position, as shown in Figure 7, the cartridge mount 45 is biased out of contact with the fixed lower part 43 so that the cartridge mount 45 is moved out of contact with the outlet and inlet piercer members 21, 22. The cartridge mount 45 is provided with an aperture 57 for receiving there through the inlet and outlet piercers 21, 22 and a head of the cartridge recognition means 20 when the cartridge mount 45 is moved into the closed position.

The upper part 43 comprises a generally circular body 58 housing a circular viewing window 59 through which a consumer can view the beverage cartridge 100 during a dispense cycle and also visually confirm whether a cartridge 100 is loaded in the machine 10. The viewing window 59 is cup-shaped having a downwardly directed rim. In addition, the viewing window 59 is provided with a clamping member in the form of an inwardly directed tubular extension 61 as shown in Figure 7. The extension 61 is directed towards the lower part 44 and lies within the volume of the cartridge head when in the closed position as shown in Figure 6. The viewing window 59 is able to move axially relative to the housing 58 of the upper part 43. One arrangement of accomplishing the relative movement is to provide a wave spring (not shown), or similar resilient means such as a

rubberised ring, positioned between the viewing window 59 and the circular housing 58. In an alternative arrangement, a series of helical compression springs (not shown) are provided extending between the viewing window 59 and the housing 58. In both cases the resilient means allows the viewing window 59 to move axially relative to the circular housing 58 by a small degree.

When the holder 18 is in the closed position, a distal end 62 of the tubular extension 61 of viewing window 59 bears against the clamping surface 18a of the beverage cartridge 100 biasing it against the lower part 44 as shown in Figure 6 (in which the arrangement is illustrated containing a cartridge having a greater depth). The pressure exerted by the tubular extension 61 on the outer member 102 ensures a fluid tight seal between the cartridge 100 and the holder 18. It should be noted that the height of the viewing window 59, and hence also the cartridge head 17, is such that cartridges 100 of various depths can be inserted. In Figure 6 the arrangement is shown with a relative deep cartridge. The same cartridge head 17 can also accommodate shallower cartridges. In this case there will be a gap between the upper surface 11 of the cartridge 100 and the window 59. However the cartridge 100 is fully sealed at inlet and outlet by the pressure applied by the tubular extension 61.

The lower part 43 comprises the inlet and outlet piercers 21, 22 and the head of the cartridge recognition means 20. The inlet piercer 21 comprises a hollow needle-like tube 63 having a sharpened end 64 for perforating the

laminate 108 of the beverage cartridge 100 in use. The inlet piercer 21 is in fluid communication with a water conduit 65, as shown in Figure 7, which passes through the lower part 43 and is connected to an outlet conduit 66 of the water heater 13. The outlet piercer 22 is similar in type to the outlet piercer described in the EP-A-0389141 and EP-A-0 334572 and comprises an open ended cylinder of circular or D-shaped cross-section having dimensions larger than the beverage discharge spout 109. An arcuate portion 67 of the upper end of the outlet piercer 22 is serrated to pierce and eventually cut the laminate of the beverage cartridge 100. The remainder of the upper end is cut back longitudinally of the cylinder at least to the base of the teeth 68 of the serrated portion to fold or pull the cut laminate 108 away from the outlet aperture before the beverage is dispensed there through. The outlet piercer 22 pierces the laminate 105 externally of the discharge spout 143 and when the cartridge mount 45 is in the closed position, rests in the annulus between the discharge spout 143 and the outer wall 42 of the discharge funnel 140. The outlet piercer 22 folds back the cut laminate 105 into the annulus. Thereby both the outlet piercer 22 and the cut laminate 105 are held out of the way of the discharged beverage.

The outlet piercer 22 is surrounded by a ledge which is raised relative to its surroundings by 0.5mm.

Advantageously, the outlet piercer 22 is removable from the lower part 43 to enable it to be thoroughly cleaned, for example, in a dishwasher. The removable outlet piercer 22 is received in a recess in the lower part 43 where it is

seated. The inlet piercer 21 and/or the outlet piercer 22 may be made of a metal, such as stainless steel, or from a plastics material. Advantageously, the use of plastic cutting elements is enabled by use of a laminate 105 which is able to be punctured and cut by a non-metallic material. Consequently, the piercers 21, 22 can be made less sharp which lowers the risk of injury to the consumer. In addition, plastic piercing elements are not prone to rust. Preferably, the inlet piercer 21 and the outlet piercer 24 are formed as a single, integral unit which is removable from the lower part 43.

In use, the upper part 44 of the holder 18 is movable from an open position in which it is orientated vertically or towards the vertical as shown in Figure 2, to a closed position in which it is orientated substantially horizontally and in interengagement with the fixed lower part 43 and cartridge mount 45. The upper part 44 is moved from the open to the closed positions by operation of the clamping lever. To close the upper part 44 a user takes hold of the clamping lever by the U-shaped arm 47 and pulls downwards. Consequently, the upper part 44 rotates which first brings the tubular extension 61 of the viewing window 59 into contact with the clamping surface 118a of the beverage cartridge 100. Continued rotation of the upper part 44 rotates the upper part 44 and cartridge mount 45 down into contact with the lower part 43. Further rotation of the U-shaped arm 47 causes the U-shaped arm 47 to rotate relative to the upper part 44 and the lower part 43 resulting in the hook members 52 of the upper part 44 engaging the bosses 53 of the lower part 43 with the cam

surface riding over the bosses 53. During this last stage of rotation the cartridge 100 is compressed between the cartridge mount 45 and the viewing window 59. As a result, the viewing window 59 is moved axially slightly relative to the circular housing 58 of the upper part 44 against the bias of the wave spring or helical springs. This movement allows for a take up of tolerances in the beverage cartridge 100 and beverage preparation machine 10 and ensures that the amount of compressive force applied to the cartridge 100 is kept within an acceptable range. The clamping force of the mechanism as moderated by the action of the wave spring or helical springs ensures a clamping pressure on the cartridge 100. It has been found that a force of between 150N and 400N is required to counter the pressure in the cartridge 100. During closure of the cartridge head the laminate 105 of the cartridge 100 is tensioned as it is brought into contact with the ledge surrounding the outlet piercer 22 which causes the laminate 105 to flex out of plane as the distal end of the outer tube 42 of the cylindrical funnel is moved upwardly by 0.5mm relative to the flange 147. This movement also ensures that the great majority of the compressive force applied to the cartridge 100 acts through the central region of the cartridge 100 through the load-bearing inner member 103. These clamping forces help prevent failure of the cartridge 100 during pressurisation and also ensure that the inner member 103 and outer member 102 are fully seated relative to one another and thus that all internal passageways and apertures remain at their intended dimensions even during internal pressurisation.

