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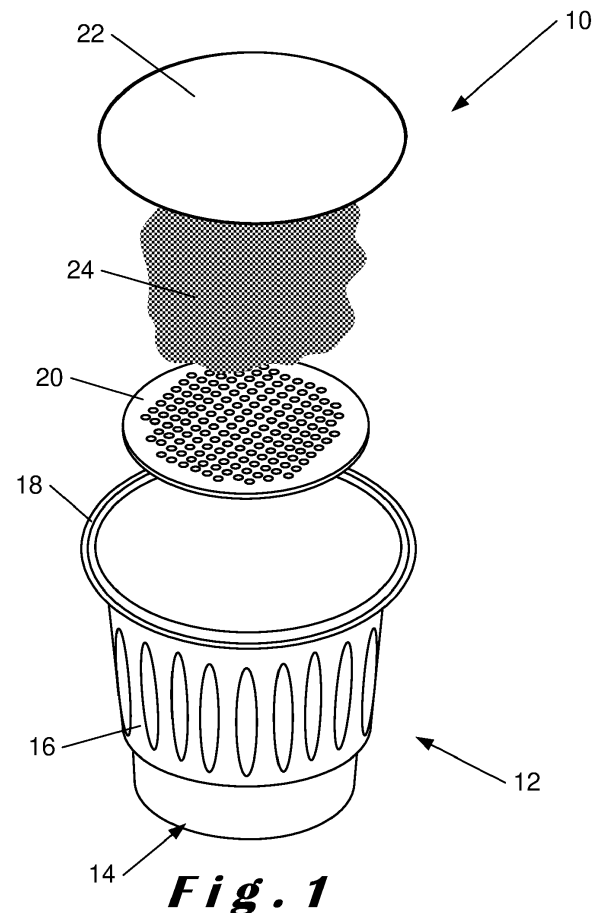
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(54) **A BEVERAGE CAPSULE**

(57) A beverage capsule (10) for use in a beverage preparation machine to prepare a beverage by passing a fluid therethrough. The beverage capsule comprises: a cup-shaped body (12) having a base (14) and a sidewall (16); a lid (22) sealed to the cup-shaped body; and a punctured support plate (20) positioned inside the cup-shaped body and dividing the interior volume into a first compartment for holding beverage ingredients (24) and a second compartment. The punctured support plate is located at a distance from the base which is larger than a piercing height of a draining member of the beverage preparation machine. The cup-shaped body, the lid and the punctured support plate are made of a material comprising metal.



**Fig. 1**

## Description

### Technical field

**[0001]** The present invention relates to a beverage capsule for use in a beverage preparation system to prepare a beverage by passing a fluid through the beverage capsule. The present invention further relates to a use of the beverage capsule in a beverage preparation system to prepare a beverage.

### Background art

**[0002]** A known beverage capsule comprises: a cup-shaped body comprising a base and a sidewall contiguous with the base, wherein the base is configured to be pierced by a draining member of the beverage preparation machine to allow draining a beverage from the beverage capsule; a lid which is typically sealed to the cup-shaped body, the lid and cup-shaped body enclosing an interior volume, wherein the lid is configured to be pierced by an injection member of the beverage preparation machine to inject a fluid into the beverage capsule; and a punctured support plate positioned inside the cup-shaped body and dividing the interior volume into a first compartment delimited in part by the lid and configured for holding one or more beverage ingredients and a second compartment delimited in part by the base, wherein the punctured support plate is located at a distance from said base which is equal or larger than a piercing height of the draining member of the beverage preparation machine and wherein said beverage is able to pass through the punctured support plate.

**[0003]** Such a beverage capsule is known from WO 2013/39585 A1 where a filter paper is attached to the plastic punctured support plate. The paper filter in the capsule disclosed in WO 2013/39585 A1 is configured to filter the beverage made by passing the water through the beverage ingredients contained in the capsule. In other words, the filter paper retains at least most of the beverage ingredients inside the capsule which, if these were to come out together with the beverage, would reduce the quality of the latter. The role of the punctured support plate is avoiding that the filter paper gets damaged by the ingredients and/or the piercing member of the beverage preparation machine.

**[0004]** In the prior art various beverage ingredients are known. These may be divided roughly into two classes, namely extraction or infusion ingredients and dissolving ingredients. The beverage capsule according to the present invention may be applied in both cases, i.e. either in the case in which the capsule is of the type which contains beverage ingredients intended to allow the beverage to be made by extraction or infusion (such as roasted ground coffee or tea leaves as with the capsule disclosed in WO 2013/39585 A1) and in the case in which the capsule is of the type which contains beverage ingredients intended to allow the beverage to be made following

complete or partial dissolving of the beverage ingredients when the water passes through it (for example milk, chocolate, powdered tea, instant drink, etc.).

**[0005]** The known beverage capsules are used in a beverage preparation system where fluid (usually water) is supplied directly into the capsule. More specifically, the capsule is inserted in an openable and closable chamber, defined inside the beverage preparation system. When the capsule is inside the closed chamber, an injection member of the beverage preparation machine pierces the lid and water (usually hot and pressurised as required) is injected into the capsule, in order to obtain the beverage following the interaction of the water with the beverage ingredients (e.g. extraction, infusion, or partial or whole dissolution). Finally, the beverage is released from the capsule by a draining member which pierces the base allowing the beverage to flow along an outflow path of the beverage preparation system.