In the closed position, the separation of the distal end 62 of the tubular extension 61 and the lower part 44 is shown by reference D in Figure 6. This distance is fixed by the dimensions of the viewing window 59, housing 58 and lower part 44. The distance D is chosen to be the same or marginally smaller than the distance d between the clamping surface 118a and laminate 105 under surface of the cartridges 100. In this way, on closure of the cartridge head 17 the cartridges 100 are subjected to a fixed, known degree of compression. In addition, both the first and second embodiments of cartridge can be clamped with the same degree of compression since distance D is the same for both cartridge types.

An imaginary datum line can be drawn between the first and second pivot points 48, 50 of the holder 18. As can be seen in Figure 7, in the open position the third pivot points 51 are located on the side of the datum line nearest the fixed lower part 43. As the upper part 44 reaches the closed position, the third pivot points 51 of the clamping lever pass through the datum line joining the first and second pivot points 48, 50 to the opposite side of the line, furthest from the fixed lower part 43. Consequently, the U-shaped arm 47 'snaps through' from a first stable position to a second stable position. The snap through action is accommodated by shortening of the over-centre arms 49 and consequential compression of the resilient sleeves 49c. Once the third pivot points 51 are past the imaginary datum line, the recovery of the resilient sleeves 49c acts to continue the motion of the third pivot points 51 away from the imaginary datum line. The clamping lever thus has a bi-

stable operation in that the lever is stable in the open or closed positions but unstable at the point when the third pivot points 51 lie on the imaginary datum line joining the first and second pivot points 48, 50. Thus, the snap-through action of the clamping lever provides a positive closure mechanism which leads to a definite closure action wherein in the final stages of the clamping lever's rotation, the snap-through action of the U-shaped arm 47 and second arms forces the hook members 52 firmly into engagement with the bosses 53. In addition, the resilient sleeves 49c provide a resistance to re-opening of the upper part 44 since a minimum force is required to compress the sleeves 49c sufficiently to move the third pivot points 51 back into line with the datum line joining the first and second pivot points 48, 50. Advantageously, the interengagement of the hook members 52 and the bosses 53 prevents separation of the upper and lower parts other than by rotation of the clamping lever. This is useful in preventing opening of the cartridge head 17 during operation when the cartridge head 17 is subject to internal pressurisation.

The pressure exerted by the upper section 44 ensures a full fluid tight seal between the cartridge 100 and the cartridge holder 18. The clamping forces help prevent failure of the cartridge 100 during pressurisation and also ensure that all of the internal passageways and apertures within the cartridge 100 remain at their intended dimensions even during internal pressurisation. To improve the seal with the cartridges 100 the applicant has now found that lining the recess 55 of the cartridge mount 45 with a rubber seal 55a (see Figure 7a) improves the machine's ability to

withstand the significantly higher pressures generated during the brewing cycle.

Control of the brew cycle is effected by the control processor of the beverage preparation machine 10, which comprises a processing module and a memory. The control processor is operatively connected to, and controls operation of, the heater 13, pump 14, user interface 16, and other components described below.

The operational behaviour of the machine 10 is determined by software embedded in the control processor, for example as described in EP-A-1440644. The memory of the control processor includes one or more variables for one or more operational parameters for the beverage preparation machine 10. In the prior art machines these are generally the temperature of the liquid passed through the beverage cartridge 100 during the operating stage, the speed of charging the beverage cartridge 100, the presence or otherwise of a soak step, the total dispensed volume of the beverage, the flow rate of the liquid during the discharge stage, and the period of the purge stage.

One purpose of the cartridge recognition means 20 is, inter alia, to allow the machine 10 to recognise the type of beverage cartridge 100 that has been inserted and to adjust one or more operational parameters accordingly. The variables for the operational parameters are stored in the memory. The cartridge 100 comprises a code 120 provided on or in the cartridge 100 representing the operational parameters required for optimal dispensation of the beverage

in that cartridge 100. An example of the code is described in EP-A-1440644.

The control processor memory further stores information on the type of beverage dispensed so that the operating cycle of the machine 10 may be adjusted for the next cartridge 100. This is especially advantageous where two or more beverage cartridges 100 are used sequentially to form a beverage. For example a coffee cartridge may be dispensed followed by a milk cartridge to form a cappuccino beverage. Alternatively a chocolate cartridge could be used followed by a milk cartridge to produce a creamy hot chocolate beverage. By using a memory that stores information on the first beverage dispensed, the manner of dispensing the second cartridge, say a milk cartridge, may be altered to achieve an optimum beverage. In the above example the milk dispensed for hot chocolate may, typically, be diluted less than the milk added to the coffee. In addition, the milk dispensed for chocolate may be dispensed at a slower flow rate to lessen the degree of foaming of the beverage. Many combinations of cartridges are possible and operating parameters as will be obvious to the skilled person. In addition, the memory may be used to allow the machine 10 to 'predict' the type of beverage that a user will next want to dispense. For example, if a user predominantly drinks one beverage type then the machine can instruct the water heater to remain at the optimum temperature for that beverage type.

Operation of the known prior art machines 10 comprises insertion of a beverage cartridge 100 into the cartridge head 17, carrying out a dispense cycle in which the beverage

is dispensed and removal of the cartridge 100 from the machine.

To insert the cartridge 100 the cartridge holder 18 is opened as described above to expose the cartridge mount 45. The cartridge 100 is then placed on the cartridge mount 45 received within the recess 46. The cartridge holder 18 is then closed by operation of the clamping handle 51 as described above. During closure the inlet and outlet piercers pierce the cartridge 100 to form the cartridge inlet 107 and outlet 108.

To commence the operating cycle the user operates the start/stop button 28. The operating cycle comprises the steps of cartridge recognition and the beverage preparation cycle.

Cartridge recognition is performed by the optical cartridge recognition means 20 as described above assuming that the outputs from the cartridge sensor and lock sensor are satisfactory. Once the barcode 40 has been decoded the operational parameters of the machine 10 are adjusted by the control processor. The preparation cycle is then automatically commenced. The preparation cycle has four main stages, although not all of these are used for all beverage types:

1. Pre-wet
2. Pause
3. Brew stage
4. Purge

In the pre-wet stage the cartridge 100 is charged with liquid from the storage tank 12 by means of the pump 14. The charging with water causes the beverage ingredients 200 in the chamber 160 to be wetted. The charging may take place at a "fast" flow rate of 600 ml/min or a "slow" flow rate of 325 ml/min. The slow charging rate is particularly useful for cartridges 100 containing viscous liquid beverage ingredients where the ingredients require some dilution before they are able to be pumped at a higher volume flow rate. The volume of liquid injected into the cartridge 100 is selected to ensure that liquid or beverage does not drip out of the cartridge outlet 108 during this stage.

The pause stage allows the beverage ingredients 200 to soak in the liquid injected during the pre-wet stage for a predetermined period of time. Both the pre-wetting and soaking stages are known to increase the yield of the extractibles from the beverage ingredients 200 and to improve the end flavour of the beverage. Pre-wetting and soaking are particularly used where the beverage ingredients are roast and ground coffee.