**[0006]** A known issue with the beverage capsules is their recyclability after having been used. The capsules are often formed from a mix of materials that are not easily distributed to specific recycling streams. For example, Keurig K-Cup™ capsules have: a body that is formed from a multilayered material that includes a polyethylene or polypropylene outer layer, an ethylene vinyl alcohol copolymer (EVOH) barrier layer and a polyethylene sealing layer; a filter that is formed primarily out of paper; and a cover that is formed from a multilayered material that includes an aluminium foil outer layer, an EVOH barrier layer and a polyethylene sealing layer. Moreover, the filter is usually attached to and irremovable from the capsule body. As such, even if the lid is removed, which in itself is already difficult since it is often welded to the cup-shaped body, it is difficult to remove the filter. Also, because the filter is not necessarily closed around the beverage ingredients, once the lid is removed the beverage ingredients can spill out of the capsule and onto the floor or machine.

**[0007]** The issue of recyclability has already been addressed in the prior art, e.g. US 2017/283163 A1 and WO 2019/204916 A1. WO 2019/204916 A1 proposes forming the entire capsule (i.e. body, filter and cover) from a single polymeric material thus allowing recycling in a single material stream. US 2017/283163 A1 proposes an aluminium capsule with a base having an elevated part to support the paper filter to avoid the use of a plastic punctured support plate.

### Disclosure of the invention

**[0008]** It is an object of the present invention to provide a beverage capsule which alleviates one or more of the above-mentioned problems.

**[0009]** This object is achieved according to the present invention with a beverage capsule in which the cup-shaped body, the lid and the punctured support plate are made of a material comprising metal.

**[0010]** Firstly, the use of metal aids in preserving the

beverage ingredients which are present within the interior volume. More specifically, a known downside of polymeric materials (as in the capsule disclosed in WO 2019/204916 A1) is a low preservation of food ingredients inside the capsule, this is particularly caused by an insufficient oxygen tightness. The use of metal overcomes this issue.

**[0011]** Secondly, the present inventors realized that the punctured support plate can perform the role of a conventional filter paper. As such, there is no longer any need to include a filter paper inside the capsule. This improves the recyclability of the capsule since there is no longer any need to separate the filter paper from the remainder of the capsule as with the capsule disclosed in US 2017/283163 A1.

**[0012]** In an embodiment of the present invention the beverage capsule further comprises the one or more beverage ingredients, which ingredients are either extraction/infusion based ingredients (e.g. roasted ground coffee, tea leaves, etc.) or dissolution based (e.g. powder materials such as milk powder, chocolate powder, powdered tea, powdered soup, instant drink, etc.). Preferably, when the ingredients are extraction/infusion based ingredients, the beverage ingredients have a particle size distribution determined using optical microscopy according to ISO 13320:2020, wherein at least 90 volume%, and in particular at least 95 volume%, of the one or more beverage ingredients have a particle size of at least 30  $\mu\text{m}$ , in particular at least 40  $\mu\text{m}$  and more particularly at least 50  $\mu\text{m}$ . The beverage capsule according to the present invention is thus usable for preparing a variety of beverages.

**[0013]** In an embodiment of the present invention, when the ingredients are extraction/infusion based ingredients, the punctured support plate comprises openings having a size so as to prevent at least 90 volume%, in particular at least 95 volume%, and specifically at least 99 volume%, of the one or more beverage ingredients from passing therethrough. This avoids that too much of the ingredients would pass into the beverage which could otherwise negatively affect beverage quality.

**[0014]** In an embodiment of the present invention, when the ingredients are extraction/infusion based ingredients, the punctured support plate comprises openings having a smallest dimension which is at most 500  $\mu\text{m}$ , in particular at most 300  $\mu\text{m}$ , more in particular at most 200  $\mu\text{m}$ , and most in particular at most 100  $\mu\text{m}$ . Advantageously, the smallest dimension is comprised between 50  $\mu\text{m}$  and 100  $\mu\text{m}$ , such as 55  $\mu\text{m}$ , 60  $\mu\text{m}$ , 65  $\mu\text{m}$ , 70  $\mu\text{m}$ , 75  $\mu\text{m}$ , 80  $\mu\text{m}$ , 85  $\mu\text{m}$ , 90  $\mu\text{m}$  or 95  $\mu\text{m}$ . The smallest dimension may be the diameter in case the openings are substantially circular or the width in case the openings are formed as oblong slits. Such a smallest dimension has been found to retain conventional roasted ground coffee ingredients to a sufficient extent so as to avoid these from lowering the beverage quality.

**[0015]** In an embodiment of the present invention the punctured support plate comprises openings which are

substantially uniformly distributed across the plate. However, alternative distributions with a concentration in the center or on the outer part are also possible. The distribution is mainly determined to achieve a desired contact time between the water and the beverage ingredients, which desired contact time is dependent on the type of beverage to prepare.

**[0016]** In an embodiment of the present invention the cup-shaped body the lid and the punctured support plate are all made of a metal, preferably a food-grade metal, such as aluminium or an aluminium alloy. Ideally, all parts are made of the same metal to optimize recyclability of the capsule.

**[0017]** In an embodiment of the present invention the cup-shaped body and the lid are both made of a metal-based laminate material comprising at least one layer of metal, the metal layer preferably comprising a food-grade metal, such as an aluminium or an aluminium alloy, wherein the punctured support plate is made of a metal, preferably a food-grade metal, such as aluminium or an aluminium alloy. Ideally, the metal used for the punctured support plate is the same as that used in the metal layer of the metal-based laminate. The use of the same metal in all parts optimizes recyclability of the capsule.

**[0018]** The aluminium or aluminium alloy is preferably annealed aluminium or aluminium alloy and particularly being a soft annealed aluminium or aluminium alloy. The aluminium alloy may, for example, be of grade 3005, 3104, 3105, 3175, 8011 or 8079. The skilled person is familiar with these materials and their various advantages, in particular in the context of food-grade materials.

**[0019]** The metal-based laminate may comprises one or more lacquer layers (i.e. a lacquer-metal laminate). For example, a heat seal lacquer, in particular a vinyl heat seal lacquer, or an epoxy stove lacquer, in particular a colored or transparent epoxy stove lacquer. These lacquers can influence the visual look of the cup-shaped body exterior and may also be beneficial for, in a later stage of production, applying a lid to the cup-shaped body to seal the capsule. Moreover, the presence of one or two lacquer layers has no negative impact on the capsule recyclability as the capsule is mainly formed from a metal material.

**[0020]** The metal-based laminate may comprise one or more polymer layers (i.e. a polymer-metal laminate). The one or more polymer layers may comprise a single layer of a single polymer material or multiple layers of different polymer materials. Where multiple layers of different polymer materials are used, each layer may be applied separately when forming the sheet of material that is usually the basis for forming the cup-shaped body. However, it is preferred that the multiple layers of different polymer materials are first made up into a multilayer laminated polymer film which can then be laminated onto the metal layer (e.g. the aluminium or aluminium alloy layer) by a suitable process, for example adhesive lamination. The polymer materials of the one or more polymer layers may comprise materials selected from the group

consisting of homopolymers, copolymers and mixtures thereof. A homopolymer refers to a polymer produced by the polymerization of a single monomer. A copolymer refers to a polymer produced by the polymerization of two or more monomers. Suitable homopolymers include polyvinyl chloride (PVC), polypropylene (PP), low density polyethylene (LDPE), medium density polyethylene (MDPE), high density polyethylene (HDPE), polytetrafluoroethylene (PTFE), polyethylene terephthalate (PET), polychloroprene, polyisobutylene, and polyamides. Suitable copolymers include fluorinated ethylene propylene (FEP), ethylene propylene diene monomer (EPDM), polyamides, thermoplastic copolyesters (TPC) and olefin block copolymers (OBC). These copolymers are preferably alternating copolymers or block copolymers. An alternating copolymer refers to a copolymer with regular alternating monomer units. A block copolymer refers to a copolymer comprising two or more homopolymer subunits linked by covalent bonds.

**[0021]** The use of an all-metal capsule or a lacquer-metal based laminate is preferred for recycling purposes as opposed to a polymer-metal based laminate.

**[0022]** In an embodiment of the present invention the cup-shaped body is integrally formed (e.g. by drawing or deep drawing operations) from a sheet of material. The sheet may have a thickness between 50 and 500 microns. The thickness preferably being at least 60 microns, more preferably at least 70 microns and most preferably at least 80 microns. The thickness preferably being at most 400 microns, more preferably at most 300 microns, even more preferably at most 200 microns, still more preferably at most 150 microns, and most preferably at most 120 microns. The sheet advantageously has a thickness of about 80 to 100 microns.

**[0023]** In an embodiment of the present invention the sidewall comprises a stepped region, the punctured support plate engaging the stepped region.

**[0024]** In an alternative embodiment of the present invention the sidewall comprises a first region and a second region having a different inclination with respect to a central axis of the beverage capsule, the punctured support plate engaging the sidewall where the first region and a second region are contiguous.

**[0025]** Both embodiments rely on a change in shape of the sidewall to create an abutment surface for the punctured support plate. This allows the punctured support plate to, during assembly of the capsule, rest against the abutment surface by the influence of gravity. Once the capsule is filled, i.e. after the beverage ingredients are placed in the capsule, the lid is sealed to the cup-shaped body. In this way, the lid traps the beverage ingredients which therefore maintain the placement of the punctured support plate, e.g. by pushing lightly against this.

**[0026]** For a more secure placement, the punctured support plate may be welded to the abutment surface (i.e. the stepped region or the region where the sidewall inclination changes). It should be appreciated that the punctured support plate may generally be welded to the

sidewall without requiring an abutment surface.

**[0027]** Another way to achieve a more secure placement of the punctured support plate is to provide one or more inwardly extending protrusions facing the abutment surface (i.e. the stepped region or the region where the sidewall inclination changes). For example, during assembly of the capsule, once the punctured support plate has been placed, the sidewall of the capsule is indented in the region above the punctured support plate. In this way, the punctured support plate is trapped between the abutment surface and the protrusions.

**[0028]** In an embodiment of the present invention said distance between the punctured support plate and the base is at least 5 mm and preferably at least 8 mm or more. Such a distance has been found to be sufficiently far away to allow the draining member of the beverage preparation machine to sufficiently pierce the base to allow a satisfactory draining of the beverage from the capsule without contacting and/or damaging the punctured support plate.

**[0029]** In an embodiment of the present invention the beverage capsule does not contain a filter paper.

**[0030]** In an embodiment of the present invention the beverage capsule comprises an annular rim contiguous with the sidewall, the lid being sealed to the annular rim. The provision of an annular rim provides a surface on which the lid can be easily sealed.

**[0031]** In an embodiment of the present invention, the capsule is a single-use, disposable element.

**[0032]** The object according to the present invention is also achieved with a use of a beverage capsule as described above in a beverage preparation machine to prepare a beverage by passing a fluid through the beverage capsule.

### **Brief description of the drawings**

**[0033]** The invention will be further explained by means of the following description and the appended figures.

Figure 1 shows an exploded view of a beverage capsule according to the present invention.

Figure 2 shows a perspective view of a beverage capsule according to the present invention.

Figure 3 shows a cross-sectional view of the beverage capsule of figure 2.