In the brew stage liquid is passed through the cartridge 100 in order to produce the beverage from the beverage ingredients 200. The temperature of the liquid is determined by the control processor which sends instructions to the heater 13 to heat the liquid passing from the tank 12 to the cartridge head 17. Liquid enters the cartridge holder 18 via an inlet valve and the inlet piercer and then passes into the inlet chamber 126 of the beverage cartridge 100.

Brewing and/or mixing of the beverage in the beverage cartridge 100 occurs, as described in EP-A-1440644, before the prepared beverage exits the cartridge outlet 104, enters the outlet valve 37 and is directed into a suitably placed receptacle in the dispensing station 27.

During the purge cycle the temperature of the water heater 13 is raised sufficiently high to convert the water remaining in the system to steam and blowing the pressurised steam through the beverage preparation machine 10 and the beverage cartridge 100. This ensures that all beverage is dispensed and that the flow path is cleared ready for dispensing another beverage. The purge cycle may not commence immediately on cessation of the brew/mixing stage to allow for the majority of the fluid to clear the flow path.

Once the operating cycle has been completed, the machine automatically stops and the consumer removes the cartridge 100 by opening the cartridge holder 18 and manually removing and disposing of the cartridge 100. Alternatively, the machine 10 may be provided with an automatic ejection mechanism for removing the cartridge automatically on opening the cartridge holder 18.

The first of the significant improvements to the known beverage preparation machines 10 referred to above is the provision of variable geometry valve 60 (see Figures 9 to 15) provided adjacent the cartridge outlet 108 to provide post-cartridge pressure control. This enables the machine 10 to produce a wide variety of beverages, as it allows the

cartridges 100 to be selectively brewed at either high or low pressure or a varying pressure during the brew cycle, depending on the type of brew cycle required for the beverage ingredients in the cartridge as identified by the cartridge recognition means 20, thus providing an automated variable pressure system. The modified machine is capable of producing beverages at a range of pressures, for example from 0 to 9 bar, and more preferably from 0 to 6 bar.

The variable geometry valve 60 is positioned downstream of the cartridge 100, and preferably positioned in the beverage outlet 37, which is partially housed in, and extends from, the lower section 43 of the cartridge head 17 (see Figures 6 and 7). The valve 60 has at least an open and a restricted state, and more preferably all of the states identified below:-

1. Open (Figure 11)
2. Restricted (Figure 12)
3. Closed (Figure 10)
4. Cleaning/purging.

Various types of valve may be used for the outlet valve 60, such as ball valves, pinch valves, sleeve valves, seat valves or disc valves. The embodiment illustrated in Figures 10 to 12 is a ball type valve which has a rotating element 69 located in a chamber 70 in the beverage outlet 37. The rotating element 69 is rotatable between preset positions to provide the required states. The diameter of the bore of the valve 60 in the unrestricted position is preferably at least

5mm which is required, for example, for cartridges 100 providing low pressure filter beverages.

An alternative suitable valve is a pinch valve illustrated in Figures 13 to 15 which comprises a flexible tube 71, preferably made of silicon rubber or an elastomeric material, and a clamping mechanism 72. In the unrestricted position (Figures 13a and 14) the beverage flows freely through the tube 71. The clamping mechanism 72 is activated to provide a restricted position (Figures 13b and 15) and closed position.

The valve 60 is controlled automatically by the control processor of the machine 10. Once the type of cartridge 100 inserted into the machine 10 has been identified, by the decoding the barcode 40, the control processor selects the correct initial setting and, if appropriate, any subsequent operation of the valve 60 for the relevant beverage type.

The machine 10 can operate in a range of modes, with the valve 60 in one or more positions, some examples of which are:-

1. Valve Open Throughout The Brewing Cycle

When the valve 60 is in its open position the operating pressure is below 2 bar allowing a steady state through flow rate of up to 400 ml/min. The beverage is dispensed under similar conditions to those described in EP-A-1440644. This mode is particularly useful as it renders the machine 10 backwardly compatible with existing cartridges for preparing

low pressure beverages, such as tea, foamed milk or chocolate.

2. Valve Restricted Throughout The Brewing Cycle

When the valve 60 is in its restricted position it creates a relatively high back pressure within the cartridge 100, which results in an operating pressure of up to 4, 6 or even 9 bar and provides a steady state through flow rate of 60 to 300 ml/min. This is sufficient to obtain the necessary solids extraction and emulsification of oils in the beverage ingredients 200 for an espresso beverage. The consequential restriction in the beverage outlet 37 provides a shearing and mixing action in the beverage flowing through the valve 60, giving rise to good air/liquid emulsification and resulting in an improved crema. This mode can advantageously be used for preparing higher pressure beverages, such as espressos and cappuccinos, from cartridges 100 which do not have means for entraining air to effect the mixing action, i.e. so called non-eductor cartridges.

3. Valve Closed Then Restricted

If the valve 60 is closed immediately at the start of the brewing cycle (before the pump 14 commences and during the pre-wet cycle), this enables a higher pressure to be developed within the cartridge 100 than when the valve 60 is in it's restricted position.

Further combinations may be appropriate, such as valve closed then open or valve closed then restricted then open according to the desired effect to be achieved.

If required, the valve 60 can be pulsed between various positions during the brewing cycle, or a part thereof. This manner of valve operation during the delivery cycle enables beverages with a crema having a graduated colour and/or bubble size to be produced.

During the purge cycle the valve 60 is controlled by the control processor to divert the steam to a drain area rather than to the dispensing station 27 to preserve the appearance of the beverage and prevent contamination.

The second of the significant improvements to the known beverage preparation machines 10 referred to above is the addition to the brew control system of gas management. Surprisingly the applicant has now discovered that the characteristics of beverages prepared in this type of beverage preparation machine 10 can be modified beyond boundaries hereto seen in prior art machines. The surprising effect is enacted by controlling the volume of gas in the delivery system during the preparation of the beverage to prescribe the amount of high quality crema resulting in a controlled amount of crema on a beverage varying from a delicate layer up to a surprisingly deep layer in the final beverage. The applicant has found a way to successfully use gases within the beverage preparation machine to modify the gas:liquid ratio to produce a surprising volume of good stable crema in prepared beverages never seen before in

prior art machines. Maintaining a greater volume of gas resident in the delivery system enables a much larger gas:liquid ratio to be achieved during brewing and dispensing and this produces a correspondingly larger volume of crema. Decreasing the volume of gas enables the ratio to be decreased to reduce the crema volume. The bubble size is also influenced by the gas:liquid ratio, so a lower ratio can be used to provide a tight and creamy crema and a higher ratio used to provide a more loose and bubbly crema. This improvement therefore provides the ability to optimise the crema volume and bubble size for each beverage dispensed. It has been found that by manipulating the gas good quality espressos can be brewed with a crema volume greater than 25% of the beverage volume whilst minimising the occurrence of bubbles having a diameter of more than 172 microns which is not previously seen to be possible in known beverage preparation machines of this type.

The improvement is achieved by adapting the control of the brew cycle to provide means for managing the volume of gas within the delivery system which conveys the water from the tank 12 to the beverage ingredients 200 and to the dispensing outlet. All further references in this specification to the delivery system are intended to include any predetermined section thereof, for example the section extending from the water heater 13 to the cartridge 100 and may also include, if relevant, some gas contained within a headspace of the cartridge 100.

The "basic volume" of gas which can reside within the delivery system of any given machine 10 is dependant on its

construction. The "actual volume" at any given time will vary according to whether the machine 10 has just been used to prepare a beverage, what type of beverage it was used for and whether a steam purge cycle has been run. Thus the improved brew cycle control incorporates means for varying the volume of gas in the delivery system according to the type of beverage to be dispensed (i.e. one requiring a crema with smaller and fewer bubbles or one which requires a greater froth of larger bubbles) taking into account the actual volume of gas already present. The means for varying the volume of gas may be achieved by combinations of:-

1. purging the delivery system after a brewing cycle is complete, and prior to a subsequent high pressure brew, which will increase the gas:liquid ratio;
2. venting gas from the delivery system prior to high pressure brewing, which will decrease the gas:liquid ratio; and
3. inducting gas into the delivery system prior to high pressure brewing, which will increase the gas:liquid ratio.

Valve means are preferably provided to enable the volume of gas within the delivery system to be reduced and an air pump to enable gas (typically air) to be injected into the system. A separate, dedicated air valve may be incorporated in the delivery system, either upstream or downstream of the cartridge 100. Preferably the variable geometry valve 60 described above may be used as the valve means.

To enable this improved brew cycle control to be effected, additional parameters to those described in connection with the basic machine 10 may be stored in the memory of the control processor. These additional parameters include the basic volume of gas for the specific construction of machine 10 (which will apply to the machine 10 which is unused or after it has been purged) and the volume required during high pressure brewing for optimising the crema for each specific beverage. Preferably the additional parameters also include the actual volume of gas which will remain in the delivery system after each type of brew operation which the machine 10 is capable of. However this is not wholly necessary if the machine 10 is programmed to run a steam purge cycle after every beverage is dispensed, which effectively resets the actual volume to the basic volume, because it flushes the dispensing system downstream of the water heater 13 of any remaining liquid.

The brew cycle will therefore include an additional step, namely a gas adjustment cycle before the pre-wet cycle. The gas adjustment cycle thus includes:-

1. An assessment of the required volume of gas for the type of beverage to be prepared. This will most conveniently be the selection from the processor memory of the required parameter associated with the cartridge code 120;

2. The determination of the actual volume of gas currently resident in the delivery means according to the

last operation of the machine 10. This will be the basic volume for an unused machine or if a purge cycle has been run. If the machine has just been used to prepare a beverage and no purge cycle run, the processor ideally selects from the memory the parameter for the remaining gas according to the last beverage. Alternatively, means may also be provided to specifically monitor the volume of gas within the delivery system at any point in time;

3. A calculation of the volume of gas to be inducted into or vented from the delivery system to achieve the required volume;

4. The modification of the volume of gas, if required, by the induction of additional gas (typically air) or the venting of excess gas.

In one example the beverage preparation machine 10 has a basic volume of gas of 36ml in the section of the delivery means extending between the water heater 13 and the beverage ingredients 200.

There are a number of different modes of operation for step 4 depending on the outcome of step 3, depending on what type of valve means are used. If the valve means are downstream of the cartridge, i.e. an outlet valve, one way of controlling the volume of air upstream of the beverage ingredients 200 prior to high pressure brewing is by closing the outlet valve at different points in the brew cycle as follows:-

1. The Correct Volume of Gas is Present

If the processor calculates that it requires the full basic volume of gas (36ml) for the beverage to be dispensed, as determined from the reading of the code 120, it closes the outlet valve at the start of the brew cycle, before any water flows from the water heater 13. This means that the compression of gas in the delivery system will commence immediately and the cartridge 100 will be subject to higher pressures during the pre-wet and soak cycles, with the valve only opening to dispense the resultant beverage. As the outlet valve is closed before the pump 14 is started, all of the 36ml of trapped gas is mixed in to the resulting beverage and a larger volume of slightly coarser crema is obtained (Figure 16a). In the example shown the volume of crema Y in a graduated glass, flat bottomed beaker was 20ml compared to the volume of liquid X, which was 50ml.

The chart shown in Figure 16b represents an example of brew cycle parameters used to produce a beverage in this mode with a large volume of crema under test conditions.

In this chart, a stop condition of 0 seconds (e.g. against the remove gas step) indicates that the step is not carried out.

2. Too Much Gas is Present

If, on the other hand, a beverage with a small volume of crema is indicated by the cartridge 100 inserted and there is an excess of gas present in the system, the outlet

valve is closed after the pump 14 has operated for a short time until the excess gas in the delivery system has escaped through the open valve at low pressure. With the valve being closed later in the brew cycle, the required volume of gas is vented to atmosphere via the cartridge 100 and valve, so a smaller quantity of trapped gas is left to be compressed and mixed in to the resulting beverage during high pressure brewing and consequently a smaller volume of finer crema is obtained (Figure 17a). In the example shown the volume of crema Y in a graduated glass, flat bottomed beaker was 5ml compared to the volume of liquid X, which was 50ml.