Figures 4 and 5 show details of figure 3.

Figure 6 shows an alternative punctured support plate for use in a beverage capsule according to the present invention.

### **Description of the invention**

**[0034]** The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only

schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not necessarily correspond to actual reductions to practice of the invention.

**[0035]** Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. The terms are interchangeable under appropriate circumstances and the embodiments of the invention can operate in other sequences than described or illustrated herein.

**[0036]** Moreover, the terms top, bottom, over, under and the like in the description and the claims are used for descriptive purposes. The terms so used are interchangeable under appropriate circumstances and the embodiments of the invention described herein can operate in other orientations than described or illustrated herein.

**[0037]** Furthermore, the various embodiments, although referred to as "preferred" are to be construed as exemplary manners in which the invention may be implemented rather than as limiting the scope of the invention.

**[0038]** Figure 1 shows an exploded view of a beverage capsule 10 according to the present invention. The capsule 10 comprises a cup-shaped body 12 having a base 14, a sidewall 16 which is contiguous with the base 14 and an annular rim 18 which is contiguous with the sidewall 16. The capsule 10 further comprises a punctured support plate 20 and a lid 22 sealed to the sidewall 16, in particular to the annular rim 18. Beverage ingredients 24 are also schematically shown in figure 1.

**[0039]** As indicated in figure 3, the cup-shaped body 12 generally has a height H comprised between 25 and 65 mm. The height H is preferably at least 35 mm, more preferably at least 40 mm, and most preferably at least 43 mm. The height H is preferably at most 55 mm, more preferably at most 50 mm, and most preferably at most 47 mm. In the illustrated embodiment, the height H is about 45 mm.

**[0040]** The cup-shaped body 12 generally has an outer diameter D comprised between 30 and 70 mm. The outer diameter D is preferably at least 40 mm, more preferably at least 45 mm, and most preferably at least 49 mm. The outer diameter D is preferably at most 60 mm, more preferably at most 55 mm, and most preferably at most 53 mm. In the illustrated embodiment, the outer diameter D is about 51 mm.

**[0041]** The sidewall 16 has an inner diameter  $D_i$  measured at the end 16a contiguous with the base 14 comprised between 15 and 55 mm. The inner diameter  $D_i$  is preferably at least 25 mm, more preferably at least 30 mm, and most preferably at least 33 mm. The inner diameter  $D_i$  is preferably at most 45 mm, more preferably at most 40 mm, and most preferably at most 37 mm. In the illustrated embodiment, the outer diameter  $D_i$  is about 35

mm.

**[0042]** The sidewall 16 has an outer diameter  $D_o$  measured at the end 16b contiguous with the annular rim 18 comprised between 25 and 65 mm. The outer diameter  $D_o$  is preferably at least 35 mm, more preferably at least 40 mm, and most preferably at least 43 mm. The outer diameter  $D_o$  is preferably at most 55 mm, more preferably at most 50 mm, and most preferably at most 47 mm. In the illustrated embodiment, the outer diameter  $D_o$  is about 45 mm.

**[0043]** The dimensions H, D,  $D_i$  and  $D_o$  are mainly determined in function of the beverage preparation machine, in particular of the closed chamber inside the beverage preparation machine.

**[0044]** In the illustrated embodiment, the sidewall 16 is provided with a stepped region 16c, i.e. a region in which the diameter of the sidewall rapidly increases. The punctured support plate 20 engages this stepped region 16c as best shown in figure 4 and may be sealed thereto. The stepped region 14c divides the sidewall 14 into a first section 16<sub>1</sub> extending between the base 14 and the stepped region 16c and a second section 16<sub>2</sub> extending between the stepped region 16c and the annular rim 18.

**[0045]** As described above, the stepped region can be replaced by a change in inclination angles of the sidewall sections, e.g. the first sidewall section having an inclination angle of 30° or more (e.g. 45°) with the second sidewall section having an inclination angle of 20° or less (e.g. 8°). Furthermore, both a stepped region and/or inclination change may be absent in which case the punctured support plate 20 is welded to the sidewall 16 at the desired location.

**[0046]** The first sidewall section 16<sub>1</sub> has a height  $H_1$  comprised between 3 and 20 mm. The height  $H_1$  is preferably at least 5 mm, more preferably at least 8 mm, and most preferably at least 9 mm. The height  $H_1$  is preferably at most 15 mm, more preferably at most 12 mm, and most preferably at most 11 mm. In the illustrated embodiment, the height  $H_1$  is about 10 mm.

**[0047]** The second sidewall section 16<sub>2</sub> has a height  $H_2$  comprised between 20 and 50 mm. The height  $H_2$  is preferably at least 25 mm, more preferably at least 30 mm, and most preferably at least 33 mm. The height  $H_2$  is preferably at most 45 mm, more preferably at most 40 mm, and most preferably at most 37 mm. In the illustrated embodiment, the height  $H_2$  is about 35 mm.

**[0048]** The first sidewall section 16<sub>1</sub> has an inclination angle  $\alpha_1$  with respect to the central axis 30 of the capsule 10 comprised between 0° and 10°. The inclination angle  $\alpha_1$  is preferably at least 1° and more preferably at least 2°. The inclination angle  $\alpha_1$  is preferably at most 8°, more preferably at most 6°, and most preferably at most 4° mm. In the illustrated embodiment, the inclination angle  $\alpha_1$  is about 3°.

**[0049]** The second sidewall section 16<sub>2</sub> has an inclination angle  $\alpha_2$  with respect to the central axis 30 of the capsule 10 comprised between 0° and 20°. The inclination angle  $\alpha_2$  is preferably at least 2°, more preferably at

least 4°, and most preferably at least 5°. The inclination angle  $\alpha_2$  is preferably at most 15°, more preferably at most 10°, and most preferably at most 8° mm. In the illustrated embodiment, the inclination angle  $\alpha_2$  is about 6°.

**[0050]** The inclination angles  $\alpha_1$  and  $\alpha_2$  are determined in order to maximize the volume inside the cup-shaped body whilst allowing the cup-shaped bodies to be stackable before assembly.

**[0051]** The punctured support plate 20 divides the internal capsule volume into a first compartment C1 and a second compartment C2. The first compartment C1 is normally empty and the second compartment C2 is filled with beverage ingredients 24. The first compartment C1 is delimited by the base 14, the first sidewall section 16<sub>1</sub> and the punctured support plate 20. The second compartment C2 is delimited by the lid 22, the second sidewall section 16<sub>2</sub> and the punctured support plate 20.

**[0052]** As described above, the beverage ingredients 24 are either extraction/infusion based ingredients (e.g. roasted ground coffee, tea leaves, etc.) or dissolution based (e.g. powder materials such as milk powder, chocolate powder, powdered tea, powdered soup, instant drink, etc.). Preferably, when the ingredients are extraction/infusion based ingredients, the beverage ingredients have a particle size distribution determined using optical microscopy according to ISO 13320:2020, wherein at least 90 volume%, and in particular at least 95 volume%, of the one or more beverage ingredients have a particle size of at least 30  $\mu\text{m}$ , in particular at least 40  $\mu\text{m}$  and more particularly at least 50  $\mu\text{m}$ .

**[0053]** The second compartment C2 has a volume comprised between 30 and 70 mml. The second compartment volume is preferably at least 35 ml, more preferably at least 40 ml, and most preferably at least 45 ml. The second compartment volume is preferably at most 60 ml, more preferably at most 55 ml, and most preferably at most 52 ml. In the illustrated embodiment, the second compartment volume is about 48 or 49 ml.

**[0054]** As shown in figure 5, the annular rim 18 has a flat section 18<sub>2</sub> and a rolled-over rim portion 18<sub>1</sub>. The lid 22 is normally sealed to the flat section 18<sub>2</sub>. The use of a rolled-over rim portion 18<sub>1</sub> is a well-known technique for forming the free end of the annular rim when using a metal or metal-based laminate material to form the cup-shaped body 12. The rolled-over rim 18<sub>1</sub> has a height  $h$  comprised between 0,8 and 2,0 mm. The height  $h$  is preferably at least 1,0 mm, more preferably at least 1,2 mm, and most preferably at least 1,25 mm. The height  $h$  is preferably at most 1,6 mm, more preferably at most 1,4 mm, and most preferably at most 1,35 mm. In the illustrated embodiment, the height  $h$  is about 1,25 mm.

**[0055]** Naturally, other shapes are possible for the rolled-over rim portion, e.g. an elliptic shape which increases the surface area of the flat section 18<sub>2</sub> useable for sealing the lid 22. Furthermore, the orientation of the roll-over rim portion may also be clockwise instead of

counter-clockwise in the illustrated embodiment.

**[0056]** Figure 2 further illustrates that the base 14 is provided with a ridged contour 14c which divides the base 14 into an inner region 14<sub>i</sub> and an outer region 14<sub>o</sub>. Typically, the outer region 14<sub>o</sub> is punctured by a piercing member of the beverage preparation machine to drain a beverage from the capsule 10. The lid 22 is normally pierced by a piercing member of the beverage preparation machine to inject a fluid (typically water) into the capsule to create a beverage through interaction with the beverage ingredients. The operation of the beverage capsule 10 in a beverage preparation machine will not be described further and is considered known to the skilled person.

**[0057]** The punctured support plate 20 is provided with openings (schematically illustrated in figure 1) to allow the prepared beverage to pass therethrough. As described above, when the ingredients are extraction/infusion based ingredients, the openings in the punctured support plate 20 have a size so as to prevent at least 90 volume%, in particular at least 95 volume%, and specifically at least 99 volume%, of the beverage ingredients 24 from passing therethrough.

**[0058]** Depending on the type of beverage ingredients 24 (e.g. roasted ground coffee), the openings in the punctured support plate 20 have a smallest dimension which is at most 500  $\mu\text{m}$ , in particular at most 300  $\mu\text{m}$ , more in particular at most 200  $\mu\text{m}$ , and most in particular at most 100  $\mu\text{m}$ . The smallest dimension may be the diameter in case the openings are substantially circular (as in the illustrated embodiment) or the width in case the openings are formed as oblong slits as in the embodiment of the punctured support plate 20' illustrated in figure 6.

**[0059]** In the illustrated embodiment, the openings are substantially uniformly distributed across the punctured support plate 20 and are substantially the same. However, this is not necessary. The distribution of the openings may vary as described above. Moreover, the openings may have varying shapes and/or size.

**[0060]** The cup-shaped body 12 is usually obtained by deforming a flat sheet of material into the cup-shape. This may be done by deep drawing in a one-stage or multiple-stage process. Due to the presence of the stepped region 16c, the cup-shaped body 12 is usually manufactured in a multiple-stage process using differently sized punches sequentially. However, a multiple-element punch may also be used to manufacture the cup 12 in a single step.

**[0061]** According to the present invention, the cup 12, the punctured support plate 20 and the lid 22 all comprise metal and ideally a same metal for improving recyclability.