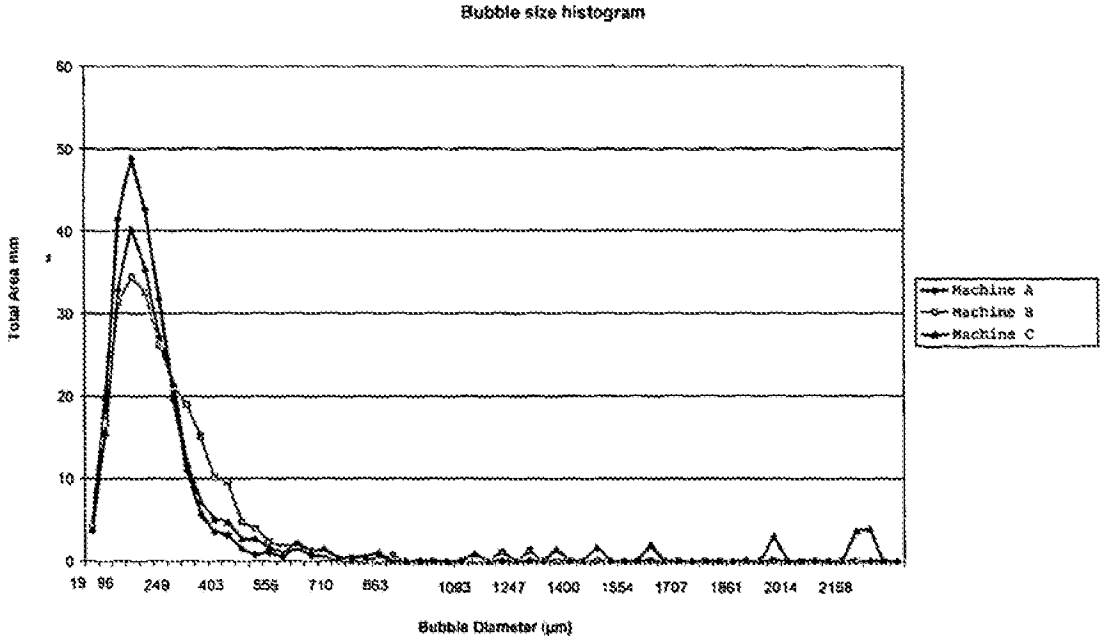
The chart shown in Figure 17b represents an example of brew parameters used to produce a beverage in this mode with a small volume of crema under test conditions.

3. Insufficient Gas Present

If step 3 indicates that more gas needs to be inducted, the outlet valve is closed immediately and the air pump operated until the deficit has been made up. Thereafter high pressure brewing commences.

The following graph is a digital image analysis showing a comparison of the crema characteristics produced by the present beverage preparation machine 10 (machine A) utilising the gas management system and two prior art machines (machines B and C) without such gas management system. Comparing the profiles for each machine from the peak (~172μm diameter) rightwards (increasing bubble size), it can be seen that machine A exhibits a very tight

distribution of small bubbles within the crema. Machine C (the Nespresso Latissma (tm)which is a high pressure machine which has a pressure rating of around 19 bar and operates at a pressure between 9 and 15 bar) produces a broader/coarser distribution with a number of larger diameter bubbles, whilst machine B (the applicant's own Tassimo/Bosch Machine(tm) similar to that described in EP-A-1440644 which is a low pressure machine operating at pressures below 2 bar) is coarser still, though without the larger bubbles seen for machine C.



The tail to the left of the chart (extremely small bubbles) is characteristic of the limits of the image analysis systems used to produce the graph, though is qualitatively similar.

Some elements of the control of the gas in the beverage machine 10 may also be effected manually by the use of suitable buttons for the user to press, to indicate the type of beverage being produced and the required crema characteristics.

Whilst this improvement has been described with reference to beverage machines 10 which use cartridges 100, it may also be used in bulk brewers and other non-cartridge machines.

Embodiments of cartridges 100 which are suitable for use in the machine 10 having the improvements described above are shown in Figures 18 to 30.

The cartridge 100 generally comprises an outer member 102, an inner member 103 and a laminate 105. The outer member 102, inner member 103 and laminate 105 are assembled to form the cartridge 100 which has an interior 106 for containing one or more beverage ingredients, an inlet 107, an outlet 108 and a beverage flow path linking the inlet 107 to the outlet 108 and which passes through the interior 106. The inlet 107 and outlet 108 are initially sealed by the laminate 105 and are opened in use by piercing or cutting of the laminate 105. The beverage flow path is defined by spatial inter-relationships between the outer member 102, inner member 103 and laminate 105 as discussed below. Other components may optionally be included in the cartridge 100, such as a filter 104, as will be described further below.

A first version of cartridge 100 which will be described is shown in Figures 19 to 29. The first version of the cartridge 100 is particularly designed for use in dispensing espresso-style products such as roast and ground coffee where it is desirable to produce a crema. However, this version of the cartridge 100 may be used with other products such as chocolate, coffee, tea, sweeteners, cordials, flavourings, alcoholic beverages, flavoured milk, fruit juices, squashes, sauces and desserts.

As can be seen from Figure 23, the overall shape of the cartridge 100 is generally circular or disc-shaped with the diameter of the cartridge 100 being significantly greater than its height. A major axis X passes through the centre of the outer member as shown in Figure 19. Typically the overall diameter of the outer member 102 is 74.5 mm ±6mm and the overall height is 16 mm ±3mm. Typically the volume of the cartridge 100 when assembled is 30.2 ml ±20%.

The outer member 102 generally comprises a bowl-shaped shell 110 having a curved annular wall 113, a closed top 111 and an open bottom 112. The diameter of the outer member 102 is smaller at the top 111 compared to the diameter at the bottom 112, resulting from a flaring of the annular wall 113 as one traverses from the closed top 111 to the open bottom 112. The annular wall 113 and closed bottom 112 together define a receptacle having an interior 134.

A hollow inwardly directed cylindrical extension 118 is provided in the closed top 111 centred on the major axis X. As more clearly shown in Figure 20, the cylindrical

extension 18 comprises a stepped profile having first, second and third portions 119, 120 and 121. The first portion 119 is right circular cylindrical. The second portion 120 is frusto-conical in shape and is inwardly tapered. The third portion 121 is another right circular cylinder and is closed off by a lower face 131. The diameter of the first, second and third portion 119, 120 and 121 incrementally decreases such that the diameter of the cylindrical extension 118 decreases as one traverses from the top 111 to the closed lower face 131 of the cylindrical extension 118. A generally horizontal shoulder 132 is formed on the cylindrical extension 118 at the junction between the second and third portions 120 and 121.

An outwardly extending shoulder 133 is formed in the outer member 102 towards the bottom 112. The outwardly extending shoulder 133 forms a secondary wall 115 co-axial with the annular wall 113 so as to define an annular track forming a manifold 116 between the secondary wall 115 and the annular wall 113. The manifold 116 passes around the circumference of the outer member 102. A series of slots 117 are provided in the annular wall 113 level with the manifold 116 to provide gas and liquid communication between the manifold 116 and the interior 134 of the outer member 102. As shown in Figure 21, the slots 117 comprise vertical slits in the annular wall 113. Between twenty and forty slots are provided. In the embodiment shown thirty-seven slots 117 are provided generally equi-spaced around the circumference of the manifold 16. The slots 117 are preferably between 1.4 and 1.8 mm in length. Typically the length of each slot 117 is 1.6 mm representing 10% of the overall height of the

outer member 102. The width of each slot 117 is between 0.25 and 0.35 mm. Typically, the width of each slot 117 is 0.3 mm. The width of the slots 117 is sufficiently narrow to prevent the beverage ingredients passing there through into the manifold 116 either during storage or in use.

An inlet chamber 126 is formed in the outer member 102 at the periphery of the outer member 102. A cylindrical wall 127 is provided, as most clearly shown in Figure 23, which defines the inlet chamber 126 within, and partitions the inlet chamber 126 from, the interior 134 of the outer member 102. The cylindrical wall 127 has a closed upper face 128 which is formed on a plane perpendicular to the major axis X and an open lower end 129 co-planar with the bottom 12 of the outer member 102. The inlet chamber 26 communicates with the manifold 116 via two slots 130 as shown in Figure 19. Alternatively, between one and four slots may be used to communicate between the manifold 116 and the inlet chamber 126.

A lower end of the outwardly extending shoulder 133 is provided with an outwardly extending flange 135 which extends perpendicularly to the major axis X. Typically the flange 135 has a width of between 2 and 4 mm. A portion of the flange 135 is enlarged to form a handle 124 by which the outer member 102 may be held. The handle 124 is provided with an upturned rim 125 to improve grip.

The outer member 102 is formed as a single integral piece from high density polyethylene, polypropylene, polystyrene, polyester, or a laminate of two or more of

these materials. A suitable polypropylene is the range of polymers available from DSM UK Limited (Redditch, United Kingdom). The outer member may be opaque, transparent or translucent. The manufacturing process may be injection moulding.

The inner member 103 as shown in Figures 25 to 28, comprises an annular frame 141 and a downwardly extending cylindrical funnel 140. A major axis X passes through the centre of the inner member 103 as shown in Figure 25.

As best shown in Figures 26 and 27, the annular frame 141 comprises an outer rim 151 and an inner hub 152 joined by ten equi-spaced radial spokes 153. The inner hub 152 is integral with and extends from the cylindrical funnel 140. Filtration apertures 155 are formed in the annular frame 141 between the radial spokes 153. A filter 104 is disposed on the annular frame 141 so as to cover the filtration apertures 155. The filter is preferably made from a material with a high wet strength, for example a non-woven fibre material of polyester. Other materials which may be used include a water-impermeable cellulosic material, such as a cellulosic material comprising woven paper fibres. The woven paper fibres may be admixed with fibres of polypropylene, polyvinyl chloride and/or polyethylene. The incorporation of these plastic materials into the cellulosic material renders the cellulosic material heat-sealable. The filter 104 may also be treated or coated with a material which is activated by heat and/or pressure so that it can be sealed to the annular frame 141 in this way.

As shown in the cross-sectional profile of Figure 25, the inner hub 152 is located at a lower position than the outer rim 151, resulting in the annular frame 141 having a sloping lower profile.

The upper surface of each spoke 153 is provided with an upstanding web 154 which divides a void space above the annular frame 141 into a plurality of passages 157. Each passage 157 is bounded on either side by a web 154 and on a lower face by the filter 104. The passages 157 extend from the outer rim 151 downwardly towards, and open into, the cylindrical funnel 140 at openings 156 defined by the inner extremities of the webs 154.

The cylindrical funnel 140 comprises an outer tube 142 surrounding an inner discharge spout 143. The outer tube 142 forms the exterior of the cylindrical funnel 140. The discharge spout 143 is joined to the outer tube 142 at an upper end of the discharge spout 143 by means of an annular flange 147. The discharge spout 143 comprises an inlet 145 at an upper end which communicates with the openings 156 of the passages 157 and an outlet 144 at a lower end through which the prepared beverage is discharged into a cup or other receptacle. The profile of the discharge spout 43 comprises a stepped profile with a distinct dog-leg 166 near an upper end of the tube 143.

As shown in Figure 25, the discharge spout 143 is provided with a partition 165 which extends part way up the discharge spout 143 from the outlet 144. The partition 165

helps to prevent the beverage spraying and/or splashing as it exits the discharge spout 143.

A rim 167 is provided upstanding from the annular flange 147 joining the outer tube 142 to the discharge spout 143. The rim 167 surrounds the inlet 145 to the discharge spout 143 and defines an annular channel 169 between the rim 167 and the upper portion of the outer tube 142. The rim 167 is provided with an inwardly directed shoulder 168. At one point around the circumference of the rim 167 an aperture 170 is provided in the form of a slot which extends from an upper edge of rim 167 to a point marginally below the level of the shoulder 168 as most clearly shown in Figures 25 and 25a. The slot has a width of 0.64 mm.

An air inlet 171 is provided in annular flange 147 circumferentially aligned with the aperture 170 as shown in Figures 28 and 28a. The air inlet 171 comprises an aperture passing through the flange 147 so as to provide communication between a point above the flange 147 and the void space below the flange 147 between the outer tube 142 and discharge spout 143. Preferably, and as shown, the air inlet 171 comprises an upper frusto-conical portion 173 and a lower cylindrical portion 172. The air inlet 171 is typically formed by a mould tool such as a pin. The tapered profile of the air inlet 171 allows the mould tool to be more easily removed from the moulded component. The wall of the outer tube 142 in the vicinity of the air inlet 171 is shaped to form a chute leading from the air inlet 171 to the inlet 145 of the discharge spout 143. As shown in Figure 28a, a canted shoulder 174 is formed between the air inlet

171 and the chute to ensure that the jet of beverage issuing from the slot 170 does not immediately foul on the upper surface of the flange 147 in the immediate vicinity of the air inlet 171.

The inner member 103 may be formed as a single integral piece from polypropylene or a similar material as described above and by injection moulding in the same manner as the outer member 102.

Alternatively, the inner member 103 and/or the outer member 102 may be made from a biodegradable polymer. Examples of suitable materials include degradable polyethylene (for example, SPITEK supplied by Symphony Environmental, Borehamwood, United Kingdom), biodegradable polyester amide (for example, BAK 1095 supplied by Symphony Environmental), poly lactic acids (PLA supplied by Cargil, Minnesota, USA), starch-based polymers, cellulose derivatives and polypeptides.

The laminate 105 is formed from two layers, a first layer of aluminium and a second layer of cast polypropylene. The aluminium layer is between 0.02 and 0.07 mm in thickness. The cast polypropylene layer is between 0.025 and 0.065 mm in thickness. In one embodiment the aluminium layer is 0.06 mm and the polypropylene layer is 0.025 mm thick. This laminate 105 is particularly advantageous as it has a high resistance to curling during assembly. As a result the laminate 105 may be pre-cut to the correct size and shape and subsequently transferred to the assembly station on the production line without undergoing distortion. Consequently,

the laminate 108 is particularly well suited to welding. Other laminate materials may be used including PET/Aluminium/PP, PE/EVOH/PP, PET/metallised/PP and Aluminium/PP laminates. Roll laminate stock may be used instead of die cut stock.

The cartridge 100 may be closed by a rigid or semi-rigid lid instead of a flexible laminate 105.

Assembly of the cartridge 100 involves the following steps:

a) the inner member 103 is inserted into the outer member 102;

b) the filter 104 is cut to shape and placed onto the inner member 103 so to be received over the cylindrical funnel 140 and come to rest against the annular frame 141;

c) the inner member 103, outer member 102 and filter 104 are joined by ultrasonic welding;

d) the cartridge 100 is filled with one or more beverage ingredients;

e) the laminate 105 is affixed to the outer member 102.