**[0062]** In the illustrated embodiment, the cup 12 and the lid 22 are both made either solely from a metal or a metal-based laminate having a metal layer with a lacquer layer on one or both sides. Possible and preferred metals have been described above and will not be repeated. The punctured support plate 20 in the illustrated embodiment is made solely from a metal and ideally the same metal as used for the cup 12 and the lid 22.

**[0063]** In another embodiment, the cup 12 and the lid 22 are both made from a same metal-based polymer laminate. In this embodiment, the punctured support plate 20 is preferably made solely from a metal and ideally the same metal as used for the metal layer in the cup 12 and the lid 22. Possible and preferred metals and polymers have been described above and will not be repeated.

**[0064]** In yet another embodiment, the cup 12 is made from a metal or a metal-based laminate having a metal layer with a lacquer layer on one or both sides; the lid 22 is made from a metal-based polymer laminate and the punctured support plate 20 is preferably made solely from a metal. Ideally the metal is the same for each component. Possible and preferred metals and polymers have been described above and will not be repeated.

**[0065]** Although aspects of the present disclosure have been described with respect to specific embodiments, it will be readily appreciated that these aspects may be implemented in other forms within the scope of the invention as defined by the claims.

## Claims

1. A beverage capsule (10) for use in a beverage preparation machine to prepare a beverage by passing a fluid through the beverage capsule, the beverage capsule comprising:

- a cup-shaped body (12) comprising a base (14) and a sidewall (16) contiguous with the base, wherein the base is configured to be pierced by a draining member of the beverage preparation machine to allow draining a beverage from the beverage capsule;

- a lid (22) sealed to the cup-shaped body, the lid and cup-shaped body enclosing an interior volume, wherein the lid is configured to be pierced by an injection member of the beverage preparation machine to inject a fluid into the beverage capsule; and

- a punctured support plate (20, 20') positioned inside the cup-shaped body and dividing the interior volume into a first compartment (C2) delimited in part by the lid and configured for holding one or more beverage ingredients and a second compartment (C1) delimited in part by the base, wherein the punctured support plate is located at a distance (H1) from said base which is larger than or equal to a piercing height of the draining member of the beverage preparation machine and wherein said beverage is able to pass through the punctured support plate,

**characterized in that** the cup-shaped body, the lid and the punctured support plate are made of a material comprising metal.

2. The beverage capsule according to claim 1, **characterized in that** the beverage capsule further comprises the one or more beverage ingredients (24).

3. The beverage capsule according to claim 2, **characterized in that** the one or more beverage ingredients are extraction ingredients, such as roasted ground coffee, tea leaves, etc.

4. The beverage capsule according to claim 3, **characterized in that** the one or more beverage ingredients have a particle size distribution determined using optical microscopy according to ISO 13320:2020, wherein at least 90 volume%, and in particular at least 95 volume%, of the one or more beverage ingredients have a particle size of at least 30  $\mu\text{m}$ , in particular at least 40  $\mu\text{m}$  and more particularly at least 50  $\mu\text{m}$ .

5. The beverage capsule according to claim 2, **characterized in that** the one or more beverage ingredients are powder-based dissolving ingredients.

6. The beverage capsule according to any one of claims 1 to 4, **characterized in that** the punctured support plate comprises openings having a size so as to prevent at least 90 volume%, in particular at least 95 volume%, and specifically at least 99 volume%, of the one or more beverage ingredients from passing therethrough.

7. The beverage capsule according to any one of claims 1 to 4 or 6, **characterized in that** the punctured support plate comprises openings having a smallest dimension which is at most 500  $\mu\text{m}$ , in particular at most 300  $\mu\text{m}$ , more in particular at most 200  $\mu\text{m}$ , and most in particular at most 100  $\mu\text{m}$ .

8. The beverage capsule according to claim 7, **characterized in that** at least some of the openings, and in particular all of the openings, comprise any one of the following shapes: substantially circular and oblong slits, wherein all of the openings preferably have a same shape.

9. The beverage capsule according to any one of the preceding claims, **characterized in that** the punctured support plate comprises openings which are substantially uniformly distributed across the plate.

10. The beverage capsule according to any one of the preceding claims, **characterized in that** the cup-shaped body, the lid and the punctured support plate are all made of a metal, preferably a food-grade metal, such as aluminium or an aluminium alloy.