These steps will be discussed in greater detail below.

The outer member 103 is orientated with the open bottom 112 directed upwards. The inner member 103 is then inserted into the outer member 102 with the outer rim 151 being received as a loose fit in an axial extension 114 at top 111 of the cartridge 100. The cylindrical extension 118 of the

outer member 102 is at the same time received in the upper portion of the cylindrical funnel 140 of the inner member 103.

The third portion 121 of the cylindrical extension 118 is seated inside the support rim 167. The shoulder 132 of the cylindrical extension 118 between the second portion 120 and third portion 121 bears against the upper edge of the support rim 167 of the inner member 103. An interface zone is thus formed between the inner member 103 and the outer member 102 comprising a face seal between the cylindrical extension 118 and the support rim 167 which extends around nearly the whole circumference of the cartridge 100. The seal between the cylindrical extension 118 and the support rim 167 is not fluid-tight though since the slot 170 in the support rim 167 extends through the support rim 167 and downwardly to a point marginally below the shoulder 168. Consequently the interface fit between the cylindrical extension 118 and the support rim 167 transforms the slot 170 into an aperture providing gas and liquid communication between the annular channel 169 and the discharge spout 143. The aperture is typically 0.64 mm wide by 0.69 mm long.

The filter 104 is then placed over the inner member 103 such that the filter material contacts the annular rim 151. An ultrasonic welding process is then used to join the filter 104 to the inner member 103 and at the same time, and in the same process step, the inner member 103 to the outer member 102. The inner member 103 and filter 104 are welded around the outer rim 151. The inner member 103 and outer

member 102 are joined by means of weld lines around the outer rim 151 and also the upper edges of the webs 154.

As shown most clearly in Figure 29, the outer member 102 and inner member 103 when joined together define a void space in the interior 106 below the annular flange 141 and exterior the cylindrical funnel 140 which forms a filtration chamber. The filtration chamber 160 and passages 157 above the annular frame 141 are separated by the filter paper 104.

The filtration chamber 160 contains the one or more beverage ingredients 200. The one or more beverage ingredients 200 are packed into the filtration chamber 160. For an espresso-style beverage the ingredient is typically roast and ground coffee. The density of packing of the beverage ingredients in the filtration chamber 130 can be varied as desired. Typically, for a filtered coffee product the filtration chamber contains between 5.0 and 10.2 grams of roast and ground coffee in a filtration bed of thickness of typically 5 to 14 mm. Optionally, the interior 106 may contain one or more bodies, such as spheres, which are freely movable within the interior 106 to aid mixing by inducing turbulence and breaking down deposits of beverage ingredients during discharge of the beverage.

The laminate 105 is then affixed to the outer member 102 by forming a weld 161 around the periphery of the laminate 105 to join the laminate 105 to the lower surface of the outwardly extending flange 135. The weld 161 is extended to seal the laminate 105 against the lower edge of the cylindrical wall 127 of the inlet chamber 126. Further,

a weld 162 is formed between the laminate 105 and the lower edge of the outer tube 142 of the cylindrical funnel 140. The laminate 105 forms the lower wall of the filtration chamber 160 and also seals the inlet chamber 126 and cylindrical funnel 140. However, a small gap 163 exists prior to dispensation between the laminate 105 and the lower edge of the discharge spout 43. A variety of welding methods may be used, such as heat and ultrasonic welding, depending on the material characteristics of the laminate 105.

Advantageously, the inner member 103 spans between the outer member 102 and the laminate 105. The inner member 103 is formed from a material of relative rigidity, such as polypropylene. As such, the inner member 103 forms a load-bearing member that acts to keep the laminate 105 and outer member 102 spaced apart when the cartridge 100 is compressed. It is preferred that the cartridge 100 is subjected to a compressive load of between 130 and 280N in use. The compressive force acts to prevent the cartridge failing under internal pressurisation and also serves to squeeze the inner member 103 and outer member 102 together. This ensures that the internal dimensions of passageways and apertures in the cartridge 100 are fixed and unable to change during pressurisation of the cartridge 100.

In use the water, under pressure, enters the cartridge 100 through the inlet 107 into the inlet chamber 126. From there the water is directed to flow through the slots 117 and round the manifold 116 and into the filtration chamber 160 of the cartridge 1 through the plurality of slots 117. The water is forced radially inwardly through the filtration

chamber 160 and mixes with the beverage ingredients 200 contained therein. The water is at the same time forced upwardly through the beverage ingredients 200. The beverage formed by passage of the water through the beverage ingredients 200 passes through the filter 104 and filtration apertures 155 into the passages 157 lying above the annular frame 141.

Beverage in the radial passages 157 flows downwardly along the passages 157 formed between the webs 154 and through the openings 156 and into the annular channel 169 of the cylindrical funnel 140. From the annular channel 169 the beverage is forced under pressure through the aperture 128 by the back pressure of beverage collecting in the filtration chamber 160 and passages 157. The beverage is thus forced through aperture as a jet and into an expansion chamber formed by the upper end of the discharge spout 143. As shown in Figure 29, the jet of beverage passes directly over the air inlet 171. Passage of the beverage through the restriction of the aperture causes the pressure of the beverage to be reduced. As the beverage enters the discharge spout 143 the pressure of the beverage is still relatively low. As a result air is entrained into the beverage stream in the form of a multitude of small air bubbles as the air is drawn up through the air inlet 171. The jet of beverage issuing from the aperture is funnelled downwards to the outlet 144 where the beverage is discharged into a receptacle such as a cup where the air bubbles form the desired crema. Thus, the aperture and the air inlet 171 together form an eductor which acts to entrain air into the beverage. Flow of beverage into the eductor should be kept

as smooth as possible to reduce pressure losses. It should be noted that, in the high pressure state, the air eduction mechanism is de-activated.

The sealing of the filter 104 onto the spokes 153 and the welding of the rim 151 with the outer member 102 ensures that there are no short-circuits and all the beverage has to pass through the filter 104.

Figure 30 shows a second embodiment of beverage cartridge 100 which can be used in the beverage preparation machine 10 of the present invention. Like components between the first and second embodiments have been referenced with like numerals. Many of the components and functions of the second embodiment of cartridge 100 are the same as for the first embodiment. However, it can be seen from Figure 30 that the cartridge 100 has a greater overall height compared to the cartridge 100 shown in Figure 29. The outer member 102 is taller and thereby defines a larger void space in which a larger quantity of beverage ingredients 200 can be stored. The second embodiment of cartridge 100 is therefore suitable for dispensing larger volumes of beverage. The diameter of the outer member 102 and cartridge 100 are the same as in the first embodiment. Typically the storage volume of the cartridge 100 when assembled is 50 to 58 ml ±20%. As with the first embodiment, the upper surface of the outer member 102 is provided with a recess having a clamping surface 118 located at a bottom thereof. According to the present invention, the separation D between surface 118a and the underside of the laminate 105 is the same as for the first embodiment. As a result, the elongated recess extends

approximately 60% of the distance towards the laminate 105. This advantageously allows for a simplified clamping arrangement to be used as described below.

Also, the second embodiment of cartridge 100 lacks an eductor air inlet 171.

The first and second embodiments of cartridge 1 described above are given as examples of an "eductor" type of cartridge and a "non-eductor" type cartridge which may be used with the improved beverage preparation machine described above.

CLAIMS:

1. A method of preparing beverages using a beverage preparation machine for preparing beverages from one or more beverage ingredients, characterised by controlling the volume of gas in at least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

2. A method of preparing beverages as claimed in claim 1 in which the volume of gas is actively controlled by increasing the volume to increase the gas:liquid ratio in the beverage produced, decreasing the volume to decrease the gas:liquid ratio or maintaining the volume.

3. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of gas in the delivery system is controlled by inducting additional gas into the delivery system, venting gas from the delivery system and/or purging the delivery system.

4. A method of preparing beverages as claimed in any one of the preceding claims further comprising the step of measuring the actual volume of gas resident in the delivery system.

5. A method of preparing beverages as claimed in any one of the preceding claims in which an actual volume of gas resident in the delivery system is calculated from stored parameters relating to a volume of gas remaining in the delivery system after a last operation of the machine.

6. A method of preparing beverages as claimed in any one of the preceding claims in which the control of the volume of gas is effected on a beverage by beverage basis.

7. A method of preparing beverages as claimed in any one of the preceding claims in which the control of the volume of gas is effected automatically according to the type of beverage being produced.

8. A method of preparing beverages as claimed in any one of claims 1 to 5 in which the control of the volume of gas is effected manually.

9. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of gas upstream of the beverage ingredients is controlled.

10. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of gas downstream of the beverage ingredients is controlled.

11. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of gas is controlled by selectively opening and/or closing valve means in the delivery system prior to and/or during beverage preparation.

12. A beverage preparation machine for preparing a beverage from one or more beverage ingredients, characterised by the provision of means for controlling the volume of gas in at

least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

13. A beverage preparation machine as claimed in claim 12 further comprising means for determining the actual volume of gas resident in the delivery system.

14. A beverage preparation machine as claimed in claim 13 in which the means for determining the actual volume of gas resident in the delivery system comprise means for calculating the actual volume from stored parameters relating to a volume of gas remaining in the delivery system after a last operation of the machine.

15. A beverage preparation machine as claimed in claim 14 in which the stored parameters comprise a basic volume parameter stored in the control means, said basic volume being the actual volume of gas which resides in the delivery system of an unused machine or a machine after a purging cycle has been run.

16. A beverage preparation machine as claimed in claim 14 or claim 15 in which the stored parameters comprise parameters relating to the actual volume of gas remaining in the delivery system after each type of beverage which the machine is programmed to prepare.

17. A beverage preparation machine as claimed in claim 13 in which the means for determining the actual volume of gas resident in the delivery system comprise means for measuring the actual volume of gas in the delivery system.

18. A beverage preparation machine as claimed in any one of claims 13 to 17 in which parameters relating to predetermined volumes of gas required to be present in the delivery system for preparing a predetermined range of beverages are stored in the control means, said control means being programmed to calculate the difference between the predetermined volume required for a beverage in preparation and the actual volume present.

19. A beverage preparation machine as claimed in any one of claims 13 to 18 in which the means for controlling the actual volume of gas comprise valve and/or purge means for venting gas and/or pump means for injecting additional gas into the delivery system.

20. A beverage preparation machine as claimed in claim 19 in which the valve means comprise an outlet valve downstream of the beverage ingredients.

21. A beverage preparation machine as claimed in claim 19 or claim 20 in which the valve means comprise a valve upstream of the beverage ingredients.

22. A beverage preparation machine as claimed in any one of claims 18 to 22 in which the operation of the valve means is controlled relative to the beverage preparation cycle to vary the actual volume of gas present in the delivery system.

Amendments to the Claims have been filed as follows:

CLAIMS:

1. A method of preparing beverages using a beverage preparation machine for preparing beverages from one or more beverage ingredients, characterised by controlling the volume of air resident in at least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

2. A method of preparing beverages as claimed in claim 1 in which the volume of air is actively controlled by increasing the volume to increase the air:liquid ratio in the beverage produced, decreasing the volume to decrease the air:liquid ratio or maintaining the volume.

3. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of air in the delivery system is controlled by inducting additional gas into the delivery system, venting air from the delivery system and/or purging the delivery system.

4. A method of preparing beverages as claimed in any one of the preceding claims further comprising the step of measuring the actual volume of air resident in the delivery system.

5. A method of preparing beverages as claimed in any one of the preceding claims in which an actual volume of air resident in the delivery system is calculated from stored parameters relating to a volume of air remaining in the delivery system after a last operation of the machine.

6. A method of preparing beverages as claimed in any one of the preceding claims in which the control of the volume of air is effected on a beverage by beverage basis.

7. A method of preparing beverages as claimed in any one of the preceding claims in which the control of the volume of air is effected automatically according to the type of beverage being produced.

8. A method of preparing beverages as claimed in any one of claims 1 to 5 in which the control of the volume of a is effected manually.

9. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of air upstream of the beverage ingredients is controlled.

10. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of air downstream of the beverage ingredients is controlled.

11. A method of preparing beverages as claimed in any one of the preceding claims in which the volume of air is controlled by selectively opening and/or closing valve means in the delivery system prior to and/or during beverage preparation.

12. A beverage preparation machine for preparing a beverage from one or more beverage ingredients, characterised by the provision of means for controlling the volume of air

resident in at least a part of a delivery system of the machine to produce predetermined characteristics in a prepared beverage.

13. A beverage preparation machine as claimed in claim 12 further comprising means for determining the actual volume of air resident in the delivery system.

14. A beverage preparation machine as claimed in claim 13 in which the means for determining the actual volume of air resident in the delivery system comprise means for calculating the actual volume from stored parameters relating to a volume of air remaining in the delivery system after a last operation of the machine.

15. A beverage preparation machine as claimed in claim 14 in which the stored parameters comprise a basic volume parameter stored in the control means, said basic volume being the actual volume of air which resides in the delivery system of an unused machine or a machine after a purging cycle has been run.

16. A beverage preparation machine as claimed in claim 14 or claim 15 in which the stored parameters comprise parameters relating to the actual volume of air remaining in the delivery system after each type of beverage which the machine is programmed to prepare.

17. A beverage preparation machine as claimed in claim 13 in which the means for determining the actual volume of air