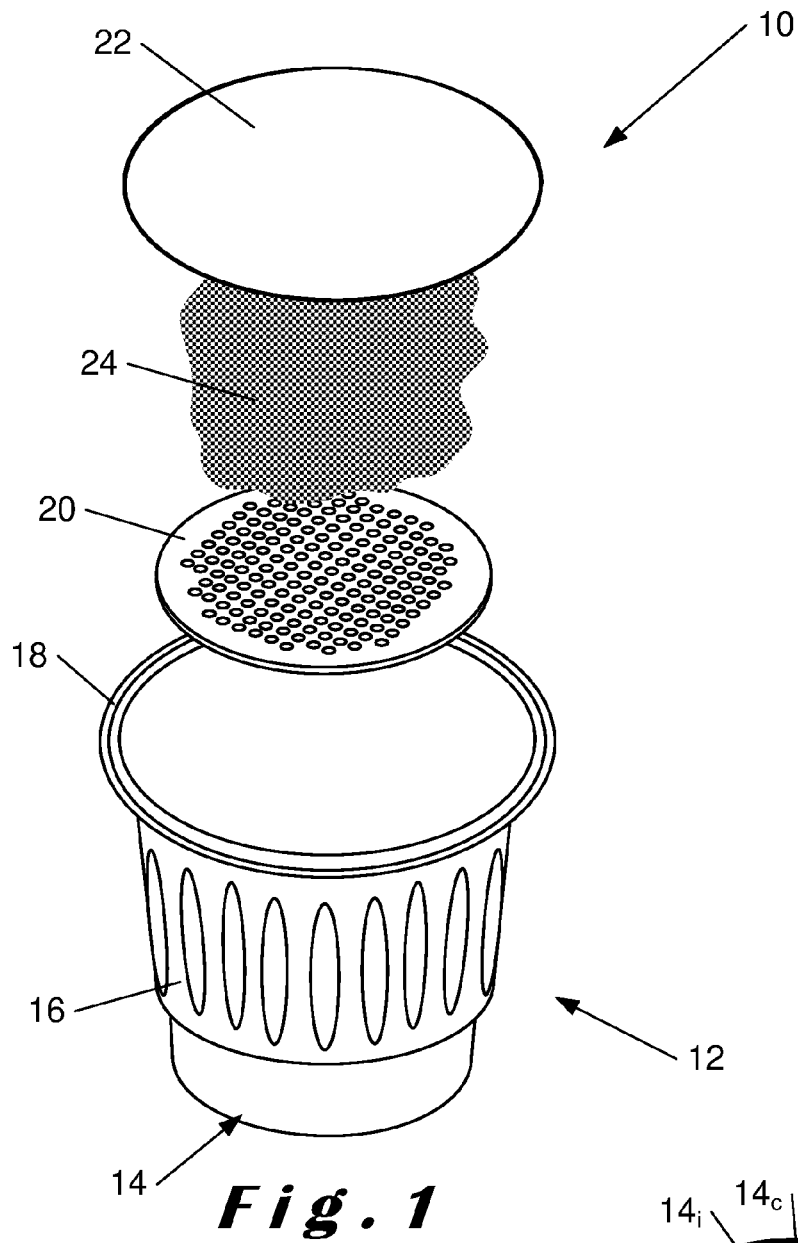
11. The beverage capsule according to claim 10 **characterized in that** the cup-shaped body, the lid and

the punctured support plate are all made of a same metal.

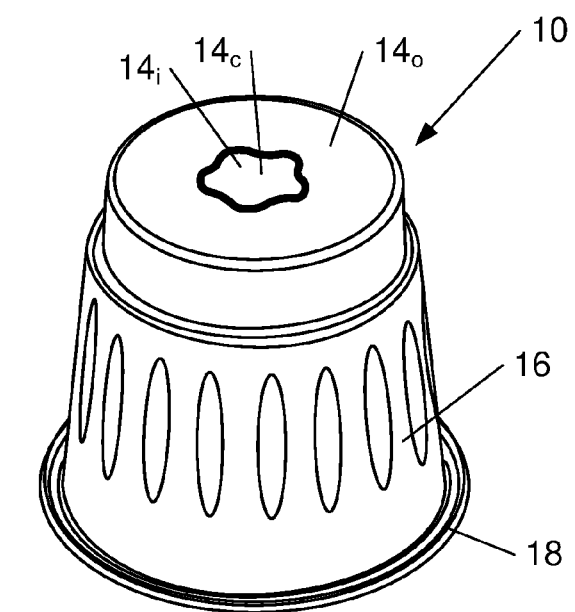
12. The beverage capsule according to any one of claims 1 to 9, **characterized in that** the cup-shaped body and the lid are both made of a metal-based laminate material comprising at least one layer of metal, the metal layer preferably comprising a food-grade metal, such as an aluminium or an aluminium alloy, wherein the punctured support plate is made of a metal, preferably a food-grade metal, such as aluminium or an aluminium alloy.
13. The beverage capsule according to claim 10 **characterized in that** the at least one layer of metal and the metal of the punctured support plate both comprise the same metal.
14. The beverage capsule according to any one of the preceding claims, **characterized in that** the sidewall comprises a stepped region (16c), the punctured support plate engaging the stepped region.
15. The beverage capsule according to any one of the claims 1 to 13, **characterized in that** the sidewall comprises a first region (16<sub>1</sub>) and a second region (16<sub>2</sub>) having a different inclination with respect to a central axis of the beverage capsule, the punctured support plate engaging the sidewall where the first region and a second region are contiguous.
16. The beverage capsule according to claim 14 or 15, **characterized in that** the punctured support plate rests on the stepped region or on the sidewall where the first region and a second region are contiguous.
17. The beverage capsule according to claim 14 or 15, **characterized in that** the punctured support plate is welded on the stepped region or on the sidewall where the first region and the second region are contiguous.
18. The beverage capsule according to claim 14 or 15, **characterized in that** the sidewall is provided with one or more inwardly extending protrusions located adjacent the stepped region or where the first region and a second region are contiguous, the punctured support plate being fixed between the one or more inwardly extending protrusions and the stepped region or where the first region and the second region are contiguous.
19. The beverage capsule according to any one of the preceding claims, **characterized in that** the punctured support plate is welded to the sidewall.
20. The beverage capsule according to any one of the preceding claims, **characterized in that** said dis-

tance between the punctured support plate and the base is at least 5 mm and preferably at least 8 mm or more.

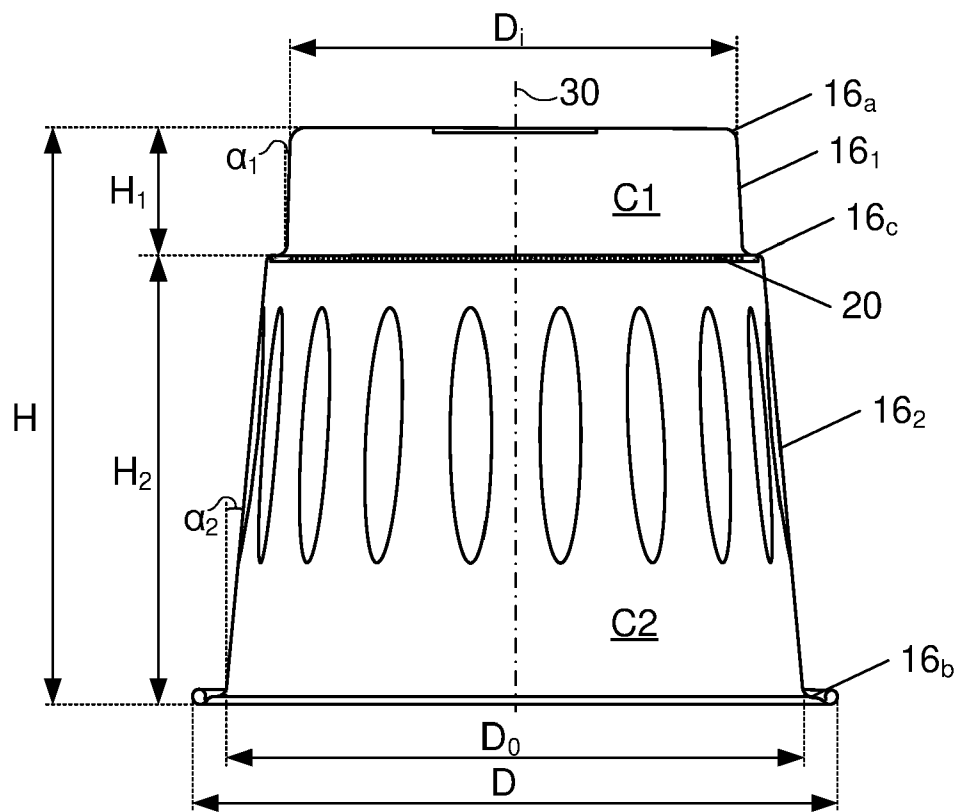
21. The beverage capsule according to any one the preceding claims, **characterized in that** the beverage capsule does not contain a filter paper.
22. The beverage capsule according to any one of the preceding claims, **characterized in that** the beverage capsule comprises an annular rim (18) contiguous with the sidewall, the lid being sealed to the annular rim.
23. Use of a beverage capsule according to any one of the preceding claims in a beverage preparation machine to prepare a beverage by passing a fluid through the beverage capsule.



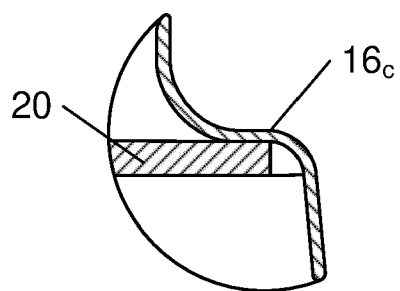
**Fig. 1**



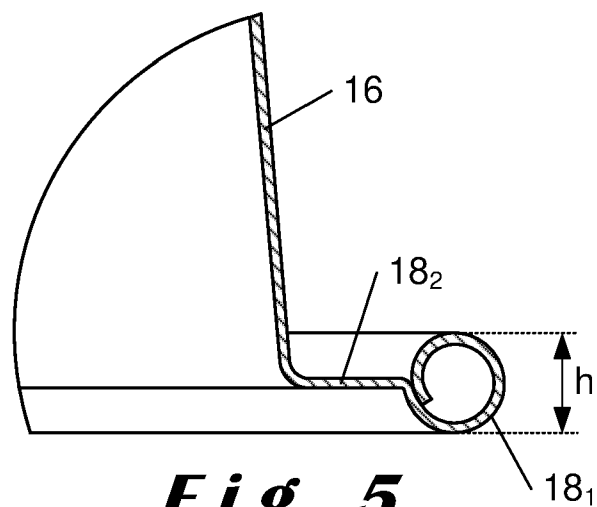
**Fig. 2**



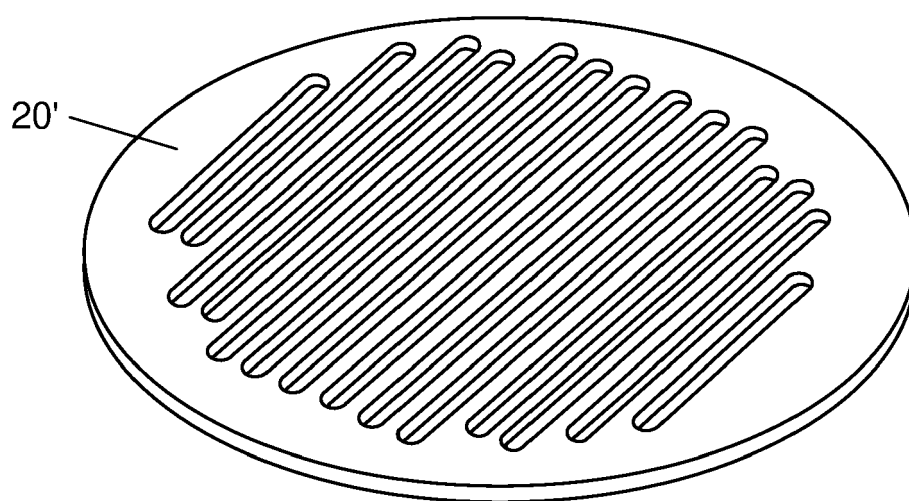
**Fig. 3**



**Fig. 4**



**Fig. 5**



***Fig. 6***



## EUROPEAN SEARCH REPORT

Application Number

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| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                            | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (IPC) |
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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☒ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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